# SR Nexco®

# special feature

Vol. 1/2014

- Research and development and materials science
- Framework-free restorations
- Framework-supported restorations

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# Editorial

**Dr Thomas Hirt**
*Chief Technology Officer*
*Ivoclar Vivadent AG*

Dear Readers

Roughly a year has passed since the market introduction of the light-curing SR Nexco® Paste lab composite. Now the time has come to listen to the opinions and experiences of dental technicians, dentists and researchers.

This "style book" is a collection of different specialised articles about SR Nexco, including background information and practical case reports.

The chapter "Research & Development and Materials Science" reports on results from materials science and describes the tension between researchers and the desired final product. If researchers optimize one parameter during the development phase, they must not lose sight of the fact that this might affect other physical properties of the composite as well. The article by Dr Akikazu Shinya from Nippon Dental University in Tokyo, Japan, shows the first scientific study results on the physical properties of SR Nexco. These results bridge the gap between research and clinical use.

The chapters regarding the fabrication of framework-free and framework-supported restorations show the application of SR Nexco in the daily routine of dental technicians. These chapters cover a broad range of indications, reaching from conventional veneers and various implant cases to the design and fabrication of prosthetic gingiva portions.

The SR Nexco lab composite, which was developed for dental technicians by Ivoclar Vivadent, is easy to process and gives the restoration a natural appearance. The composite is used for the veneering of framework-supported and framework-free prosthetic restorations. The range of indications covered by SR Nexco includes inlays, onlays, crowns, bridges as well as implant and combination works. Furthermore, SR Nexco is particularly suitable for the reconstruction of prosthetic gingiva portions due to its extensive shade range. The lab composite is polymerized using conventional light-curing devices.

The authors of this publication document the versatile application possibilities of SR Nexco. SR Nexco leads to excellent results. See for yourself and let yourself be inspired by the articles!

Best regards

Dr Thomas Hirt
Chief Technology Officer
Ivoclar Vivadent AG

# Table of contents

## Research and development and materials science



## Framework-free restorations



## Framework-supported restorations

# Fast, straightforward, true-to-nature

## Profile of a modern lab composite

**Ing. Simonette Hopfauf**
*Ivoclar Vivadent AG*

**Users expect modern lab composite to ideally offer the following characteristics: fast and easy to use, lifelike esthetics and a clinical behaviour that mimics the natural dentition as closely as possible. This report examines if and to what extent these expectations can be met realistically.**

Let's face the fact: Even those properties mentioned above depend on several factors that can only be reconciled to a limited extent with each other when a new material is developed. For instance, the structure of a material is responsible for its characteristics. If we try to modify, or improve, one of the characteristics, we may inadvertently change the entire material. A simple example shall suffice to illustrate this point: We want to optimize the strength of a microfilled composite and add additional quantities of glass fillers and mixed oxides to achieve a strength of >140 MPa, because microfillers alone do not allow us to achieve strength values of this magnitude. However, these fillers affect the material's esthetic properties. The refractive indices of the resulting material are higher than those of the monomers used in the original material. As a consequence, the material now appears opaque; the opal effect has vanished. Initial wear testing and artificial ageing clearly show that the glass filler content has to be again reduced because the material is susceptible to high abrasion and changes in surface texture as particles dissolve from the matrix. In a second trial, additional micro particles are added to improve the material's polishing properties. Again, a handling test reveals that the material's consistency has changed as a result. This example shows that a material has to be modified carefully stage by stage until the ideal properties are achieved.

**Fig. 1** Opal effect of SR Nexco

## SR Nexco®: the material

The matrix and fillers of SR Nexco® are ideally matched to one another. By coordinating these components, certain advantages with regard to susceptibility to discolouration, plaque affinity and wear have been achieved. The interaction between matrix and fillers also determines the optical properties of a material: By carefully coordinating the refractive indices of the raw materials, the optical properties of the natural tooth can be mimicked. With its lifelike opal effect, SR Nexco is an example of this.

## Resistance to discolouration

Certain beverages and foodstuffs may cause natural teeth and restorations to become discoloured. In the majority of cases, the discolouration is only superficial and can be mechanically removed, e.g. with polishers. However, a material should offer little opportunity for staining. Low surface roughness, a high and stable gloss of the restorations and little affinity of the restorative material to attract discolouring substances are essential to ensure a low discolouration rate. The matrix of SR Nexco is based on an aromatic-aliphatic urethane dimethacrylate (UDMA) and additionally comprises different types of dimethacrylates that act as diluents. Composites based on UDMA have been shown to demonstrate clearly less tendency for discolouration and plaque accumulation than conventional composites, most of which are based on a matrix of bisphenol A diglycidyl dimethacrylate (bisGMA): In contrast to bisGMA, UDMA has no hydroxyl side groups and therefore UDMA-based composites generally exhibit low water absorption.

Discolouration tests can be easily simulated in the lab by immersing the test specimens in different staining media, such as coffee, red wine or tea, for a specified length of time. Subsequently, the overall change in colour is determined using a spectrophotometer (ΔE).

The copolymers incorporated into SR Nexco essentially consist of a material that is similar to SR Nexco and has been prepolymerized and ground down. In the process, a filler content of about 83 per cent by weight is achieved, resulting in a homogeneous material with excellent polishing properties. Studies have shown that SR Nexco exhibits a stable gloss even

| | | |
|---|---|---|
| Flexural strength in compliance with ISO10477:2004 | [MPa] | 90 ± 10 |
| Modulus of elasticity | [MPa] | 6500 ± 500 |
| Vickers hardness HV0.5/30 | [MPa] | 460 ± 5 |
| Water absorption in compliance with ISO10477:2004 | [µg/mm$^3$] | 15 ± 1 |
| Water solubility in compliance with ISO10477:2004 | [µg/mm$^3$] | 1 ± 0.5 |

**Fig. 2** Materials science data of SR Nexco

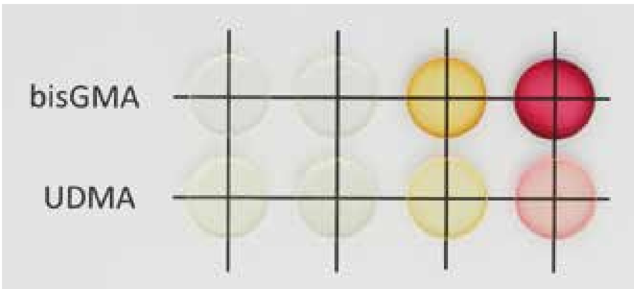


**Fig. 3** Direct comparison between UDMA-based and bisGMA-based matrix after staining (16 hours of boiling in distilled water, coffee and a 0.1% red Safranin T solution)

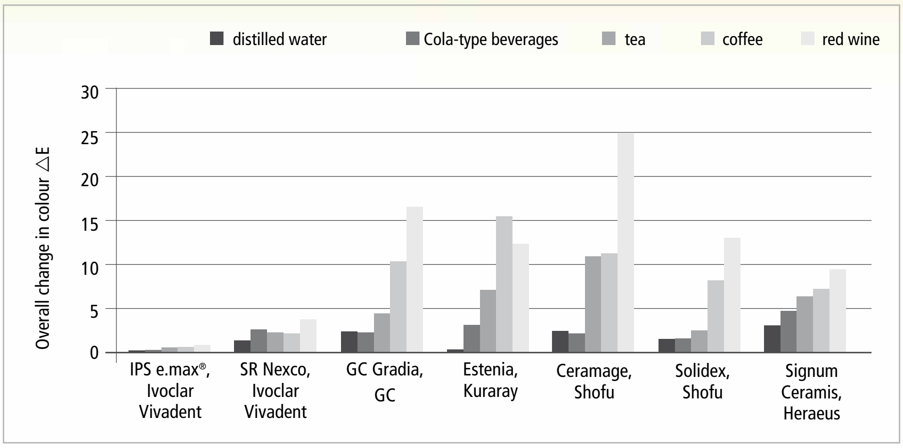


**Fig. 4** Staining test on various materials

Source: Dr Shyna, Nippon Dental University, School of Life Dentistry, Tokyo/Japan, 2012

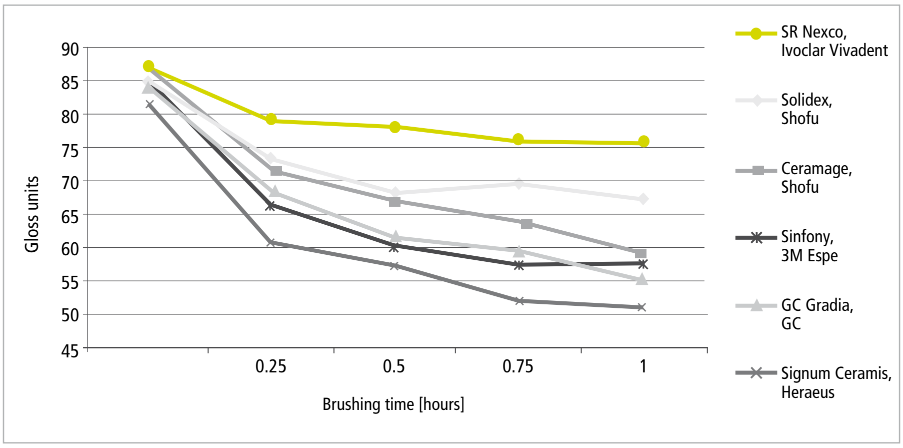


**Fig. 5** Average lustre of lab composites after simulated tooth brushing in relation to the length of brushing (0.25 to 1 hour)

after exposure to wear, e.g. tooth brushing (Fig. 5). To simulate the wear caused by tooth brushing, the test specimens are polished to a high gloss, placed in a device for simulated tooth brushing and subjected to several hours of circular tooth brushing in a slurry of tooth paste (RDA 75). Subsequently, the level of gloss is measured using a glossmeter. Measurements of >70 gloss units are regarded to be high gloss, measurements between 50 and 70 units are labelled as medium gloss and measurements of <50 units are low gloss.

## A lasting bond: SR Link

A stable, functioning bond between alloy and veneering material is a prerequisite for the longevity of a metal-supported composite restoration. The SR Link bonding system is based on a phosphoric acid ester coupled with a methacrylate-functionalized molecule. The phosphoric acid part of the molecule is a strong acid and as such in a position to undergo a chemical reaction with the metal oxides on the alloy surface and to form phosphates. The phosphates create what is known as passivation layers on the metal surfaces. These layers are generally highly inert and therefore protect the metal against further chemical attacks and endow it with stability. Furthermore, the methacrylate groups of the molecule react with the monomer component of the SR Nexco Opaquer by forming copolymers and thereby establishing a bond with the veneering composite. The coupling link between the metal-oxide active sequence of the molecule (phosphoric acid ester) and the monomer-active sequence of the molecule (methacrylate group) consists of a hydrophobic aliphatic hydrocarbon chain, which significantly enhances the hydrolytic stability of SR Link and additionally stabilizes the bond between the metal and veneering material.

As a general rule, the less precious the metallic character, the more reactive is the transition from metal to metal oxide and the more effective is the subsequent coupling reaction between phosphoric acid ester and the metal phosphate. The more precious the metal is, the less readily the different partners react with each other and the formation of metal-to-phosphate bonds is considerably more sluggish. For this

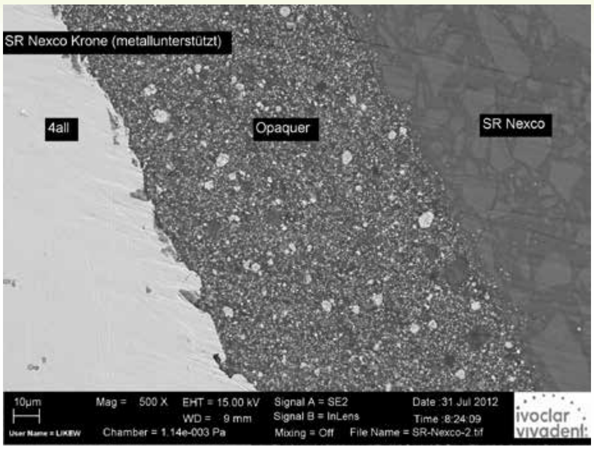


**Fig. 6** Scanning electron microscopic image of a metal-supported SR Nexco crown in cross-section

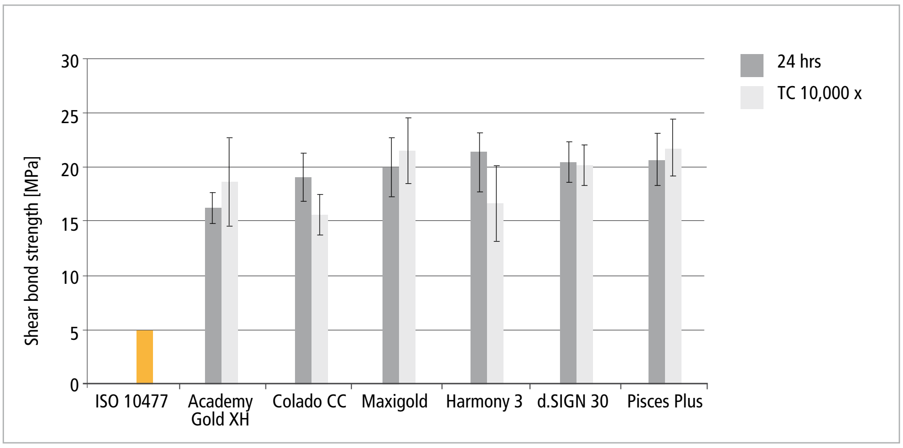


**Fig. 7** Shear bond strength of SR Nexco with SR Link on selected metal alloys

reason, certain restrictions on the use of alloys have to be taken into account when using SR Link in combination with SR Nexco: If alloys consisting to more than 90 per cent of gold, palladium or platinum are used, the reactivity necessary for the proper functioning of the bonding system is not fully present. Consequently, the use of, for instance, electroplated gold is contraindicated. Whatever alloy is used, mechanical retentions always enhance the bond strength between the metal and veneering composite.

To evaluate the bond strength of a material, a shear bond strength test is performed according to the international standard ISO 10477. The samples are subjected to thermocycling at temperatures alternating between 5 °C and 55 °C at intervals of 30 seconds. This cycle is repeated 5,000 times.

The bond strength values of SR Nexco combined with the SR Link bonding agent were measured after 10,000 thermocycles at 5 °C and 55 °C (Fig. 7).

## SR Connect

Before materials based on polymethyl methacrylate (PMMA) are characterized or modified with SR Nexco, they are conditioned with SR Connect. This light-curing bonding agent does not form a layer and generates a reliable bond. One of the constituents of SR Connect is methyl methacrylate (MMA), which causes the PMMA-based substrate to swell. In a further step, a thin inhibition layer is produced by light-curing. This layer polymerizes with SR Nexco as SR Nexco is being light-cured.

## Device-independent polymerization

Correct polymerization is a prerequisite for SR Nexco to unfold its optimum effect. To ensure that SR Nexco is compatible with a wide range of commercial curing devices, it comprises two photoinitiators: camphorquinone, which is widely used and has an absorption peak at 490 nm, and Lucirin TPO with an absorption peak at 380 nm. As a result, SR Nexco responds to

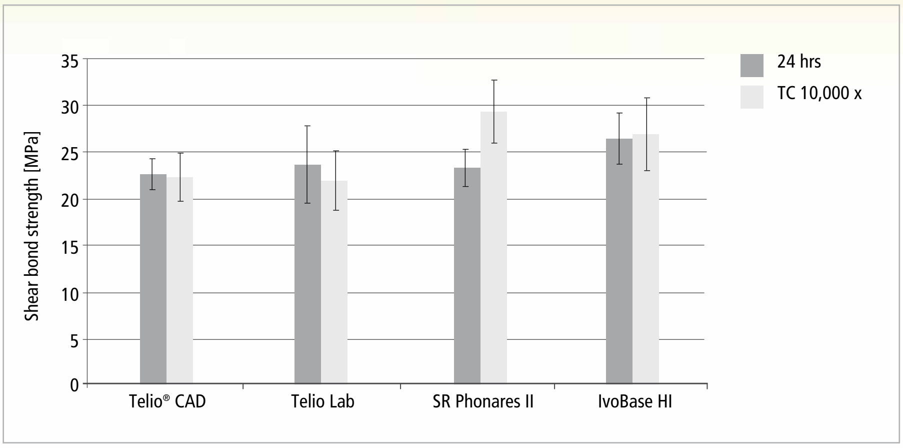


**Fig. 8** Shear bond strength of SR Nexco with SR Connect on selected PMMA-based substrates

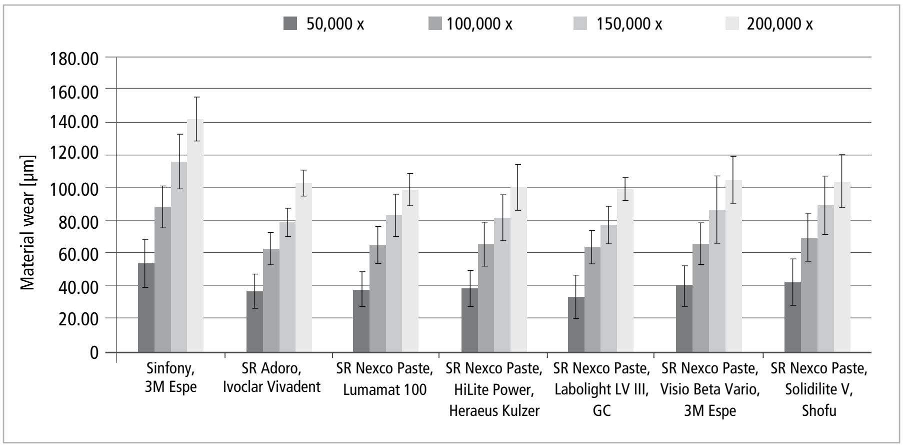


**Fig. 9** Wear testing of SR Nexco in the ACTA wear machine in conjunction with various polymerization devices

Source: Dr M. Rosentritt, Polyclinic for Dental Prosthetics, University of Regensburg/Germany, 2011

a broad light spectrum. It can also be used for small intraoral repairs in conjunction with, e.g. a Bluephase curing light. Studies have shown that an identical material quality is achieved if the polymerization parameters specified are adhered to, irrespective of which of the recommended curing lights is used (Fig. 9).

## Wear behaviour

Wear is a mechanical process and is determined by several factors. The mechanical properties of a material are not the only factors responsible for wear. The composition and size of the fillers as well as the matrix also have a direct effect on wear. Of no less importance is also the role played by the polishing properties and surface roughness of the material. Various methods are employed to simulate clinical wear (attrition, abrasion and fatigue) in the lab. Two-body wear testing, performed in a chewing simulator without the addition of an abrasive medium, has become the established method of measuring wear. If this method is used, plane samples are subjected to 120,000 chewing cycles at a frequency of 1.6 Hz and a load of 50 N. An antagonist consisting of an artificial cusp made of IPS Empress ceramic moves across the occlusal surface of the test material along a gliding path of 0.7 mm. Simultaneously, the samples are subjected to thermocycling (at 5 °C and 55 °C). Maximum vertical wear is quantified with a laser scanner.

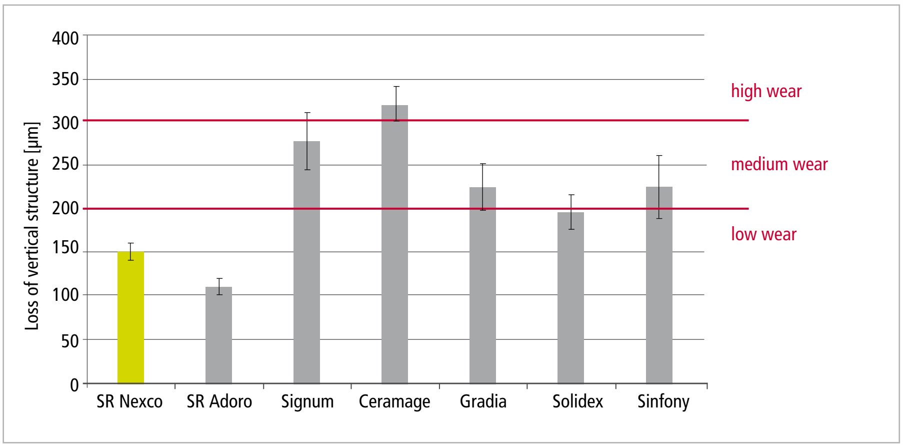


**Fig. 10** Wear testing of SR Nexco and other lab composites in the Willytec chewing simulator

Source: Ivoclar Vivadent, 2011

## Conclusion

High strength values are not necessarily synonymous with favourable wear characteristics. A hard material may be difficult to polish and therefore produce a rough surface with an increased tendency for plaque accumulation. When a material is developed, compromises are inevitable to meet the request of the user for an ideal material that offers ease of use, lifelike esthetics, flexible choice of curing device, reduced susceptibility to discolouration and plaque accumulation and favourable wear properties. The trade-off is a slight decrease in strength and hardness. The challenge is to combine several material properties that complement each other harmoniously to ensure the reliability and durability of the material in use. The studies mentioned in this report confirm that we have taken the right track with SR Nexco.

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# More gloss and natural esthetics

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## A case study and evaluation of lab composites

**Dr Akikazu Shinya from Nippon Dental University in Tokyo documents the results from research and dental practice regarding composite materials. He describes the fabrication process of a fixed partial denture made with an Au-Pd alloy framework, typically used in Japan, and veneered with the lab composite SR Nexco®. Furthermore, Dr Shinya undertook a study to evaluate the effects of discolouring solutions and tooth brush abrasion on the appearance of different composite materials available on the market.**

The recent development of hybrid composite technology offers dental professionals the possibility of fabricating esthetic, composite-veneered metal and metal-free dental prosthesis even for molar teeth. Metal-free hybrid composite full coverage crowns are an alternative to composite-veneered metal crowns, and can offer an alternative to metal-ceramic crowns. However, in the fabrication of fixed partial dentures, metal-free hybrid composite is not commonly used, especially if the patient suffers from bruxism and/or clenching. Previous studies have shown that the longevity of metal-free composite fixed partial dentures is lower than that of composite with metal framework restorations. The two main problems of veneering composite include discolouration and reduced gloss after a few years in situ, especially in the anterior region.

The colour reproducibility of laboratory composite has become very good due to an increase in the number of available shades. In addition, new nanofilled hybrid-types of laboratory composite provide prosthetics with a high surface polish and smooth texture to give a more natural appearance. The success of laboratory-fabricated composite prosthetics depends mainly on their surface gloss and colour stability. However, discolouration after prolonged exposure to the oral environment is still a major problem, leading to an unacceptable colour match of the restoration.

The present report describes a clinical case involving a fixed partial denture made with an Au-Pd alloy framework which was veneered with the lab composite SR Nexco®. Furthermore, this study undertook to evaluate the colour stability of seven lab composites after exposure to commonly consumed beverages, using reflection spectrophotometry based on the NBS (National Bureau of Standards) colour system. The examination also aimed to clarify the effect of tooth brush abrasion on gloss resistance. These topics were investigated by Dr Akikazu Shinya and he was also interviewed on the subject of lab composites.

### Clinical procedures

#### Case analysis

The patient was a 23-year-old female who had lost her upper right central incisor in a car accident at the age of 13 years. After the accident, the patient received a fibre-reinforced direct bonded composite fixed partial denture (FPD). Figure 1 shows the front view before the treatment on the patient's first visit.

#### Preparation of abutment teeth

After the occlusal analysis with articulating paper, the old composite fillings on the neighbouring teeth, 12 and 21, and the fibre-reinforced composite (FRC) pontic were removed.

**Fig. 1** Front view before the treatment

**Fig. 2** Tooth preparation

The design of the tooth preparations was similar to that used for PFM restorations. The teeth were prepared according to the philosophy of conserving a maximum amount of the tooth structure. The walls of the abutment teeth were flared between 6° and 10°. All internal line angles were rounded, and the rounded shoulder margin was prepared with a butt joint. A buccal reduction of 2 mm was made in order to obtain enough space for the placement of the metal frame and composite veneer (Fig. 2).

**Fig. 3** Provisional FPD made of Telio CS C&B

### Impression and temporization

Impressions of the prepared and opposing teeth were made using an elastomer material (Imprint™ 3 Regular and Imprint™ 3 Heavy Body, 3M ESPE, St Paul, MN, USA). Then, the provisional FPD made with a chemical-cure resin (Telio® CS C&B, Ivoclar Vivadent, Schaan, Liechtenstein, Fig. 3) was temporarily cemented with Telio CS Link (Ivoclar Vivadent, Schaan, Liechtenstein, Fig. 4). The shade of the final veneered composite resin was selected using a Vita Classical Shade Guide (Fig 5).

**Fig. 4** Temporary cementation with Telio CS Link

**Fig. 5** Shade selection

### Prosthesis fabrication

The waxed-up framework was finished and checked on the working die. Die stone was poured and the casts were mounted in a semi-adjustable articulator (Protar 7, Kavo Dental GmbH, Warthausen, Germany). Retention beads were sprinkled on the wax framework. The metal framework was cast using Au-Pd alloy (Castwell M.C., GC, Tokyo, Japan) (Fig. 6). Finally, the metal framework was coated with the metal-composite bonding agent SR Link and covered with an opaquer and veneered with SR Nexco laboratory composite (Fig. 7). The marginal fit and morphology of the prosthesis were checked on the working die before final polymerization (Fig. 8). The veneering resin was polymerized with a laboratory light-curing unit (Quick, Lumamat 100, Ivoclar Vivadent, Schaan, Liechtenstein) for 20 s per layer. Final polymerization was carried out for 5 min (Spectramat, Ivoclar Vivadent, Schaan, Liechtenstein).

### Try-in and adhesive luting of the prosthesis

At the luting appointment, the provisional restorations were removed with a scaler and the abutment teeth were cleaned with fluoride-free polishing paste (Proxyt® RDA 36 medium grit, Ivoclar Vivadent, Schaan, Liechtenstein). Before it was permanently placed, the prosthesis was evaluated intraorally to assess its marginal fit, occlusion and esthetics (Figs 9 and 10). The adhesive cementation of the prosthesis proceeded according to the recommendations of the manufacturer. Therefore, the area was isolated with a cotton roll and the abutment teeth were coated with Multilink® Primer (Ivoclar Vivadent, Schaan, Liechtenstein) for 15 s and then gently dried with air. The inner surface of the retainers was etched (37% acid etching gel, Total Etch, Ivoclar Vivadent, Schaan, Liechtenstein) and then conditioned with Monobond® Plus (Ivoclar Vivadent, Schaan, Liechtenstein). The restorations were placed with a dual-cure cement (Multilink Automix, Ivoclar Vivadent, Schaan, Liechtenstein), and they were polymerized with a hand light-curing unit (Bluephase®, Ivoclar Vivadent, Schaan, Liechtenstein) after the excess cement had been removed. Figure 11 shows the front view of the finished prosthesis two weeks after cementation.

**Fig. 6** Metal framework

**Fig. 7** Veneered with SR Nexco

**Fig. 8** Marginal fit and morphology of the prosthesis

**Fig. 9** 1st try-in

**Fig. 10** Occlusal view

**Fig. 11** Front view of the finished prosthesis two weeks after cementation

## Clinical results and discussion

A treatment option involving the placement of implants was avoided due to the patient's young age and because of psychological reasons. A fixed partial denture comprising an Au-Pd alloy framework veneered with a lab composite was selected in order to offer the patient a rigid arch anterior structure, enhanced esthetics and a conservative fixed solution. The esthetic recreation of the missing teeth on a metal framework represented a particular challenge. The use of a laboratory composite on a metal framework in the fabrication of a highly esthetic fixed partial denture requires a high level of skill in the design of the framework, the build-up of the lab composite and the reproduction of the colour aspects of the teeth. Excellent communication between the dental practitioner and the lab technician is a very important factor in the establishment of a strong bond between the lab composite and the framework, and the creation of a highly esthetic pontic area. The final outcome in this case was very good, especially with regard to the marginal fit, occlusion (anterior guidance), and the colour and texture of the buccal aspect. The case was followed for half a year. During this time, the patient was problem-free and the esthetic appearance remained unchanged. In the materials science part, we therefore examined how these properties affect the different types of composite.

### Appearance testing of laboratory composites

One of the major problems of laboratory composites is that their appearance can change. In some cases, discolouration and/or reduced gloss have been observed after only a few months, because of chewing movements, certain beverages and tooth brushing. Therefore, composite resins are often unsuitable for permanent prosthetics especially in the anterior region.

### Materials and methods

The following lab composites in shade A2 were used:

1) SR Nexco (Ivoclar Vivadent)
2) SR Adoro (Ivoclar Vivadent)
3) Estenia (Kuraray Noritake Dental)
4) Ceramage (Shofu)
5) Gradia Forte (GC)
6) Twiny (Yamamoto Edelmetall)
7) Signum ceramis (Heraeus Kulzer)
8) Signum sirius (Heraeus Kulzer)

For the discolouration test, the lab composite specimens were prepared in disc form in a silicone mould (16 mm diameter × 1.5 mm height, n=6). They were pressed with a glass plate. For the gloss test, all the materials were prepared in a stainless steel mould (20 mm length × 10 mm width × 1.5 mm height, n=15), and they were covered with plastic film and pressed with a glass plate. The specimens of each material were polymerized according to the manufacturer's instructions. The samples were stored dry at room temperature for 24h before polishing.

### Polishing procedure

All the specimens were smoothed with polishing felt and with slurry ($Al_2O_3$ with distilled water). The gloss test specimens were polished with felt wheels (Busch, Engelskirchen, Germany) and diamond paste (for each brand, same as lab composite) at low speed using a handpiece. All the diamond-polished sides of the gloss test specimens were checked using a gloss checker (gloss meter VG 2000, Nippon Denshoku). The gloss value of the polished surface of all the specimens was established to be more than 80% before starting tooth brush abrasion. After polishing, all of the specimens were rinsed with water and stored dry at room temperature for 24h before testing.

### Materials science – discolouration test

Four different beverages were used in the test: coffee, tea (commercially available bottled tea, Sinvino Java Tea Straight, Otsuka, Japan), red wine and Coca-Cola were used. In order to maintain an acceptable level of carbonation, a new cola bottle was used every day and all the beverages were changed daily.

The coffee solution was prepared by adding 3 mg of instant coffee (Nescafe Classic, Nestle, Morocco) to 100 ml distilled water. Distilled water was used in the control group (baseline). All the specimens were immersed in 100 ml of different beverages for five weeks and incubated at 37 °C. Before the colour measurement, the specimens were rinsed with water for 2 min and dried. The colour of each specimen was measured after five weeks of immersion according to the CIELAB colour scale on a reflection spectrophotometer (CR200, Konica-Minolta).

**NSB = 0.92 ∆E*ab**

The NBS (National Bureau of Standards) unit represents the difference in the average values of before (baseline) and after five-week immersion in different beverages.

### Materials science – gloss change after tooth brush abrasion

Tooth brush abrasion was tested according to ISO standards (ISO/TR 14569-1:2007, Dental materials, Guidance on testing of wear, Part 1: Wear by tooth brushing). The gloss of all the specimens (20 mm length×10 mm width×1.5 mm height) was checked, and the gloss value of all the specimens was higher than 80% (average gloss was 85%). A tooth brush abrasion testing machine (Japan MECC, Tokyo, Japan) was used for the abrasion test. A commercially available tooth brush (P-60 Oral-B, Procter and Gamble Company, Ohio, USA) was moved over the stainless steel specimen holder with a circular motion at 1 Hz cycles (<200 g weight). The stainless steel specimen holder contained five samples per test cycle. The specimens were brushed with a slurry liquid which contained distilled water and toothpaste (Settima, Germany) in a one-to-one ratio. In order to detect early-stage gloss changes, the samples were checked after 1,000 brushing movements during the first 5,000 cycles. The long-term gloss changes were measured after every 5,000 brushing movements until the samples had been brushed 50,000 times.

## Results and discussions

### Discolouration test

Discolouration of the specimens after five-week immersion in coffee, tea, red wine or Coca-Cola was easily visible with the naked eye. The mean value of the colour change (NBS) of different lab composites after immersion in a test beverage is summarized in Figure 12. Estenia, Ceramage, Gradia Forte and Twiny are in the NBS range of 6.0 and 12.0. Signum Ceramis and Signum Sirius have an NBS value between 3.0 and 6.0. SR Nexco and SR Adoro are in the NBS range of 1.5 to 3.0. Their colour change was categorized as "Noticeable". The NBS system is an established guideline for colour changes: NBS value 0 to 0.5: Trace, 0.5 to 1.5: Slight, 1.5 to 3.0:

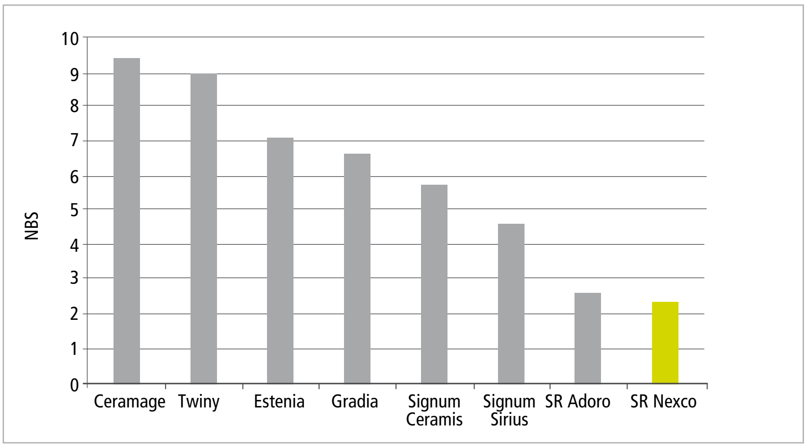


**Fig. 12** NBS value of tested laboratory composites

| | NBS |
|---|---|
| trace | 0~0.5 |
| slight | 0.5~1.5 |
| noticeable | 1.5~3.0 |
| appreciable | 3.0~6.0 |
| much | 6.0~12.0 |
| very much | 12.0~ |

**Fig. 13** NSB guideline

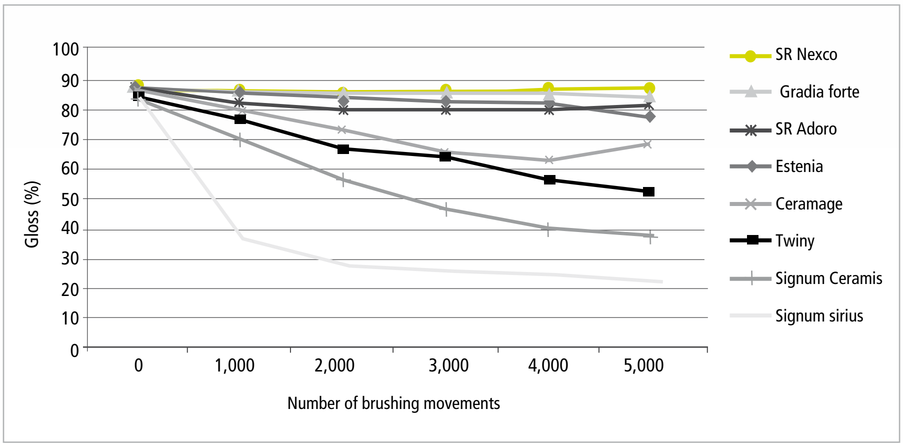


**Fig. 14** Early-stage gloss changes

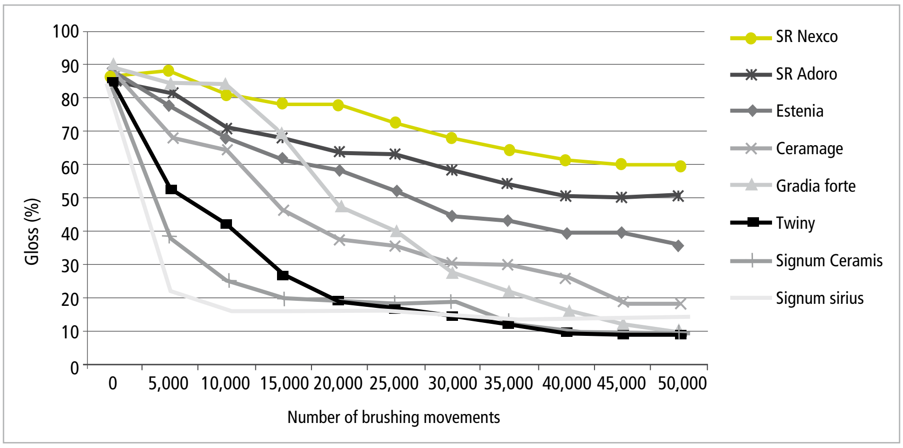


**Fig. 15** Long-term gloss changes

Noticeable, 3.0 to 6.0: Appreciable, 6.0 to 12.0: Much, over 12.0: Very much (Fig. 13).

### Gloss change after tooth brush abrasion

The results of early-stage gloss changes are summarized in Figure 14. The gloss of Signum Sirius decreased from 84.2% to 36.65% after 1,000 brush movements. After an additional 1,000 brushing times, the gloss value changed only slightly. The gloss of Signum Ceramis and Twiny decreased linearly in relation to the number of brushing movements. After 5,000 brushing cycles, the values dropped from 82.1% to 37.6% in Signum Ceramis and from 83.5% to 52.3% in Twiny. The gloss of Ceramage changed slightly between 0 and the first 4,000 tooth brush abrasion cycles. However, after 5,000 cycles, the gloss value increased. A very small change was observed in the gloss of SR Nexco, SR Adoro, Estenia and Gradia Forte within the first 5,000 brushing movements. No significant differences between these materials were noted.

The results of long-term gloss changes are summarized in Figure 15. The gloss of all the tested materials decreased (average: 26.25%). The gloss values after 50,000 tooth brush abrasion cycles were recorded as follows: SR Nexco: 58.8%, SR Adoro: 50.6%, Estenia: 36.4%, Ceramage: 18.4%, Signum Sirius: 14.2%, Signum Ceramis: 12.9%, Gradia Forte: 9.8%, Twiny: 8.9%.

Three different gloss change tendencies were established from the results

1) Early change: gloss changed primarily within the first 15,000 brushing movements: Signum Sirius, Signum Ceramis and Twiny,
2) Linear change: gloss change was related to the brushing time: Ceramage,
3) Slight change: gloss changed only slightly: SR Nexco, SR Adoro and Estenia.

The results of Gradia Forte could not be related to any of these tendencies. In the early stage, between 0 and 10,000 tooth brush abrasion cycles, the gloss of Gradia Forte, decreased very slightly. However, after more than 15,000 tooth brush abrasion movements, the gloss decreased so rapidly that a linear change tendency could not be established.

Typically, the teeth of a normally healthy person are exposed to 10,000 brushing movements in one year. Based on this information, SR Nexco and SR Adoro can be expected to keep 50% of their gloss for more than five years after cementation. At present, there is no set reference with regard to how much gloss is an acceptable value in a clinical situation. Nevertheless, within the limitations of this in vitro study, it was established that different laboratory composites exhibit different levels and intensities of discolouration and gloss change. The findings suggest that material selection plays an important role in producing long-lasting esthetic results.

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# Anterior composite veneers

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## SR Nexco®: a new generation of composites

**While until recently lab composites have mainly been used for indirect veneering applications in removable telescopic prosthetics in particular, their consistent further development is now opening up new applications. Composite materials are increasingly being employed in framework-free indirect anterior and posterior restorations.**

Rather than replacing ceramic materials, lab composites allow new treatment options. Lab composites are not superior or inferior to ceramics – they merely offer different physical properties. It is therefore at the discretion of the user to decide, from case to case, which material is best suited for the specific biological make-up of the individual patient.

### Task and procedure

If, like in the case discussed in this study, a patient shows marked signs of abrasion in the anterior region without a need for repair in the posterior region (Fig. 1), the advantages of composite restorations come into play:

- Clearly reduced risk of fracture due to overloading because composites are more flexible than ceramic materials
- Less wear of the opposing dentition because composites are less hard than ceramics
- Possibility of "topping up" existing composite restorations with new material after prolonged periods of wear without having to replace the entire restoration.

At the beginning of this kind of treatment, the dimension of the new restoration is determined by means of lab-fabricated mock-ups to test and assess the planned restoration in terms of speech, function and esthetics (Fig. 2). Subsequently, the dimension to be achieved in the new restoration is transferred to a silicone key and then waxed up on the die model (Fig. 3).

A new paste-type composite material, SR Nexco® from Ivoclar Vivadent, has been employed in the case presented in this report. SR Nexco incorporates a mixture of inorganic micro-opal fillers and organic fillers, also referred to as co- or prepolymers, and, as a result, offers excellent properties in terms of shade reproduction, surface gloss and wear resistance. These three criteria are decisive when selecting a restorative material. The interplay of the monomers and fillers determines the optical properties of a material, i.e. shading, opalescence, and fluorescence. With SR Nexco, the light refraction index of the fillers and matrix are optimally coordinated with each

**Fig. 1** Initial situation: Abraded damaged anterior teeth

**Fig. 2** Mock-up: The try-in of the "trial teeth" simulates the dimensions of the new restoration.

**Fig. 3** The length of the mock-up is transferred to the wax-up by means of a palatal transfer key.

**Fig. 4** Stone dies should be completely covered in a thin layer of SR Nexco Liner.

other, resulting in an outstanding opalescent effect. This is particularly advantageous in e.g. the incisal area. Those who are used to working with the IPS e.max® system/Ivoclar Vivadent will see that the same shade designations and descriptions are used for the SR Nexco materials system. This also means that users can continue to use the same layering design as for ceramic materials to build up the composite restoration. As the layering diagram stays the same, the composite restoration procedure is facilitated.

To begin the restoration procedure, the die model is first prepared. For this purpose, two thin coats of sealer are applied to the stone dies and, if necessary, to the counterbite. The impressions in the palatal bite rim, as shown in Fig. 3, are also sealed. Then, SR Nexco liner is applied in the desired shade (Fig. 4). The liner acts as foundation material and foundation shade and mediates a reliable bond between the restorative and luting composite on the tooth structure. Next, the palatal-incisal frame of the composite veneer is established with the help of the palatal silicone key. For this purpose, an initial layer of Dentin material is applied from labial and built up beyond the incisal die margin (Fig. 5) to achieve an even extension of the individual dentin cores, as not all die preparations feature the same incisal width and length. This measure helps prevent diverging shade effects between the individual veneers from occurring. Next, the palatal incisal plates are built up. The silicone key is loaded with a very thin layer of Incisal and Transpa material and precured (Fig. 6). Particularly with "older teeth", creating a somewhat warmer tone in the incisal area may be appropriate and can be achieved with e.g. Transpa orange-grey pure Effect material, either used on its own or mixed in with the corresponding Incisal shade. If a somewhat darker Incisal material is selected, a warm, almost amber-like, tone is clearly noticeable, imitating the shade frequently seen in the incisal area of older teeth.

The silicone key is removed (Fig. 7), and the incisal plate is now built up with appropriate Dentin, Incisal and Transpa materials. A smooth transition is created on the inner dentin core by applying a thin tapered layer of Dentin (Fig. 8). Subsequently, the shape is completed with alternate layers of Incisal materials in varying degrees of intensity and translucency (Fig. 9).

**Fig. 5** Initial application of Dentin material to create a uniform dentin core

**Fig. 6** The palatal incisal plate is built up with the help of the silicone key.

**Fig. 7** Precured incisal plate – the work can now proceed without silicone key.

**Fig. 8** Inner dentin core with smooth tapered transition to the incisal edge

Additional shade effects, such as light discolouration in the incisal or proximal area, may be achieved with SR Nexco Stains (Fig. 10). Stains materials are applied with a fine brush and precured. The fine lamellae occurring in alternating layers is best recreated with a root canal broach, similar to the ceramic technique. For this purpose, the composite material is spread out in a thin layer on a mixing pad. Next, fine lamellae are separated off with the broach, brought to the site where required and seated with a slight rotation of the broach (Figs 11a to c). This method prevents the material from sticking to the instrument and allows the laminella to be accurately placed. The special consistency of SR Nexco enables users to apply and distribute small quantities of material in an extremely fine thickness. Consistent intermediate curing ensures that the lamellae are tacked in place. Additionally, vertical and horizontal structures can be easily applied to the veneer with a special brush featuring bristles of varying lengths (Fig. 12).

Final contouring is achieved with a thin layer of the appropriate Incisal material (Fig. 13), as can be seen above in tooth 11. Next, a special gel is applied to prevent the formation of an

**Fig. 9** The shape is built up using various Incisal and Transpa materials.

**Fig. 10** Individual shade characterizations can be created using SR Nexco Stains.

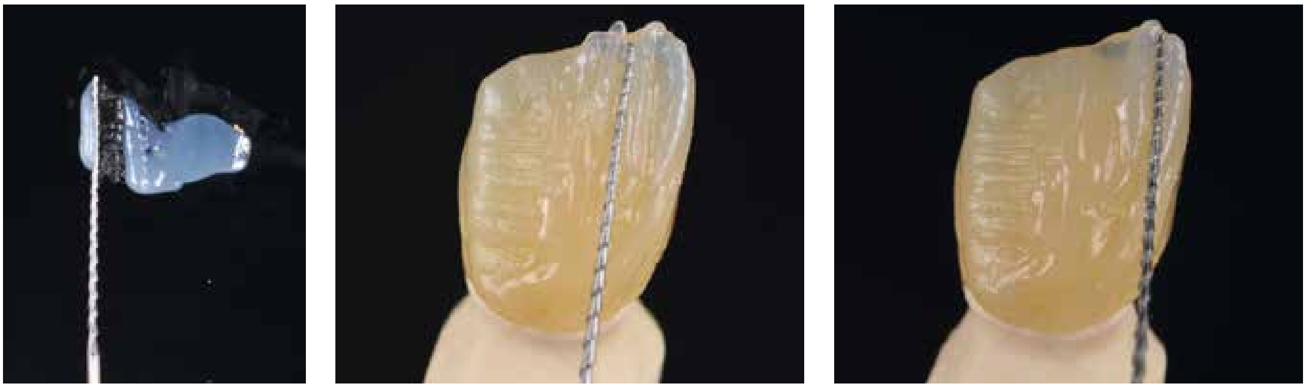

**Fig. 11a to 11c** Thin lamellae are formed with a broach on a mixing pad and then placed onto the veneer.

oxygen inhibition layer. Now, the veneers are ready to be polymerized in a light-curing device. After completion of the polymerization procedure, finishing and polishing are carried out (Fig. 14). Tungsten carbide burs are used for this step; final surface polishing is performed with universal polishing paste, polishing material, a goat's hair brush and a cotton buff (Fig. 15). After removing them from the working dies, the contact and marginal areas can be double-checked on the uncut model (Fig. 16). In this context, an additional advantage of the special composition and consistency of SR Nexco comes into play: Unlike other materials, SR Nexco does not require a bonding fluid to apply additional material to the roughened surface if adjustments should become necessary at a later stage. Given the special composition and consistency of the material, a reliable chemical bond forms between cured and new material, enabling a very tidy and neat working procedure. By contrast, bonded composite surfaces always tend to be sticky and susceptible to contamination. The completed composite veneers are incorporated adhesively with Variolink II (Ivoclar Vivadent); Figs 17 and 18 show the restoration in situ after a period of wear of three months.

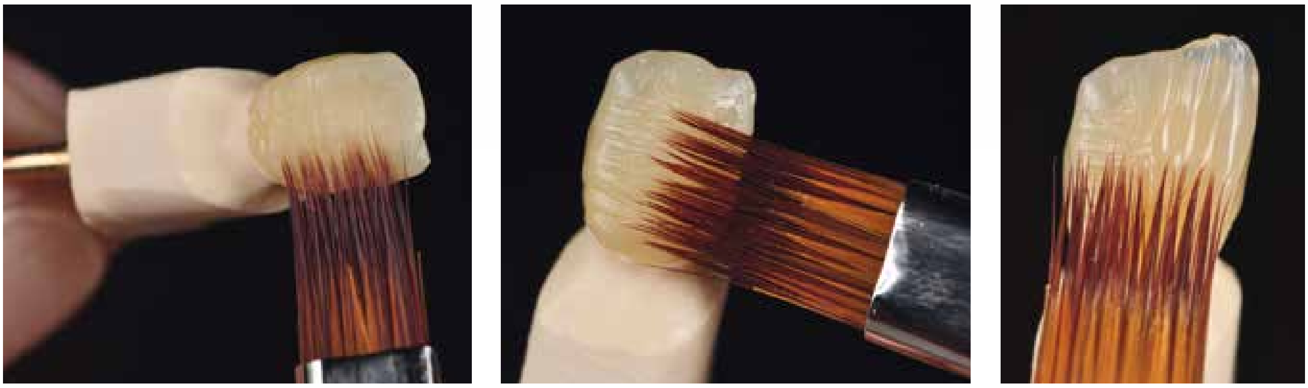

Fig. 12a to 12c Surface texture can be formed in a horizontal and vertical direction using a special brush.

Fig. 13 Shaping is completed with a final thin layer of Incisal material, as shown here on tooth 11.

Fig. 14 Completed surface texture of the composite veneer

Fig. 15 High-gloss polishing with a goat's hair brush, cotton buff and composite polishing paste

Fig. 16 Margins and contact areas are checked on the master model.

Fig. 17 Bonded SR Nexco veneers after having been worn for three months

Fig. 18 A new appearance

## Conclusions

SR Nexco is a protagonist of the latest generation of composites. Given the fact that its composition presents a further development of SR Adoro, the material is based on many years of experience. The new composite is distinguished by decisive features including low wear values, high gloss stability and a natural-looking shade effect similar to the opalescent and fluorescent characteristics of the natural dentition. These properties optimize the use of this material not only for framework-free restorations but also for removable and/or implant-supported restorations, where the excellent wear resistance and stable surface gloss are particularly advantageous.

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# Trauma without drama

## Composite reconstruction of a fractured crown using an atraumatic tooth-conserving procedure

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**Dr Anne Laure Simon**
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**Treating an anterior tooth trauma in the permanent dentition of a child poses a formidable challenge for the dentist and dental technician. Providing treatment that i) is appropriate for the degree of injury, ii) causes a minimum of pain and iii) allows a minimally invasive, tooth-conserving procedure is of decisive importance not only for the continued therapeutic success but also for the psychological development of the child [1] and the child's future attitude to dental care. Composite-based restorative measures are considered a standard method to repair fractured clinical crowns. The authors of this report describe a procedure for the reconstruction of a fractured anterior tooth with a composite resin and discuss the rationale for using this form of treatment.**

In the case of an anterior tooth trauma, the treatment is determined by the degree of injury. Crown fractures without pulpal involvement usually carry a good to excellent prognosis (WHO classification 2, loss of enamel and dentin without pulp exposure), as long as the patient is compliant with the treatment and attends yearly recalls. The therapeutic objective is to preserve pulp vitality and to reconstruct the shape and function of the teeth affected. If the broken-off fragments cannot be repositioned or are not available, composite onlays may be indicated to restore the tooth. Pathological post-traumatic processes should be prevented. In combination with a careful clinical and radiological examination, the dental restorative work plays a pivotal role in this. The case below describes the atraumatic treatment of fractured teeth 41 and 42 in a seven-year-old boy.

### Procedure in the dental practice

At the beginning of treating the dental injury, a detailed initial examination was carried out because the risk for pulp necrosis may increase if the enamel fracture includes a luxation, extrusion or intrusion injury. If the enamel-dentin fracture involves an intrusion injury, the risk of a later pulp necrosis is almost always 100 per cent [2].

The seven-year-old patient fell at school. The clinical assessment showed a transverse crown fracture near the pulp of tooth 42 and a fracture of the incisal edge of tooth 41 (Fig. 1). Luxation or soft tissue injuries were not identified. A radiographic examination showed that a luxation injury or injury to the periodontium was not present.

The broken-off tooth pieces had been lost and could therefore not be repositioned. For this reason we decided on having the partial restoration of tooth 42 accomplished with a lab-fabricated composite onlay so as not to unduly strain the patient's willingness to comply with the treatment. A light-curing lab composite was to be used for the onlay. Only a slight chamfer was prepared to preserve the remaining tooth structure. The incisal fracture of tooth 41 was to be repaired chairside using composite material at the same appointment when the partial restoration would be placed.

As a preventive measure, immediate dentin sealing (IDS) was applied to avert the risk of an infection of the pulpo-dentin complex. Without this measure, bacteria could infiltrate the pulpal tissue through the dentin tubules that have become exposed as a result of the enamel-dentin fracture. It is essential to retain the vitality of the pulp in permanent teeth with immature roots to ensure that the apexogenesis can continue without being hampered by sustained damage. After the tooth structure had been sealed, an impression was taken to fabricate the master model, which would serve as a basis for the build-up of the composite restoration. Additionally, the tooth shade was determined taking the adjacent anterior teeth and the cervical portion of the prepared tooth (42) into account (Fig. 2).

## Reconstruction with composite

Framework-free composite reconstructions of lost tooth structure place high demands on the material employed. First, the reconstruction should not stick out because of its shape, the shade should be indiscernible from the remaining tooth structure in the transition area and the restoration's translucent characteristics and shade effects should harmoniously blend in with the natural dentition. Second, the material should be fast and easy to process without forcing the technician to compromise on quality. Since SR Nexco lab composite meets all of these requirements, we were able to rebuild not only the shape but also the function and esthetic appearance of the tooth in line with the individual requirements of the patient. SR Nexco Paste restorations are built up layer by layer and each layer is precured.

To harden the surface and protect the stone die, the model was coated with sealer. To isolate the die and the contact surfaces on the adjoining teeth, the dental technician applied two coatings of SR Model Separator (allowing a reaction time of 3 minutes between each coating). To achieve an optimum chameleon effect, Liner clear was applied to the cervical area. Liner clear is a colourless and translucent material that can be used everywhere where the preparation shows no obvious discolouration or no discolouration at all, such as in the teeth of children. It is important to fully cover all contact areas because the Liner has a decisive effect on the bond to the luting composite. The design of the marginal areas presents another essential parameter affecting the long-term stability of the restoration. Liner incisal was applied to these areas to

**Fig. 1** Preoperative clinical situation of the seven-year-old boy showing a transverse crown fracture of tooth 42 and incisal edge fracture of tooth 41


**Fig. 2** Shade matching on the patient for the indirect fabrication of the composite restoration for tooth 42

**Fig. 3** Liner clear was applied to the die, followed by Dentin A2 to reconstruct the dentin core.

**Fig. 4** The dentin core was completed with a layer Transparent Clear.

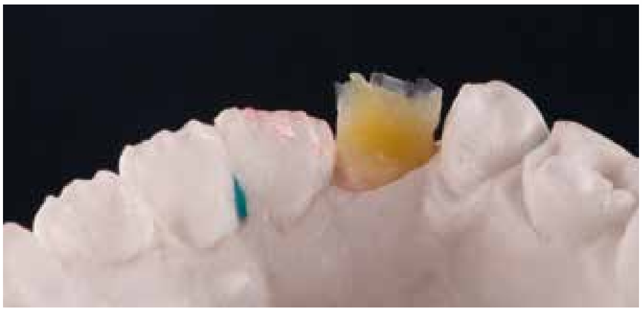

**Fig. 5** A layer of Dentin A2 and Occlusal Dentin orange was placed over the layer of Transparent Clear mimicking the sclerotic dentin of the natural tooth structure.

**Fig. 6** After the intermediary layers were polymerized, the mamelons were mechanically prepared.

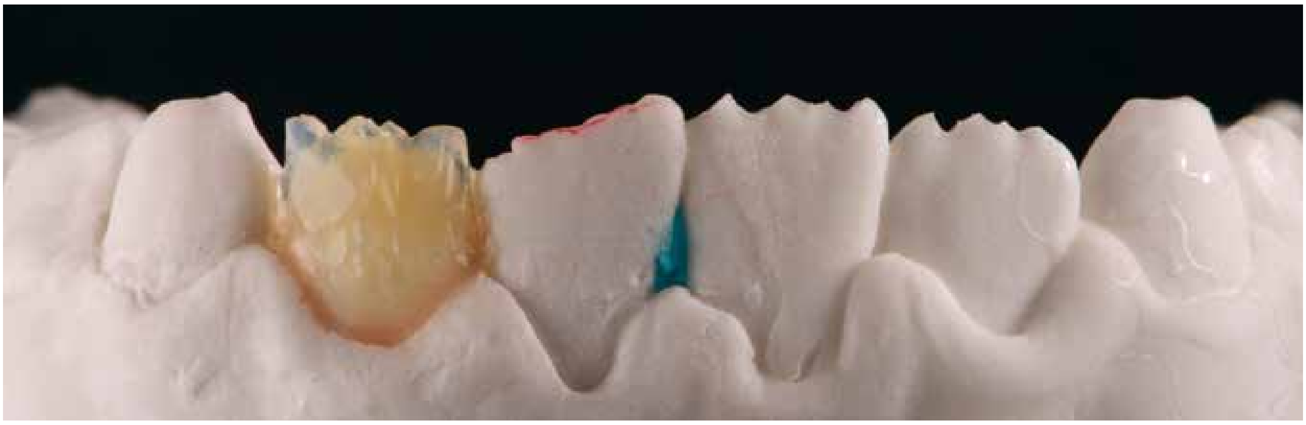

**Fig. 7** Opal Effect OE1 was applied to the dentin body after the mamelons had been shaped.

achieve the desired harmonious transition between the shade of the restoration and the gingiva. The resulting inhibition layer was removed with a disposable sponge, leaving the Liner surface completely free of residue. The polymerization parameters were selected in line with the recommendations for the apparatus used.

Now the preliminaries were out of the way. Such thorough preliminary work does not take a great deal of time, yet it affords a sound basis for achieving the desired result.

Next, the process of building up the restoration properly was commenced. With Dentin A2, the dentin core was built up in layers in such a manner that its shape and volume came as close to the original dentin body as possible. To ensure an effective bond between the lab composite and Liner surface, the first dentin layer should be adapted firmly and precured sufficiently (Fig. 3). The dentin body was completed with a layer of Effect material (Transparent Clear) (Fig. 4). Occlusal Dentin orange (ODO) was applied to the palatal and interdental areas to intensify the shade effect (Fig. 5).


**Fig. 8 and 9** Dentin body after application of Effect material. The mamelons in particular benefit from this layer, because it creates rounded smooth transitions.


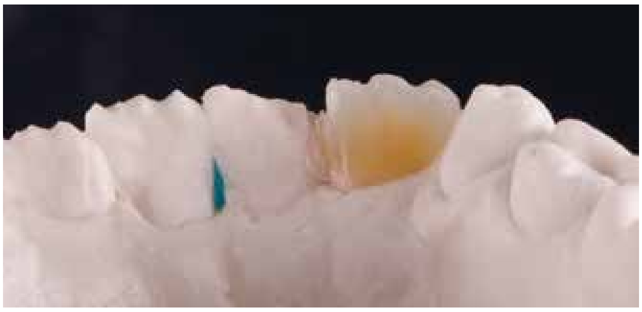

**Fig. 10 and 11** The contrast between the Enamel and Effect material creates a pleasing halo effect.

**Fig. 12** After the characteristics had been accentuated mechanically on the indirect partial composite restoration, the desired degree of gloss was attained with brushes and a buff.

After the dentin core had been polymerized, the mamelons were shaped mechanically (Fig. 6) and the marginal ridges were outlined on them using OE1 Effect material (Fig. 7). Effect materials create varicoloured reflexes, depending on the angle at which light falls onto the restoration. After the material had been precured, a thin layer of each Effect Mamelon Salmon and Dentin material A1 was applied onto the existing Effect layer to emphasize the dentin cusps physically (Fig. 8). The vibrant light reflection behaviour of the materials provides the desired contrasting effect (Fig. 9).

Next, the structure was covered with a layer of Enamel I2, followed by a thin coating of Opal Effect OE3. The contrast between Effect and Enamel material causes the light to be refracted at the incisal edge and, as a result, creates the desired "halo" effect, like in natural teeth (Figs 10 and 11).

Before finishing the restoration, SR Gel was applied in a layer that fully covered the entire surface but was not too thick. After all surfaces had been covered, final polymerization was conducted. Excess SR Gel was completely removed from the

**Fig. 13** View of the treatment area on tooth 42 with rubber dam isolation in place

**Fig. 14** The indirect composite onlay was incorporated using an adhesive technique.

**Fig. 15** Clinical situation immediately after cementation of the partial composite crown on tooth 42 and the incisal edge reconstruction of tooth 41

**Fig. 16** Six months after the atraumatic restoration: a satisfying clinical situation

restoration using running water and/or a steamer. After that, the restoration was carefully removed from the die.

Mechanical finishing was accomplished with various burs. Here, the aim was to understand the shape characteristics of the adjacent teeth correctly and to integrate them into the restoration. Micro-structuring of the smooth surfaces was achieved with a hard-bristle brush. Subsequently, the light reflecting areas were polished with a silicone rubber. Final high-gloss polishing was accomplished with Universal Polishing Paste, a Robinson brush and a cotton buff (Fig. 12).

To achieve a reliable bond with the luting composite, the cavity side of the composite crown for tooth 42 was carefully blasted with $Al_2O_3$ (80 to 100 μm) at 1 bar pressure in the laboratory. Following the try-in in the dental practice and subsequent cleaning, the cavity side was again roughened with a 50 to 100 μm diamond directly prior to the adhesive cementation and then silanized with Monobond Plus. The restoration was placed in the practice under rubber dam isolation. Here, it may be useful to apply some composite material to the lingual aspect to ensure that the clamp stays in place (Fig. 13). Next, the restoration was adhesively bonded to the sealed fracture surfaces, followed by light curing (Fig. 14). Application of the rubber dam resulted in slight irritation of the gingiva (Fig. 15), which, however, soon subsided.

After six months, the young patient visited the practice for a recall. The clinical picture was satisfying in every respect (Fig. 16) and confirmed the positive statements which the youngster made about his "new tooth" (Fig. 17). For the time being, recalls every six months are agreed.

Traumatic injuries present a challenge for the dentist and dental technician because such incidents require dental professionals to take a fast and competent diagnostic and therapeutic decision, normally with urgency. The decision they make may have positive or negative effects on the long-term outcome. When treating a young patient, the aim should be to conserve as much tooth structure as possible, especially in consideration of the state of development of the dentition. Timely minimally invasive and defect-oriented treatment of an injured anterior tooth may considerably mitigate the risk for consequential damage and the resulting need for costly treatment for the young patient affected. Furthermore, a successful early intervention may have a positive effect on a young patient's attitude towards dental treatment. In this case, treating the patient with a partial composite restoration provided a fast and long-term solution whilst preserving a maximum amount of natural tooth structure.

## Final assessment

The most common cause for losing a post-traumatic restoration is a repeat injury [3]. Therefore, a composite restoration is the treatment of choice in children if the broken-off fragments have been lost. Teeth restored in this way show a more

**Product list**

| Product | Name | Manufacturer/ Distributor |
|---|---|---|
| Masking gel | SR Gel | Ivoclar Vivadent |
| Luting material | Multilink® Automix | Ivoclar Vivadent |
| Bonding agent | SR Link | Ivoclar Vivadent |
| Rubber dam | OptraDam® Plus | Ivoclar Vivadent |
| Veneering composite | SR Nexco® Paste lab composite | Ivoclar Vivadent |

### Tips for working with SR Nexco® Paste lab composite

- Always observe the stipulated curing depths and maximum layer thickness of the individual materials during the layering procedure.
- Build up SR Nexco Paste in layers and precure each individual layer.
- Always coat SR Nexco Stains with layering material (e.g. Incisal or Transpa).
- Adapt firmly and create smooth rounded transitions between the layers using SR modelling instruments and synthetic brushes.

**Fig. 17** With the restoration complete, the young patient can again beam a happy smile, as you would expect from a child of this age.

favourable fracture behaviour than teeth restored with a ceramic material [4]. A custom fitted mouth guard provides effective protection against sports-related injury to the dentition, mouth or jaw. It is therefore in the interest of parents, sports instructors and sportspeople to take advantage of such devices. Mouth guards are particularly recommended for people practising sports activities that involve a high risk of injury, e.g. football, hockey, handball, inline skating or skateboarding.

## Literature

[1] Craddock HL: Consequences of tooth loss: 1. The patient perspective-aesthetic and functional implications. Dent Update 2009; 36: 616–9

[2] Andreasen, J.O.; Andreasen, F.M.: Farbatlas der Traumatologie der Zähne. Deutscher Ärzte-Verlag, Köln 1992

[3] Andreasen F M, Noren J G, Andreasen J O, Engelhardtsen S, Lindh-Stromberg U: Long-term survival of fragment bonding in the treatment of fractured crowns: a multicenter clinical study. Quintessence Int 26: 669–681 (1995)

[4] Magne P, Douglas W H: Optimization of resilience and stress distribution in porcelain veneers for the treatment of crown-fractured incisors. Int J Periodontics Restorative Dent 19:543–553 (1999)

[5] Mischkowski, R.A., Zöller, J.E.: Mundschutz zur Vorbeugung von sportbedingten Zahn-, Mund- und Kieferverletzungen. Dtsch Zahnärztl Z 55, 151-152

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# An alternative solution

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## Natural-looking restorations created with a new lab composite

**As a result of the advances made in dental implantology, today's edentulous patients can choose from a wide variety of prosthodontic treatments. Moreover, the materials and methods available for the creation of dental restorations are as varied as the therapeutic options. Therefore, dental practitioners and dental lab technicians are faced with the challenge of finding the most appropriate solution to suite the different needs and financial resources of their patients. This aim not only applies to "easy" cases, but also to complex situations that are demanding due to various aspects, such as durability, staining, plaque resistance, chewing and speaking ability and intraoral and extraoral esthetics. In order to offer these solutions, dental practitioners and lab technicians look for products that show excellent handling characteristics and are reliable to use. These features include good sculpting properties, which facilitate the build-up of dental restorations.**

### Treatment procedure

In the present clinical case, the patient showed considerable loss of vertical dimension. After comprehensive augmentation measures had been taken, the implants were placed. In the final dentures, the gingival parts of the restorations in the upper and lower jaw would compensate for the vertical loss of dimension. This case not only represented a major challenge for the restorative team but also for the materials used. The implant surgeon placed six implants in the upper jaw and four in the lower jaw (Camlog, Wimsheim, Germany). The implants had a standard diameter of 4.3 mm in position 15, 13, 23, 25, 34 and 45 and 5.0 mm in position 16, 26, 36 and 46. When they were inserted, the implants were positioned in such a way that they would provide ideal polygonal support of the superstructure. The implants were aligned according to a common direction of insertion. Therefore, both of the restorations were produced in the form of occlusal screw-retained implant bridges. This type of restoration facilitates repair and hygiene measures and aftercare.

### Material selection

The decision to use a CoCr framework and a laboratory composite to fabricate the permanent upper and lower dentures was based on three main aspects. The primary aim was to keep the weight of this very large restoration as low as possible. Furthermore, composite resins offer the advantage of effectively absorbing chewing forces. In a complete implant-supported denture, such as the one described in this case, the tactile sensitivity of the teeth, both in the active and passive occlusion, is greatly reduced compared with that of natural dentition[1], and the patient is capable of only partially controlling and/or influencing the chewing forces. Finally, one comprehensive composite system was preferred for the job, since it would allow both the dental and the gingival tissue to be reconstructed with coordinated components.

Therefore, the choice of material fell on the new light-curing, micro-filled laboratory composite system SR Nexco® (Ivoclar Vivadent, Schaan, Liechtenstein). Due to their excellent physical properties and attributes, the components of this system seemed to be especially made for the planned implant-

**Summary**
Modern wear-resistant and long-lasting composite resins such as SR Nexco, which are designed for restoring all types of dental and gingival tissue, may also be used in combination with a CoCr implant-supported bridge to achieve a true-to-nature prosthetic solution in the case of severe loss of vertical dimension. In addition to restoring the proper function of the teeth, these materials also help to recreate the lifelike appearance of gingival tissue (pink esthetics).

based restoration (Tab. 1). SR Nexco is an advanced version of the clinically proven SR Adoro[2]. As a result of its high content of inorganic micro-opal fillers this new lab composite promised to deliver the desired results in terms of outstanding wear, stain and plaque resistance and exceptional handling and surface gloss. The fact that SR Nexco can be reliably polymerized in many of the commercially available light-curing devices presented an additional benefit. The desired physical characteristics and an even restoration surface are easy to achieve with this product. Restorations show long-lasting colour stability and high lustre throughout their entire service life, as has been confirmed in a number of tests (Tab. 1, Figs 1 and 2).

Despite all the excellent properties of a dental material – the quality of the restorative work ultimately depends on the skill, knowledge and experience of the dental laboratory technician. Indeed, in complex cases where the patient is completely edentulous, an in-depth knowledge of the biomechanics of chewing is requisite.

## Framework fabrication

A full-contour wax-up was created of the upper and lower jaw (Fig. 3). This mock-up was tried in and then duplicated with Matrix Cast Clear using the duplicating technique (anaxadent, Stuttgart, Germany) (Fig. 4). Clear Plexiglas rods were used for the sprues. The screw access openings were sealed off with stainless steel rods and the scan abutments were inserted in the silicone base. The silicone was thinly coated with Vaseline in order to prevent sticking during the duplication process. Subsequently, the wax-up was reproduced with Pattern Resin (GC Germany, Bad Homburg, Germany). In order to achieve the required quality of the PMMA, the material was cured in a pressure container at 2.5 bar.

Next, the full-contour Pattern Resin model was cut back. Since the PMMA framework served as the pattern from which the final framework would be milled, it had to be designed with utmost precision. The composite build-up of the functional surfaces and the pink and white esthetics is highly dependent on this step. The cervicolabial areas were finished in such a way that the framework would provide adequate support for the reconstructed gingival tissue. The same applied to the design of the gingival margin, the interdental papillae and the alveolar yokes. Therefore, the individual working steps were consistently checked against the matrix. The final anatomical and cusp-supporting design was scanned (Fig. 5). Then, the framework was precision-milled from a base metal alloy block on the basis of this pattern (Fig. 6). Apart from the anatomical aspects, the framework design had to feature smooth transitions, since sharp corners and edges would have heightened the risk of cracking and chipping of the composite

| Flexural strength (MPA) | Modulus of elasticity (MPa) | Vickers Hardness (MPa) | Water absorption (µg/mm²) | Water solubility (µg/mm²) |
|---|---|---|---|---|
| 90:10 | 6500:500 | 440:5 | 15:1 | 1:0.5 |

**Tab. 1** Materials data of SR Nexco (Source: Ivoclar Vivadent, R&D, Schaan, Liechtenstein, 2011).

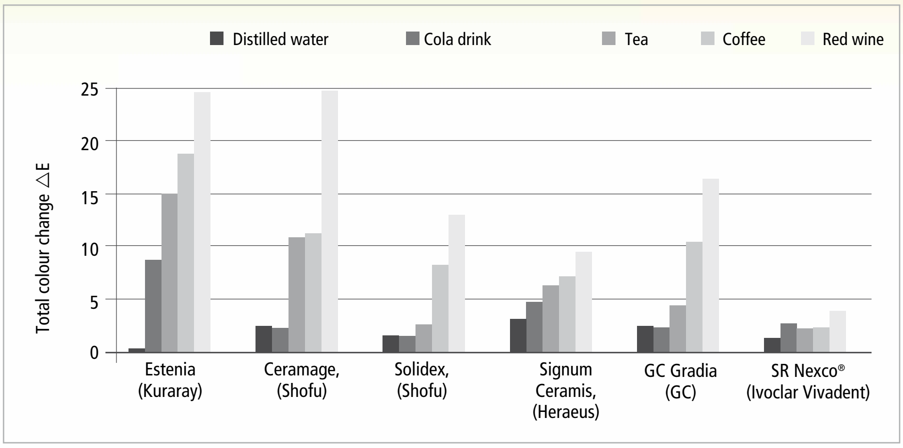


**Fig. 1** Colour stability evaluation after five-week immersion (Source: Nippon Dental University School of Life Dentistry in Tokyo, Japan, Dr Shinya, 2012).

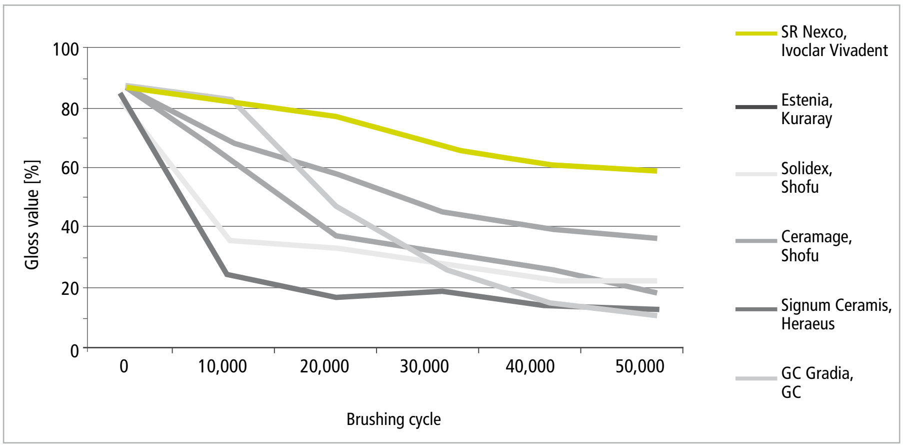


**Fig. 2** Significantly higher gloss stability of SR Nexco test specimens after simulated tooth brushing (Source: Nippon Dental University School of Life Dentistry in Tokyo, Japan, Dr Shinya, 2012).

facing. In order to apply a composite facing to the base of the restorations, these areas were also cut back at the Pattern Resin stage. The excellent homogeneity and polishability of SR Nexco would reduce the plaque affinity in this part of the restorations. Furthermore, by taking this measure, the dentures can be extraorally augmented if gingival tissue should recede in the future.

## Framework conditioning

The frameworks were tried in and assessed using the Sheffield test. Since they showed excellent fit, the metal frameworks were conditioned without any adjustments having to be made. Therefore, both frameworks were sandblasted with aluminium oxide ($Al_2O_3$) (grit-size 25 µm – not as prescribed by the manufacturer) at 2 to 3 bar pressure. Any particles left on the surfaces after sandblasting were removed by simply tapping them off the frameworks.

Then, a thin coating of the metal-composite bonding agent SR Link (Ivoclar Vivadent) was applied on the dental parts of the framework with a clean disposable brush (reaction time of 3 minutes). The bonding agent establishes a chemical bond between the metal framework and the opaquer, which is subsequently applied in two layers (a thin first layer of wash opaquer and a second covering layer). The opaquer and all the other individual layers were polymerized or pre-cured according to the time and curing depths prescribed by the manufacturer. It is of utmost importance to follow these instructions in order to prevent chipping of the restorations at a later stage. The inhibition layer was removed with the supplied sponge tips (without a solvent) (Figs 7 to 9).

The areas of the master model which will come in contact with the laboratory composite are isolated with a thin layer of Model Separator (Ivoclar Vivadent). This prevents the composite resin from sticking to the model. Model Separator is allowed to react briefly and then excess is evaporated with compressed air.

**Fig. 3** Wax-up (upper jaw)

**Fig. 4** Wax-up in the flask, prepared for the duplication process (upper jaw)

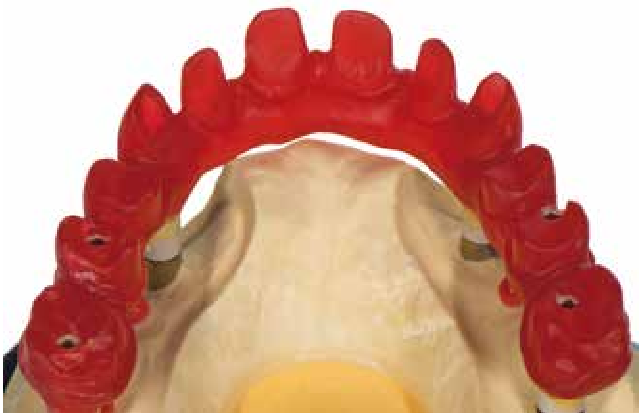

**Fig. 5** Cut-back Pattern Resin framework for the upper jaw

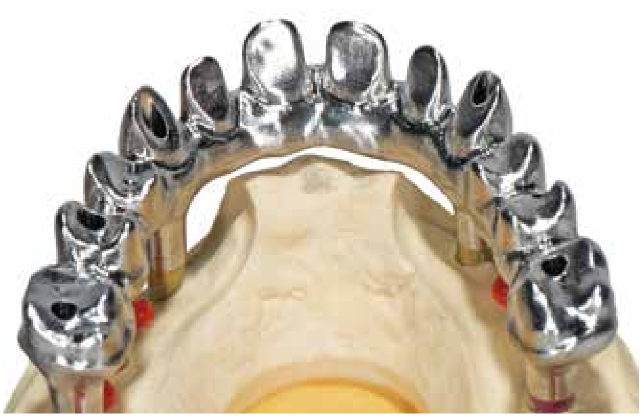

**Fig. 6** 1:1 milled and polished CoCr metal framework

## Dental framework parts

The dental parts of the framework were built up as usual with the appropriate materials from the SR Nexco system (Figs 10 to 14). The transitions between the layers were created with customary modelling instruments and acrylic brushes. The system contains a number of Effect powders, which are intended for adding individual characteristics. In the build-up process, it is very important to reproduce the dental structures, which have been captured in the wax-up, as faithfully as possible in order to avoid any unpleasant surprises with regard to the function and phonetics of the restoration and as a consequence, the dissatisfaction of the patient. An even layer thickness additionally helps to produce a harmonious-looking appearance. The outcome can be effectively monitored by consistently checking the restoration against a matrix. In the present case, the shape and function of the dental parts of the restoration were adjusted with customary grinding instruments. The restorations were pre-polished with silicone polishers (Edenta, Au, Switzerland). Final polishing took place once the dentures were completed.

**Fig. 7** Application of the SR Link bonding agent on the sandblasted upper-jaw CoCr framework

**Fig. 8** Application of the first opaquer layer

**Fig. 9** Removal of the inhibition layer after the application of the final opaquer layer

**Fig. 10 to 14** The dental framework parts are layered with Dentin, Margin, Effect and Incisal materials.



**Fig. 15 to 17** Application of the SR Link bonding agent and two layers of Gingiva Opaquer

**Fig. 18** Build-up of the basic gingival material BG34

**Fig. 19** Depth effect created through characterization with Gingiva IG5

**Fig. 20** Final layer of Transparent material

**Fig. 21** Build-up of free gingival tissue

**Fig. 22** Build-up of attached gingival tissue

## Gingival framework parts

Less experienced dental technicians are well advised to study photos of natural gums in preparation for creating true-to-nature gingival tissue. Natural gum tissue is highly individualized and its recreation will demand a great deal of creativity on the part of the dental technician. Artificial gingival tissue obtains its lifelike, three-dimensional character through the harmonious interplay of shape, colour and surface texture. The papillae should be appropriately formed to enhance the shape of the teeth. Typical gingival features that need to be recreated include shallow alveolar yokes and the stippling produced by connective tissue projections as well as a colour transition from the bright red of the attached gingiva to the darker, bluish-red shimmer of the free gingiva. The objective is to produce the impression that the tissue contains real blood vessels. The new, intensive colours of SR Nexco Intensive Gingiva help to achieve an effect of depth.

In the case at hand, the gingival framework parts were coated with a thin film of SR Link bonding agent before the Gingiva Opaquer was applied in two layers and then polymerized (Figs

**Fig. 23** Application of SR Gel

**Fig. 24 and 25** Final contouring with tungsten carbide instruments

**Fig. 26** High-gloss polishing with a universal polishing paste

**Fig. 27** Composite resin base of the implant-supported bridge

15 to 17). Subsequently, the SR Nexco Gingiva materials were applied. The basic gingival material BG34 was applied first to achieve a good overall reproduction of the gingival tissue. The restoration was further characterized with Effect powders and subsequently completed with Transparent material (Figs 18 to 22). The individual layers were pre-cured for 20 seconds per segment.

## Finishing

Prior to final polymerization, the dental and gingival areas were coated with a layer (not too thick) of SR Gel to prevent the formation of an inhibition layer (Fig. 23). The restoration was finished with customary tungsten carbide instruments and polishing equipment after the dispersion layer had been completely removed. Natural examples and photos should be studied to obtain a good idea of how to recreate the various tissue components (Figs 24 and 25).

**Fig. 28 to 30** Finished implant-supported bridge: frontal and occlusal view as well as the occlusal surface in detail

**Fig. 31 and 32** Comparison: 1:1 transfer of the wax-up to the final restoration

The dental and gingival parts of the restorations were finely polished to a smooth finish with rubber polishers and silicone polishing wheels. Any micro-roughness of the composite resin in the vestibular and base areas of the restorations in particular must be eliminated, since these sites could provide ideal prerequisites for the accumulation of plaque. High-gloss polishing with goat's hair brushes and buffs and the universal polishing paste from Ivoclar Vivadent was carried out until the desired lustre was achieved (Figs 26 to 30).

### Note

Guidelines on the lifelike reconstruction of gingival tissue are available within the scope of Ivoclar Vivadent Gingiva Solutions (prosthodontic gingival reconstruction with ceramics, composites and denture base materials). For further information, visit

**www.ivoclarvivadent.com.**

## Conclusion

The new SR Nexco provides dental technicians with a material that covers a wide spectrum of indications including the complex restoration of lost vertical dimension. Due to its paste-like consistency, the material can be sculpted with ease. As a result, it facilitates the entire restoration fabrication process (Figs 31 and 32). The coordinated materials and components of the system offer dental technicians a host of individualized design possibilities. Furthermore, dental technicians can fully rely on the system to produce lasting functional and esthetic restorations.

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## Literature

1. Hämmerle CH, Wagner D, Bragger U, et al. Threshold of tactile sensitivity perceived with dental endosseous implants and natural teeth. Clin Oral Implants Res 1995;6:83–90.
2. Olms C, Setz JM. Klinischer Vergleich von composite- und keramik-verblendeten metallunterstützten Kronen. Erste Ergebnisse nach 18 Monaten. Quintessenz Zahntech 2010;36:1364-1372.

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# Almost like a fixed restoration!

## Removable restorations with SR Nexco®

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**The patient would have preferred a fixed restoration but this option was not feasible. The alternative was a bar-retained removable overdenture using SR Nexco®. Both the dental team and patient were impressed with the result – a true-to-nature reconstruction that functions almost like a fixed restoration.**

The female patient presented with loose teeth and deep pockets. A detailed periodontal examination revealed that none of her maxillary teeth was in a good enough condition to be preserved and, as a result, all of them were extracted. Prosthetic rehabilitation with complete dentures was an absolute no-no for the patient. She was hoping for a fixed restoration.

Extensive preliminary planning involving dental imaging and the use of a wax-up, mock-up and a polyurethane dummy showed that a fixed restoration was not feasible because of excessive bone atrophy. A fixed option would have necessitated augmentative measures – a procedure which the patient did not want to undergo. We decided on a bar-retained removable prosthesis as the closest option to a fixed restoration. For this purpose, six implants were inserted in the region of tooth 1, 3 and 5 for anchoring the overdenture. The dental surgeon recommended that the implants in region 3 and 5 be splinted. A locking pin in the region of tooth 6 was used for fastening the prosthesis.

### Prosthetic planning

If, in spite of all the conservative measures taken, the natural teeth have to be removed, a fixed replacement is often desired. This is, however, not always feasible. The condition of the jaw bone and soft tissues, the ability to perform oral hygiene measures and the position of the implants are factors determining whether or not a fixed restoration is a viable option.

Detailed planning is key for the treatment of complex cases of this kind. Treatment planning and implementation are based on a careful analysis of the clinical situation by means of various methods such as photography, dental imaging, set-up, wax-up and, subsequently, a mock-up, or polyurethane dummy (Fig. 1). The dummy can be modified and adjusted until the teeth are correctly positioned esthetically and functionally. Phonetics presents another key stage in the planning procedure. A polyurethane mock-up provides an excellent means to examine the speech prior to fabricating the final restoration and offers several advantages over wax patterns, such as a stable position, no shifting of teeth and superior surface smoothness.

The information gathered in the process is then transferred to a drilling template to enable the surgeon or dentist to insert the implants at a site that is convenient for the placement of the subsequent dental prosthesis.

In the present case, an impression was taken using an open custom tray after the healing phase was completed. The model was created in the customary manner. As some parts of the restoration were fabricated using CAD/CAM technology, a scannable material was used for the gingival mask.

## Primary and secondary structures

Laser scanning technology (Trios, 3Shape, DK) was employed for the digital images of the model (Fig. 2). Telescopic zirconium oxide abutments were placed on the implants in the region of tooth 1. The implants in the region of tooth 3 and 5 were splinted with a zirconium bar, which was provided with a bar stub at the distal end to accommodate the lock blades. The lack of agreement between the connection geometry of the implants for the bar construction was overcome by means of an abutment insert (2-CONnect, nt-trading, Karlsruhe, Germany). This adapter converted the internal into an external connection with a tolerance range of 20°. We used a multi-unit abutment only on the distal implant to ensure that the screws were not the sole parts responsible for absorbing the lion's share of the loading forces. On the mesial side, a conventional bonding base interconnecting with the internal configuration of the implants was employed to ensure a balanced distribution of forces.

After the sintering process, the zirconium parts were bonded using a self-curing luting composite (Multilink® Implant, Ivoclar Vivadent, Liechtenstein) in accordance with the manufacturer's directions and tried in on the patient (Fig. 3). In the laboratory, the abutments and bars were processed and polished using a water-cooled turbine and a Komet 2° grinding set (Gebr. Brasseler, Lemgo, Germany). With the help of a parallelometer, the bar stubs were provided with recesses for the lock blades (Fig. 4). The lock blades were cast in precious metal using prefabricated wax profiles and then integrated into the dummy to keep a clear overview of the restoration and to be able to make optimal use of the space available (Fig. 5).

In the current case, the distal section of the first molar was utilized as a "lifter". To ensure optimum integration into the tooth shape, the posterior section at the centre of the transverse crest was cut out from the molar on the dummy and subsequently waxed up on the lock blades using modelling wax. This section was then invested, cast, polished and joined

**Fig. 1** Try-in and adjustment of the polyurethane dummy

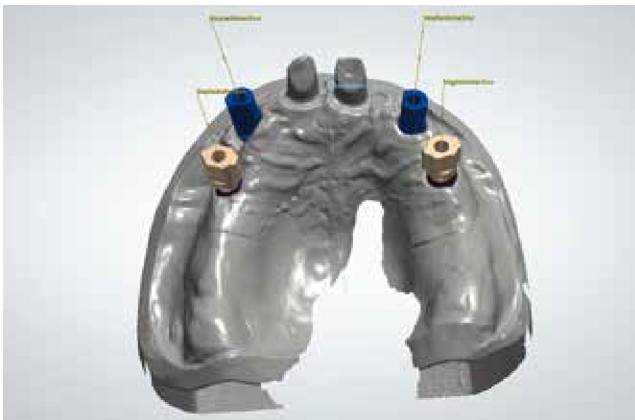

**Fig. 2** Screenshot to determine the insertion path

**Fig. 3** Try-in of the zirconium abutments and bars

**Fig. 4** Recess for the lock blade on the bar stub

**Fig. 5** Lock blade cast in precious metal (on the polyurethane dummy)

**Fig. 6** Locking bar lasered to the tooth in an opened position (on the polyurethane dummy)

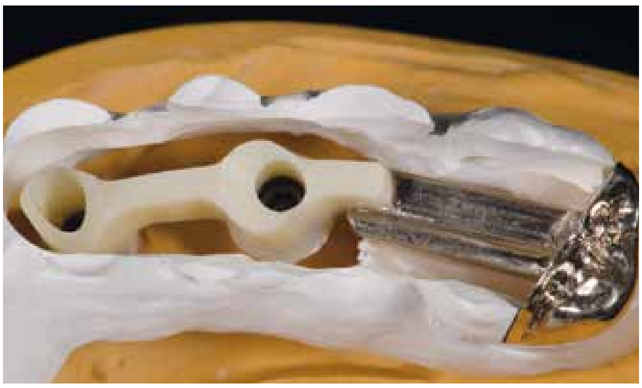

**Fig. 7** Dummy after having been cut open to check the spatial arrangements

to the lock blades by means of laser technology (Fig. 6). Finally, the dummy was cut open with grinding instruments to double check the spatial conditions (Fig. 7).

Next, the telescopic abutments at the site of tooth 11 and 21 were supplied with additional friction elements (TK-soft, Wegold, Wendelstein, Germany) to ensure that the retention strength can be re-established if it should become weakened. The placeholders for the friction elements were bonded to the milled surfaces of the abutments, coated with conductive silver varnish and subsequently electroformed. Additionally, the lock blades were provided with retention elements (Mini-Presso-Matic, Metalordental, Stuttgart, Germany) to prevent

**Fig. 8** Electroformed secondary parts with friction elements on abutments 11 and 21

**Fig. 9** Electroformed bar stub with retention element bonded to the basal surface of the lock blade

**Fig. 10** Tertiary structure made of cobalt-chromium, seated on the model

**Fig. 11** One-to-one copy of the dummy in wax

the bars from accidental opening during e.g. mastication. The retention elements were bonded to the basal surface of the lock blades, coated with conductive silver varnish and electroformed (Figs 8 to 9).

## Tertiary structure

To achieve sufficient stability and ensure a passive fit, the tertiary structure was made of cobalt-chromium alloy using a conventional model casting technique and luted intraorally using the passive fit technique (Fig. 10). Long hole drilling was performed to prevent the lock blades from disengaging. The

**Fig. 12** Wax pattern with the framework in the duplicating flask

initial hole was drilled with the locking bar in a closed position. Subsequently, the locking bar was carefully opened while the drill was being rotated until the desired position was achieved. The lock blade is prevented from slipping out by a wire which is bonded to the tertiary structure and touches the mesial edge of the long hole.

A silicone impression of the planned restoration was taken to ensure that the final prosthesis would look exactly the same as the dummy. The impression was provided with a sprue for the wax and then fitted onto the framework over the master model. Wax was filled into the cavity to obtain a one-to-one copy of the dummy. Subsequently, the gingival portions were removed and the contours of the teeth reconstructed in detail (Fig. 11).

In line with the compression technique of Annette von Hajmasy, a flask method was used for the veneering of the prosthetic restoration to avoid any inaccuracies. This technique ensures that the position and dimension of the teeth do not deviate from the model. The framework was removed from the master model for the flasking procedure. Next, a model was created from kneadable hard silicone and placed in the lower flask half. Prior to fabricating the silicone model, transparent silicone was applied to all bridge units to ensure that the surfaces under the bridge units would polymerize properly. An additional layer of transparent silicone extending to the equator of the teeth was applied to facilitate the cut-back for the incisal pressing. Next, the upper flask half was filled with clear silicone. It is advisable to use a hard silicone putty (72 shore hardness) for this procedure (Fig. 12).

## Veneering and finishing

For the polymerization process, the flask was placed in a pressure pot at 5 bar pressure to prevent air entrapments. After the two flask halves had been separated, the bridge framework was removed, cleaned and conditioned for the application of the opaquer. First, the entire framework was air-blasted with 100 µm aluminium oxide and then coated with SR Link. After the bonding agent was allowed to evaporate (three minutes), the first layer of opaquer was applied. It is necessary to apply the opaquer in two thin coatings to ensure it polymerizes completely. SR Nexco can be polymerized in virtually all commercially available polymerization devices. The correct polymerization times should be obtained from the operating instructions of the corresponding unit. The inhibition layer of the opaquer was thoroughly removed with a disposable sponge prior to pressing the dentin (Figs 13 and 14). All parts including the composite were heated up to 50 °C to ease the application of the material into the matrix and facilitate the pressing procedure. Before the two flask halves are assembled, a surplus material reservoir should be created. For this purpose, a groove is cut into the lower flask half from the vestibular, using a scalpel. Any surplus material can now flow into this "catchment area".

The dentin was filled into the flask without entrapping air bubbles. The flask halves were again assembled and placed in the pressure pot for 10 minutes to allow the silicone to regain its original dimensions whilst the surplus material was squeezed out into the reservoir (Fig. 15).

Subsequently, the flask was transferred to a light-curing device to polymerize the composite. When a thin press flash forms at the separation area, the occlusal height has been achieved (Figs 16 and 17).

With a targeted cut-back, the space required for pressing the incisal material was created. The natural appearance of the incisal region can be enhanced by creating a mamelon-shaped cut-back. The mamelon effect can be additionally increased with Opal Incisal, Transpa and Mamelon material. Similarly, the esthetic effect of the posterior region may be heightened by using the SR Nexco Effect materials, e.g. Transpa, Opal Incisal and Occlusal Dentin. The Transpa Incisal material was applied in layers into the same matrix and then again processed in the pressure pot and polymerization unit (Figs 18 to 21). The basal part of the reconstruction was completed with a cold-curing polymer (ProBase Cold, Ivoclar Vivadent, Liechtenstein). This procedure facilitates the application of relining material at a later stage.

**Fig. 13** Removing the inhibition layer from the opaquer

**Fig. 14** Repositioning the prepared framework into the duplicating flask


**Fig. 15** Application of SR Nexco dentin paste into the upper flask half to reproduce the waxed-up teeth in SR Nexco composite

**Fig. 16** Teeth polymerized onto the framework (a thin press flash is visible)

**Fig. 17** Occlusal view of the pressed result

The patient described in this report had a high smile line and, as a result, the gingival portions were also in need of customization. For this purpose, the gingival area between the two premolars was reduced, coated with SR Connect and processed in the polymerization device. This step created an interface to the underlying cold-curing polymer and established the conditions for applying gingival materials in various shades (Fig. 22). SR Nexco provides a comprehensive range of shades to design true-to-nature prosthetic gingival parts.

For the final polymerization, the dentures were coated with a fully covering but not inappropriately thick layer of SR Gel and then processed in the polymerization unit. Prior to polishing the restoration, the inhibition layer was completely removed. Tungsten carbide and diamond instruments are best suited for

**Fig. 18** Composite teeth cut back to mimic mamelons

**Fig. 19** True-to-nature incisals achieved with the SR Nexco Effect materials

**Fig. 20** Layering scheme applied to tooth 11: visualized and implemented

**Fig. 21** Occlusal surface customized with Effect materials (prior to incisal pressing)

**Fig. 22** Reconstructed and customized soft tissue parts

**Fig. 23** Completed maxillary prosthetic restoration with opened locking bars and adjustable friction element on tooth 21

**Fig. 24** Basal view of the completed restoration: adjustable retention elements at the site of tooth 11 and 21 and multi-unit abutments at 15 and 25

**Fig. 25** Natural and harmonious interplay of shape and shade between the "completely" restored upper jaw and the natural dentition of the lower jaw

**Fig. 26** The patient is pleased with her customized restoration.

finishing. Prepolishing was performed with silicone rubber polishers. High-gloss polishing was achieved using polishing brushes and a cotton buff (Figs 23 and 24).

## Conclusion

Reconstructing the function and esthetics of complex oral structures not only presents a challenge to the dental technician but also poses high demands on the materials used. The restoration should smoothly blend in with the existing natural oral environment, offer a high level of comfort during mastication and allow efficient laboratory procedures.

A decisive aspect in the success of such a reconstruction is the technician's ability to recognize the patient-specific shapes and shades of the natural teeth and the soft tissues and to use the available materials accordingly. Featuring excellent clinical properties and a straightforward application protocol, SR Nexco enables the technician to meet these requirements. SR Nexco offers a range of materials to harmoniously integrate parameters such as shade, translucency and dimension to achieve a dental reconstruction that ensures long-term shade and shape stability. Against such a backdrop, we were able to accomplish a restoration that met the patient's expectations for a true-to-nature reconstruction – a prerequisite for high patient acceptance and satisfaction.

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# From implant shoulder design to a harmonious smile

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## Restoration of an edentulous mouth with partially removable dentures

**Our smile is part of our identity. Recreating the smile characteristics in an edentulous patient represents the pinnacle of dental prosthetics.**

When we smile, we show emotions. People respond with many feelings to the way we use our mouth. If we show our teeth, we reveal something about ourselves. These are only a few examples illustrating the fact that our mouth does not only fulfil a biological function but also reflects our feelings. Every dentist-technician team aims to recreate the functional and anatomical characteristics of the teeth and the surrounding tissues. This is coupled with an additional issue: the patient's individuality (Figs 1a and b). This report describes the case of a female edentulous patient whose restorative needs were met with a customized esthetic restoration. Striking a balance between a high smile line, an extremely low mandibular vertical dimension and limited vertical space in the maxilla proved to be the main challenges here.

**Fig. 1a and b** The individuality of the patient should be reflected in every prosthetic reconstruction. This patient has had a high smile line since her childhood. In her mid-sixties, she presented with an edentulous upper and lower jaw.

### Patient case

The patient came to see the treatment team with the request to have her edentulous upper and lower jaw restored. At first sight, we noticed a high smile line and short upper lip length. The lower jaw bone showed signs of severe atrophy. By comparison, the upper alveolar bone appeared to be unduly large. When we were trying to establish the best possible treatment plan to meet the patient's individual needs, we had to clarify what defined a "fixed restoration" to the patient. Restorations that are partially removable (or partially fixed) can be "fixed" in the mouth and yet offer advantages over non-removable restorations (e.g. hygiene capabilities). A partially removable implant-retained restoration presents a well-established treatment option that has been successfully used for decades and was selected for the case described in this report. The treatment team decided to insert six implants in the upper jaw and four implants in the lower jaw.

#### Procedure in the dental lab

After osseointegration of the implants, impression-taking was performed. Detailed prosthetic planning made it clear that fabricating the prosthesis was going to be no mean feat. Because of the large maxillary alveolar ridge, the vertical space available for the prosthetic restoration was limited. The vertical dimension in the mandible was accordingly large. This aspect was at the forefront of our considerations. The superstructure would have to be skilfully used to diminish this discrepancy. However, there were more challenges to overcome: the patient's pronounced lip dynamics posed additional difficulties for achieving good restorative esthetics. The aim was to find a way of camouflaging the transition between prosthetic and natural gingiva so that it blended naturally. Again, the lack of alveolar height proved to be a limitation – the maxillary restoration could not be designed to extend to the gingivobuccal fold. What to do instead?

### Creating the mock-up

After the models were transferred to the articulator, a mock-up was created and a try-in performed on the patient to visualize the prospective results (Figs 2a to d). Tooth-coloured polyurethane material ensured that the patient did not get distracted by an unnatural tooth colour. With the mock-up placed in the patient's mouth, the dentist was able to clarify all contingencies, whilst taking esthetic preferences, function and phonetic aspects into account.

At the mock-up stage, the following objective and subjective characteristics were assessed:

- Has the facial plane been faithfully transferred to the dentures (occlusal plane)?
- How do the upper and lower jaw relate to each other (vertical bite relationship)?
- Has a harmonious balance between pink and white esthetics been achieved?
- How much "white" is possible, how much "pink" is necessary to ensure an esthetically harmonious smile?
- Is the patient capable of articulating speech clearly (phonetics)?
- What are the patient's subjective feelings regarding the restoration and can she identify with it?
- Does she have any additional requirements or requests for amendments?

**Fig. 2a to d** Mock-up to visualize the intended result. Objective and subjective criteria were analysed.

### Planning the superstructure

In a tricky case like this, accurate groundwork requires time and a detailed analysis of the given situation. For the upper jaw, we decided to fabricate a telescopic bridge veneered with a lab composite. Additional locking components were required due to the lack in vertical height. The sliding friction of the telescopes alone would not have been sufficiently strong to keep the dentures tight in place. In the lower jaw, a bar-sustained prosthesis was indicated and again esthetic veneering with a composite was the method of choice. To achieve a lasting friction, attachments (Preci-Line) would be used in conjunction with the bar construction. As the existing bone was used to perform the implantation, the implants were not ideally distributed over the entire alveolar ridge. Additionally, the extreme bite height appeared to pose a certain level of difficulty; physical stability (leverage forces) was another issue of concern.

After we knew how we were going to design the superstructure, we "froze" the mock-up in a transparent flask (Figs 3a and b). This method allowed us to preserve all the specifications that we had worked out. Utilizing transparent duplicating silicone is key to be able to transfer the planned reconstruction to the final restoration.

### Fabricating the final restoration

The primary and secondary retentive elements were fabricated. The frameworks were tried in on the patient and checked for accuracy of fit (Figs 4a to c). That achieving a tension-free fit was paramount in this context may here be mentioned only in passing.

The frameworks were veneered with a special veneering composite: SR Nexco®. This light-curing lab composite with micro-opal fillers is characterized by material and processing features specifically geared to the needs of the lab technician. It offers a beautiful optical appearance and good clinical behaviour. Given its physical and optical properties, SR Nexco is ideally suited for this type of work. Compared with ceramic materials, the composite is capable of absorbing forces and is therefore especially suited for veneering applications in implant restorations.

**Fig. 3a and b** The mock-up was duplicated in a transparent flask using clear silicone material.

**Fig. 5** The mandibular restoration was pressed in dentin only ...

**Fig. 6** ... and then ground to the dentin core (cut back) and ...

**Fig. 4a to c** The frameworks for the superstructure fitted on the model and in the mouth without causing tension (mandible: implant-sustained bar; maxilla: telescopes for a bridge restoration).

**Fig. 7** ... complemented with appropriate incisal material using a flask technique.

At this stage, we were able to ripe the benefits of our meticulous approach to planning and of our transparent flask method. SR Nexco dentin material of the appropriate shade was pressed onto the conditioned framework and polymerized in a curing device (Fig. 5). With this method, the prosthesis was homogeneously reproduced in dentin in a relatively short time. The reconstruction was removed from the flask and reduced to the dentin core using the silicone key as a guide, similar to the cut-back technique (Fig. 6).

Customized layering is essential to achieve a true-to-nature effect, not unlike ceramic restorations. To complement the incisal area, the corresponding incisal material was applied into the flask and pressed onto the "dentin core" using heat and then polymerized. In a few stages, we transferred the planned restoration to the final reconstruction using an esthetic dentin and incisal build-up (Fig. 7).

**Fig. 8a to d** The gingival parts were manually built up in layers using the comprehensive SR Nexco shade range.

After the pressed "frameworks" were finished and fitted onto the models, the functional parameters were checked in the articulator and adjustments were performed accordingly. The next stage was to create lifelike gingival parts. The comprehensive range of SR Nexco shades unfolded its true potential here. The gingival materials were manually layered onto the framework. The range includes a multitude of gingival shades – materials in various degrees of translucency and opacity are available, giving abundant scope for creativity. These materials were selectively used to create a natural-looking artificial gingiva in line with the requirements of this demanding situation (Figs 8a to d).

Lifelike fluorescent and opalescent effects are paramount to ensure a harmonious integration of the tooth shade under varying light conditions.

The restoration was completed in the customary manner. Shape, morphology and surface structure were all given due attention. After finishing (Figs 9a to c), an initial try-in was performed on the patient. All the aspects evaluated in the mock-up were checked again. In addition, the shade effect was assessed. The transition between natural and artificial gingiva in the upper jaw was examined particularly careful. A reminder: the patient shows pronounced lip dynamics and as a result the entire vestibular space is visible when she laughs. However, this characteristic did not curtail the esthetic success. All criteria were met with the satisfaction of the patient and the treatment team: approval for surface finishing and polishing was given.

During polishing the beautiful characteristics and homogeneous material properties became apparent (Fig. 10). The optimally coordinated combination of micro-opal fillers and composite matrix endows SR Nexco with the ability to be polished to an unmatched, durable high gloss. The natural looking opalescent effect can be seen in images 11 and 12 and is, among others, the result of the high content of inorganic opal fillers. The optical properties can be best observed in transmitted and incident light. It is hardly believable that this is a composite. Studies have shown that SR Nexco offers long-lasting shade stability, a durable gloss and low plaque affinity, providing the team with the necessary assurance of reliability. The patient

**Fig. 9a to c** Completed restorations on the model

**Fig. 10** After polishing: the lab composite offers an impressive finish.

**Fig. 11 and 12** The natural opalescent properties can be clearly seen here.

**Fig. 13** Emotions are reflected in the mouth: the teeth naturally blend in with the oral environment.

**Fig. 14 and 15** In spite of the suboptimal initial situation, we achieved a result that matches the characteristics of the patient: she has been given back her individuality (cf Figs 1a and b).

was overjoyed with her "fixed" restoration. The dentures naturally blend in with the features of her face (Fig. 13). In spite of the suboptimal preoperative situation, we managed to create a customized and highly esthetic restoration. Both the hygiene capabilities and long-term stability of the restoration are ensured.

## Conclusion

Our efforts were rewarded with a happy patient (Figs 14 and 15), when the restorations were inserted. It was equally rewarding to see this patient again after a while and be still given the same smile of gratitude. A well-structured treatment plan and ideal materials enable us to fulfil the fundamental human need for individuality.

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# Pink-white esthetics

## in an All-on-4 bar restoration

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**A full maxillary rehabilitation requires that all esthetic and functional parameters are taken into consideration. This report discusses the aspects of such a treatment. The surgical protocol and implant treatment to achieve temporary and final restorations that can be immediately loaded are reviewed stage by stage and the clinical and prosthetic conditions required to attain an ideal result explored.**

### Chewology

A 65-year-old male presented at the practice with the request to have a complete ceramic bridge retained on natural teeth replaced. A clinical and radiological evaluation revealed numerous cysts, root factures of the canines and fatigue of the bridge abutments. These conditions were inappropriate for a restoration on natural abutments (Fig. 1). By incorporating a temporary composite bridge we were able to restore the oral function and esthetics and gain time for the patient to make up his mind on the final treatment. His decision making was accelerated by a fracture of the bridge near tooth 23.

First, a computer-aided simulation was created using NobelGuide® software (Nobel Biocare, Cologne, Germany) (Fig. 2). This planning software enables us to design a detailed treatment plan and devise a strategy to implement the treatment plan while taking the patient's individual anatomy and specific requirements of the given prosthetic project into account. [1-4,6,8,19,25,26]

The aim was to insert four implants: two implants in the incisor area and two posterior implants angled at 45° and positioned anterior to the maxillary sinus in line with the principles of the All-on-4 treatment concept. A maximum of ten teeth may

**Fig. 1** Initial situation

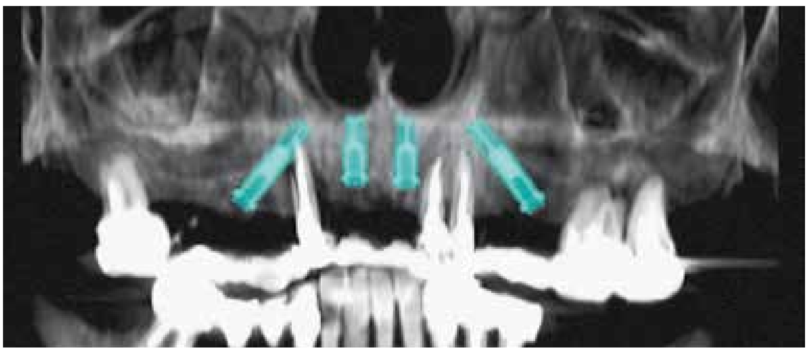


**Fig. 2** Computer-assisted simulation using NobelGuide® software

be included in the temporary bridge for the prosthetic reconstruction. This range may be extended to include twelve teeth for the final restoration after reassessing the situation. [9-11,13,14,17,20-24]

The patient decided in favour of this treatment plan because of the short treatment time, low costs, avoidance of extensive and painful bone-grafting procedures and because of the fact that he would be able to wear a "fixed" prosthesis screwed onto the implants 48 hours after tooth extraction.[7,16,18,27]

## Surgical protocol

Local anaesthesia was administered with articaine hydrochloride and adrenaline 1% using a local infiltration technique. Then, the remaining teeth were extracted and a full-thickness mucoperiosteal flap was elevated. Curettage of the lesions and careful cleaning (Betadine) allowed the removal of granulation tissue and potential foci.

Slight adjustment of the bone volume was performed in consideration of the patient's relatively high smile line. After the anterior walls of the maxillary sinus had been located, the two posterior implants were placed with the help of an All-on-4 surgical guide. Subsequently, the other two implants were inserted in the incisor area (Fig. 3). The implants were tightened using a torque of approx. 40 Ncm.
Two 30°-angled multi-unit abutments (bridge impression posts) were placed at a torque of 15 Ncm to re-establish the axes of the posterior implants. The multi-unit impression posts were screwed onto the straight 2-mm and the angled posts and tightened using 35 Ncm. Soft tissue management allowed us to preserve as much keratinized soft tissue as possible.

Impressions were taken with a customized impression tray and an addition-cured silicone (Express Penta Putty, ESPE, Seefeld, Germany) (Fig. 4). A bite record was also taken. Gingiva formers were screwed onto each implant (Fig. 5).
After only three hours the patient was ready to go home with the implants in place.


**Fig. 3** Extraction/implant placement at the treatment session

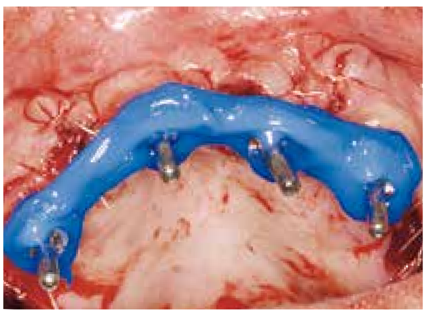


**Fig. 4** Impression taking


**Fig. 5** Gingiva formers in situ

**Fig. 6** Cast framework after separating and luting

**Fig. 7** Temporary restoration on the model

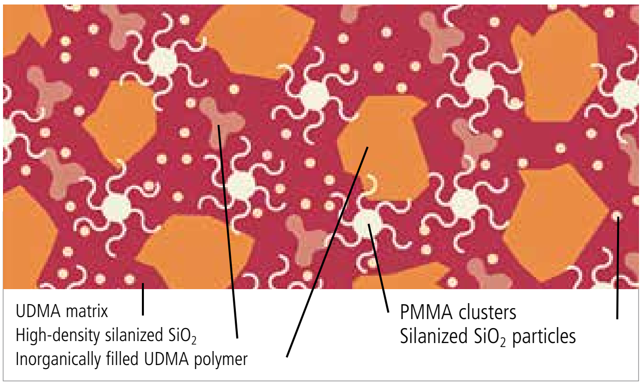



**Fig. 8** Schematic of the chemical composition of the denture teeth

**Fig. 9** A smiling patient with temporary restoration in situ

## Temporization

If this treatment approach is used, the dental technician should manufacture a passive framework in less than 48 hours and create a functional and esthetic temporary restoration suited for immediate loading.

Setup, tooth mould selection, length, width and esthetics form the most important aspects in the fabrication of the temporary prosthesis. To meet the high esthetic expectations of the patient presented in this case report, the technician aimed to select teeth that offered a high level of natural esthetics.

The framework was manufactured using burnout multi-unit posts. The advantage is that the framework can be cast using the alloy selected by the team. The distal extensions at the rear of the posterior implants were set out of occlusion. Originally, these extensions should have included two teeth. Upon consultation with the clinician, however, it was decided to implement only a single-tooth cantilever to prevent overloading from impairing the osseointegration of the implants.

The framework was cast using the cobalt chromium alloy Colado® CC (Ivoclar Vivadent, Ellwangen, Germany) and subsequently separated between each implant (Fig. 6). While still on the model, the individual sections of the framework were tack-welded and, subsequently, the framework was soldered. This is the only way to "passivate" the framework if it is not manufactured using machining technology.

Given their esthetic properties and wear resistance, the SR Phonares® II teeth (Ivoclar Vivadent) were selected for the prosthetic reconstruction (Fig. 7). The SR Phonares II tooth moulds are based on a urethane dimethacrylate matrix incorporating fillers of different types and sizes and clusters of PMMA. Their composition ensures an excellent bond with PMMA resin materials as well as with organic and inorganic fillers. Because of their shock resistance, these teeth are ideally suited for prosthetic reconstructions on implants.

The PMMA contained in the fillers heightens the teeth' capability of absorbing occlusal loads (Fig. 8). As implants offer only limited elastic resilience, it is up to the tooth material to take on this role and act as a force breaker if the

**Fig. 10** Result after 18 months

**Fig. 11** Impression reinforced with brass wire wound around the impression posts

**Fig. 12** A very hard Bis-acrylate-based composite material was applied with a syringe to splint the multi-unit impression posts and passively immobilize their position.

**Fig. 13** Working model with removable gingiva mask

loads are too high. In doing so, they fulfil an overriding purpose: to maintain the integrity of the implants. During loading, the stiffness of the framework has a decisive effect on the stability of the implants and, therefore, on the success of osseointegration. Occlusal stability, occlusal anatomy and the repositioning of the lower jaw all affect the chances of achieving successfully osseointegrated implants. In view of the patient's facial features (broad bold jaws and tendency to bruxism), it was decided to utilize teeth whose properties are, according to the manufacturer, superior to conventional denture teeth in terms of dimensional stability, wear resistance and composite cohesion (Fig. 9).

## After 18 months

The 18-month result showed the expected level of soft tissue resorption (Figs 10 and 11). Two temporary mandibular bridges replaced the old inappropriate restoration in the lower jaw. Although the patient showed signs of bruxism, the tooth material behaved flawlessly with the denture teeth showing neither wear nor chipping – occurrences that are often indicative of an inadequate occlusion or inadequately high biting loads (Fig. 10). On the basis of the outcome achieved in the provisional phase, the treatment team was now able to recommend a final treatment plan as follows: bar-supported All-on-4 bridge extending over 12 teeth with a gingival mask made of SR Nexco® lab composite (Ivoclar Vivadent) and two metal-ceramic bridges made of IPS InLine® PoM press-on-metal ceramic (Ivoclar Vivadent).

## Final restoration protocol

Multi-unit posts were again used for this step. Impression-taking can be optimally performed by winding brass wire around the posts. The wire must not be tightened to avoid the risk of deformation (avoiding any tension is even more important for this technique than for others) (see Fig. 11). In two stages, a low-shrinkage, dimensionally stable, rigid bisacryl material (Luxabite PRED, Laboratoires Pred, Arcueil Cédex, France) was applied with a syringe to splint the multi-unit impression posts and to passively stabilize their position prior to impression-taking (Fig. 12).

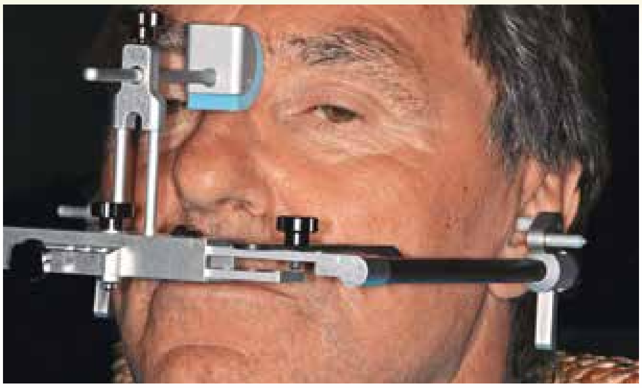


**Fig. 14** UTS 3D Universal transferbow mounted on the patient

**Fig. 15** Lingualized occlusion

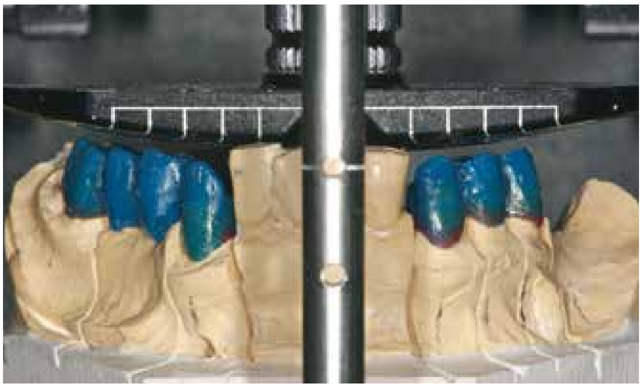


**Fig. 16** Waxed up crowns and framework components in relation to the curves of Spee and Wilson (3D setup template)

**Fig. 17** Framework components covered with wax

A polyether impression material (Impregum, 3M, ESPE) was utilized for impression-taking. Upon completion of this step, the screws were loosened from the impression posts and the impression tray was removed from the mouth. The implant analogs were carefully screwed in place while they were firmly held down to prevent them from moving within the impression (selecting an adequate impression material plays an important part here). The gingival mask was applied with a syringe and the plaster was poured into the final impression (Fig. 13).

This case, as many others, necessitated an overall treatment approach. The screw-retained prosthesis (All-on-4) should be manufactured under the best possible mechanical, functional and esthetic conditions – in a sustainable manner.

The occlusal plane of the lower jaw was in need of realignment. It is recommended to use a transfer bow (UTS-3D, Ivoclar Vivadent) for bite registration and a fully adjustable articulator (Stratos 300, Ivoclar Vivadent) for model mounting (Fig. 14). Designing the mandibular ceramic bridge was aided by a 3D setup template that automatically took into account the curve of Wilson and Spee.

SR Phonares Lingual teeth were used for the mandibular setup to implement the chosen biomechanical concept. In a mixed prosthetic restoration, the aim is to concentrate the occlusal forces in the mandibular fossae and limit the horizontal forces to the best extent possible (Fig. 15). After the setup, a silicone key was prepared to create a wax-up on the preparation. This wax-up was then reduced to manufacture a proportional framework (Fig. 16).

Furthermore, additional silicone keys should be prepared to be able to include the occlusal contours and angulations of the teeth in the design of the press-on-metal ceramic restoration (Figs 17 and 18). The frameworks were cast, processed and air-blasted. Subsequently, a full anatomic wax-up was created again with the help of the silicone key and the restorations were pressed using IPS InLine PoM ingots (Fig. 17).

The main advantage of this technique is that no dimensional changes occur. The resulting bridges fulfilled the initial specifications down to the last detail. An increase in saturation and contrast was achieved by applying shade material (A2)

**Fig. 18** Spruing on the investment ring

**Fig. 19** Bridge made of pressed ceramic on alloy

**Fig. 20** Validation index made of plaster

**Fig. 21** Crosswise fitting to validate the impression

onto the cervical third of IPS InLine PoM (Fig. 19). A glaze firing completed the process.

As soon as the mandibular bridges had been finished, they were incorporated and an anatomic impression was taken.
The maxillary impression was validated by means of a calibrated plaster index to double-check the value of the final impression prior to setting up the teeth and, most importantly, prior to manufacturing the customized bar using a CAD/CAM procedure.

Accurately measured out and mixed under vacuum conditions, super hard type IV die stone (Fujirock, GC Germany, Bad Homburg, Germany) was applied to the inside of the wax rim in situ. The index was thinned down so that it would become brittle if the slightest of tension occurred during tightening the screws – a sign of a flawed impression (Fig. 20). After that, it was placed in the mouth, screwed to the first abutment, than to the abutment on the opposite side and so forth in what may be called a crosswise fitting technique (Fig. 21). If a fracture occurs, the impression-taking procedure needs to be repeated. In the present case, the index confirmed that the record was accurate.

The next step was to create a setup on temporary posts (Temporary Coping Multi Unit, Nobel Biocare) to perform an esthetic and functional try-in (Figs. 22 and 23). After the posts had been cut down to the correct height, they were bonded with Pi-Ku-Plast (Bredent, Senden, Germany) – a powder-liquid resin system that is free of shrinkage.

To save laboratory time, the palatinal area was reinforced using Ivolen self-curing resin (Ivoclar Vivadent) (Fig. 24). Using the thus reinforced setup, the try-in could now be performed under optimal conditions (precision and stability). The cantilevers were consistent with the recommendations described in the literature, i.e. extensions may include one but no more than two teeth after the distal implant. We should bear in mind that the two-tooth cantilever was specifically designed to meet the esthetic requirement of the patient. The most distal tooth was set out of contact to prevent excessive loading on the posterior region.

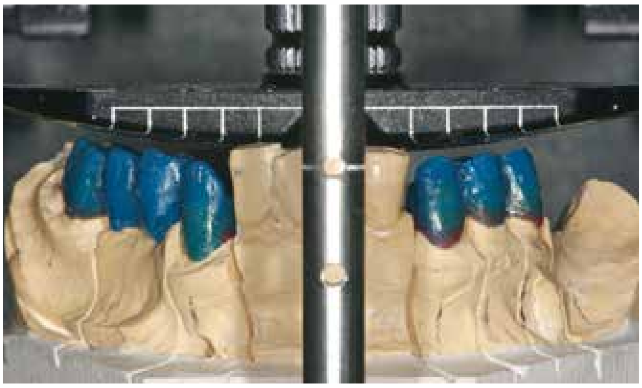


**Fig. 22** Silicone key of the esthetic setup

**Fig. 23** Temporary posts joined with resin

In this context, it is noteworthy that the upper lip needed to be completely supported by the restoration margin. The lip was flat, thin and tight (Fig. 25). The patient's severe maxillary resorption can be traced back to several traumata and extractions. Attention had to be given to handling the issues surrounding the patient's lip support in the best possible manner while the try-in was conducted.

The esthetic and functional try-in included a phonetic evaluation and a validation of the nose and chin support provided by the teeth and gingival mask. The midline between the incisors was relocated to the centre of the philtrum (Fig. 26). The temporary bridge acted as reference for the tooth shapes. The dental arches were slightly rounded out to prevent the cheeks from sagging inwards. This step is of decisive importance because the longevity of the restoration depends on the custom-made milled bar and the occlusal design. From an esthetic perspective, the SR Phonares tooth moulds are ideally suitable for this indication because they impart a natural appearance to the prosthesis. If the SR Phonares Lingual posterior tooth moulds are used, the teeth can ideally engage with the recesses on the mandibular bridge made of press-on-metal ceramic, as identical moulds are used for both restorations. In addition, undue buccal contacts can be avoided. Any buccal contact represents a potential risk for implants because they do not tolerate horizontal shearing forces very well.

The model was now forwarded to a Nobel Biocare laboratory specialising in CAD/CAM processing.

The idea of using implants with multi-unit posts and custom-made ready-to-use titanium bars, or Montreal bars, caught the attention of the treatment team. Hervé Buard, who has been using a Nobel Procera scanner for several years, digitized the setup and location of the implants and then created a design of the bar that was best suited for the given clinical situation using a dedicated software tool (Nobel Procera 3D) (Figs 27 and 28). It is of utmost importance to quantify the design of the bar correctly to ensure that patient comfort is not impaired due to the limited space available. Equally, the thickness of the resin material and the space available for the artificial teeth play also a significant part. After the computer-assisted design is completed, the design file is sent to a Biocad manufacturing centre either in Canada or the USA.

About ten days later, the lab received the bar. It was a real "jewel", showing an exceptionally accurate passive fit and an unparalleled high-gloss surface finish (Fig. 29).

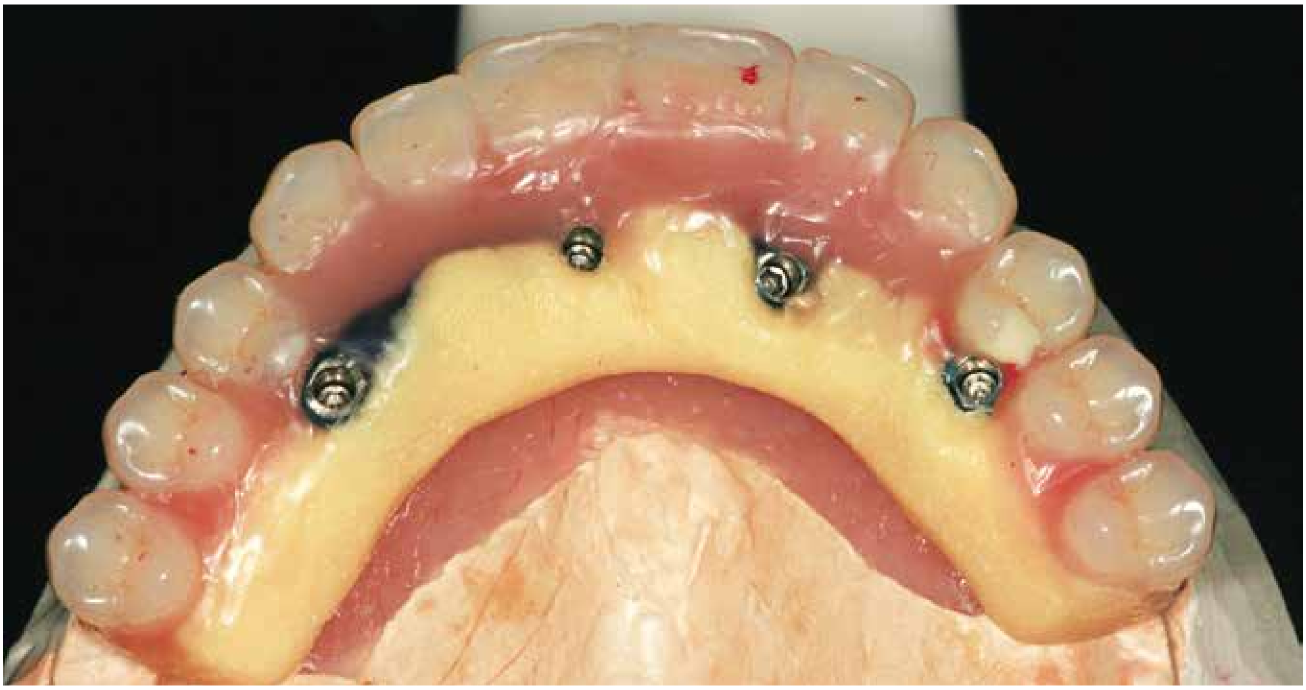


**Fig. 24** Esthetic setup screwed to the temporary posts

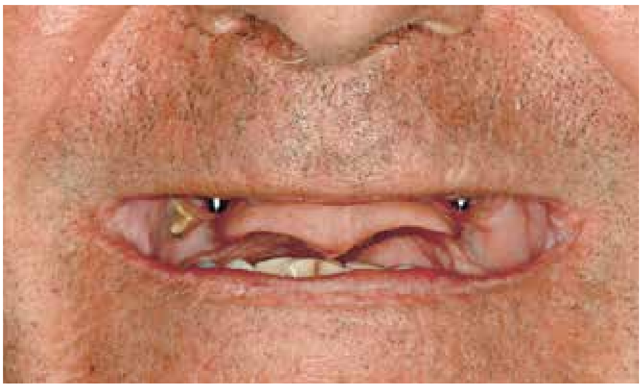
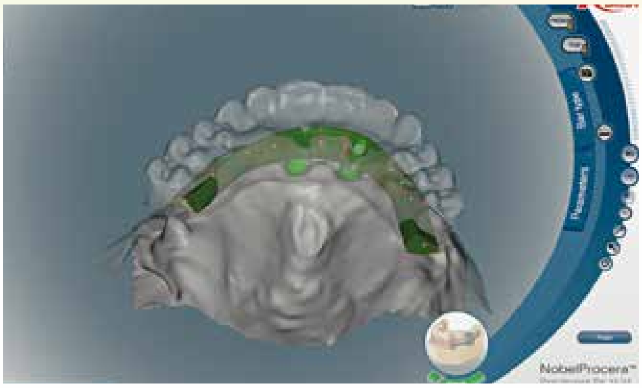


**Fig. 25 and 26** Patient without and with esthetic try-in for verification: support of the soft tissue and smile



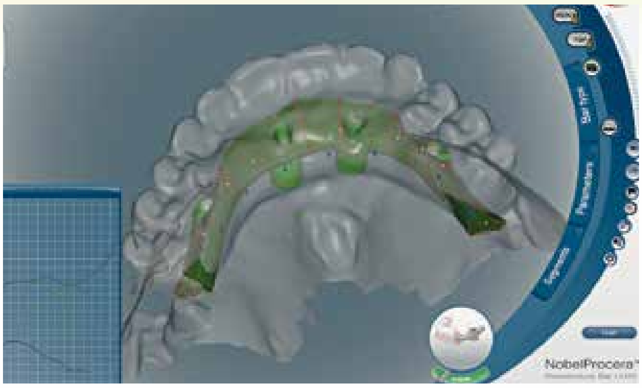




**Fig. 27 and 28** Restoration design using Nobel Procera 3D software

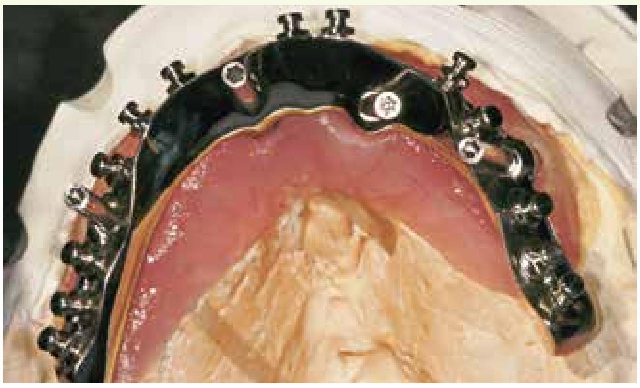
**Fig. 29 and 30** Bar milled in Canada and verification of precision and passive fit

## Passivity checking

As a basic rule, the passivity of the bar is checked first (Fig. 30). Even if it goes without saying that customized milling presents "the" method to achieve an ideal passive fit, it is better to double-check. Against this backdrop, an additional test was performed. With reference to Hervé Buard (Dinard, France) who invented this test, the authors of this report have decided to call it RVB test.

The principle behind the test: new implant analogs are screwed onto the milled bar. Next, a small socket is made using plaster (e.g. Snow White, Kerr GmbH, Rastatt, Germany). In the process, the bases of the implant analogs create a mould in the plaster. After the socket has set, the screws are loosened and the bar is removed and replaced with the plaster index used for the validation process. If the index can be screwed onto the implant analogs without anything untoward happening, it may be assumed that an optimal passive fit is present. By contrast, a fracture means that a flaw must have occurred at some point during the procedure. This test is far more reliable than screwing the structure onto the plaster model, because the model is capable of absorbing a certain amount of tension and precision-related problems can therefore not always be detected.

What was noticeable in this case was the ideal adaptation of the bar and the optimally finished and contoured design. The patient was pleased with the fact that the framework was shaped in such a way that it required only a limited amount of space. It was delivered with retention elements, which can either be cut off or loosened off, if more space is required for the denture teeth or PMMA resin. Fitting was performed after the denture teeth had been positioned in the silicone key and the guide screw inserted (Fig. 31).



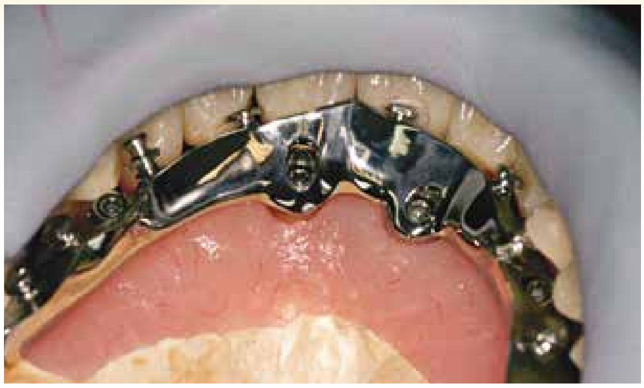


**Fig. 31 and 32** Bar on the model and position of the teeth in the silicone key

## Designing the prosthetic gingiva

The teeth were now positioned in the key and this setup transferred to resin (Fig. 32). As the try-in was performed on a screw-retained resin framework, it was agreed with the clinician that the restoration should be completed in a direct procedure, which meant that all settings had been established at the preceding step.

The esthetic expectations of patients continue to rise. Natural-looking restorations involving artificial teeth can today be achieved with modern lab technologies. However, the authors of this report were aiming for more: they also wanted the pink part of the restoration, i.e. the gingival mask, to look as natural as possible. At present, prosthetic gingiva is most commonly reconstructed by adding intensive shades to a self-curing PMMA component. Whilst this is a proven technique, it cannot be easily implemented in conjunction with a plaster index. Into the bargain, complicated mixing of materials is required to obtain different tones and tints, with the resultant shade being largely dependent on the user.

In the current case, a different approach was selected to the extent to which a light-curing lab composite, SR Nexco® (Ivoclar Vivadent), was applied to the buccal aspect and bonded to the PMMA resin via a light-curing bonding agent. SR Nexco is a composite material designed for indirect restorations and appeared to be ideally suited for the present case due to its mechanical behaviour and esthetic properties. The high content of micro-opal fillers endows the material with considerable advantages in terms of wear resistance, shade stability and surface gloss. Combined with a new matrix technology, the micro-opal fillers additionally ensure a homogeneous consistency. Given the optimal balance between the matrix and filler components, the material can be light-cured with most commonly used curing devices, providing excellent physical and lifelike optical properties.

Prosthetic gingiva reconstructions should be performed immaculately. To achieve this, an accurate morphological reconstruction and matching shades are necessary. This includes a wax-up that reliably reflects the anatomical features of the given case: interdental papillae, mobile gingiva, underlying alveolar processes, immobile gingiva and alveolar mucous membrane.

The SR Nexco Paste Gingiva materials are available in a wide range of gingiva shades including five medium-translucency materials, five intensive materials and a pink gingiva opaquer. The shade of the mucous membrane can be determined with a gingiva shade guide. In completely edentulous cases, the shade of the intraoral tissue can be used as a basic reference for shade determination.[7,16] The same gingiva shade guide as for SR Adoro®, IPS e.max® all-ceramics, IPS d.SIGN® and IPS InLine® metal-ceramics can also be used as a reference for the SR Nexco Gingiva range (Fig. 33).

The tooth setup in wax was accomplished on the milled bar. Subsequently, a model was prepared. The margins were covered in plaster (with indentations) to ensure that this part was not retentive and to prepare the transfer into resin material (Fig. 34).

The teeth were first covered with A-silicone (Flexistone Plus) and then with plaster (Fig. 35). Before any parts were unscrewed, a precision impression material (Virtual®, Ivoclar Vivadent) was applied with a syringe. This material penetrates below the bar and protects the entire construction because it prevents the resin applied into the index from escaping (Fig. 36).

The four screws securing the bar were loosened and the key was removed. Then, a drop of wax was applied onto the screw access openings to protect the screws from the effects of air-blasting.


**Fig. 33** Universal gingiva shade key

**Fig. 34** Model with indentations for the placement of the plaster index

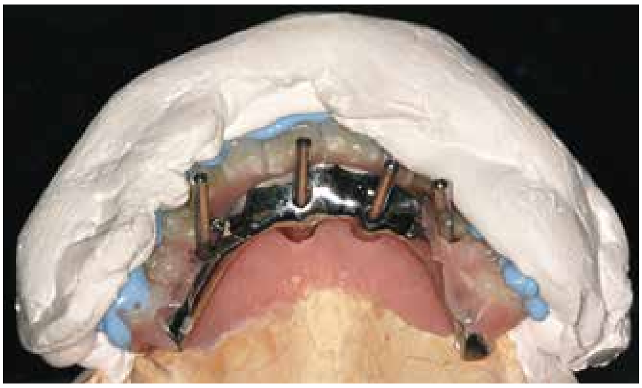


**Fig. 35** Silicone key clad in plaster

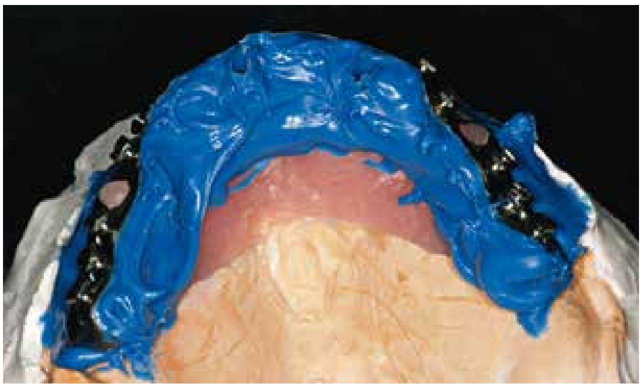


**Fig. 36** A low-consistency silicone is applied with a syringe and subsequently the wax is boiled out without leaving any residue.


**Fig. 37** Application of SR Link bonding agent for metal-composite bonding after air-blasting

**Fig. 38** Bar with ProBase Cold resin material

**Fig. 39** Application of gingiva material in layers and contouring of the surface structure

**Fig. 40** Lifelike subtle shade effects after application of the gingiva composite and high gloss polishing. The All-on-4 restoration is now completed and ready for placement in the oral cavity.

**Fig. 41** Unavoidable occlusal adjustments after the restoration has been screwed to the abutments

The milled titanium bar with the silicone protection was air-blasted. Only that part of the bar that was not industrially polished was air-blasted with 100 µm aluminium oxide at 2 bar pressure (29 psi). After any blasting residue was tapped off, a metal-composite bonding agent (SR Link, Ivoclar Vivadent) was applied (Fig. 37). This material resulted in an excellent bond between the alloy and pink opaquer.

After a reaction time of about three minutes, SR Nexco Opaquer was applied in two thin coatings. The first coating was tack-cured for 20 seconds and then a second, covering layer was applied. This layer was light-cured in a polymerization device.

Next, the bar was repositioned on the model and fastened with the screws. Mixed ProBase Cold PMMA resin was then poured into the key and subsequently polymerized at a pressure of 2.5 bar (36 psi) and a temperature of 45 °C (113 °F). Given the high pressure, the risk of deformation was avoided here (Fig. 38).

After the key had been removed, the gingival portion was roughened using a tungsten carbide bur and space was created on the entire buccal side for the application of gingiva material. In addition, the gingiva portion that needed to be stained was air blasted with 10 µm aluminium oxide at 2 bar pressure (29 psi). Any residue was removed by tapping off.

It is requisite to apply the light-curing bonding agent SR Connect in a thin layer to the surfaces to which the gingiva material will be applied. This step plays an essential part in ensuring a durable bond and long-term stability between the denture base resin and composite material. The bonding agent is cured in an appropriate polymerization device according to the manufacturer's directions.

The gingival mask is applied using a metal or silicone spatula. The volume was created on the basis of the initial material. Given its nature, this material is very convenient to process and contour. Surface characteristics can be effortlessly shaped and integrated and the natural features of immobile gingiva, e.g.

stippling, can be mimicked because the material does not flow off. Fine-tuned shades allow the characteristics of the immobile gingiva, interdental papillae and alveolar processes to be reproduced to look very natural. As the soft tissue covering the gingival emergence profile and root extension is more stretched than in the other areas it is of a more whitish tint than the surrounding tissue. Therefore, a brighter, more whitish composite paste was used for this region to reproduce whitish effects. The gingiva shade guides available are very useful to select the shades best suited for the given goal.

To create a sense of depth, Intensive Gingiva IG5 was applied between the alveolar process imitations, while Gingiva G2 was utilized to form the interdental papillae (Fig. 39).

Building up the prosthetic gingiva and designing the surface texture can be accomplished simultaneously at this stage.[5] This method increases the true-to-nature effect of the gingival reconstruction. The effect of the materials and in-depth characteristics can be assessed already before polymerizing the materials because they are the same before and after polymerization. The translucency, or shading, of certain materials, is very subtle, creating a lifelike impression. The SR Nexco composite is light-cured in a polymerization device (Lumamat 100, Ivoclar Vivadent). Device independence represents one of the major advantages of this composite because, according to the manufacturer's information, it can be polymerized with most on the market available light-curing devices.

## Finishing

Subsequently, the result was correctly polished, which involves pre-polishing with pumice and a soft goat's hair brush at low rotational speed followed by high-gloss polishing with polishing paste (Universal Polishing Paste, Ivoclar Vivadent) and a goat's hair brush or cotton/leather buff. Both polishing steps are performed at the workstation and not on the polishing lathe. Polishing in stages results in a durable gloss, preventing plaque from building up. The composite formed the buccal part of the prosthetic gingiva. The inner side and the overall denture were made of acrylic material so that it may be relined in a few years' time, if necessary. Into the bargain, PMMA materials offer an increased wettability and, to the authors' knowledge, considerably superior contact affinity towards the soft tissue (Fig. 40).

All restorations – the mandibular metal-ceramic bridges and the maxillary All-on-4 restoration – were incorporated at the same appointment. With a probe, it was checked if a small space between the bar and the mucous membrane was present to ensure ideal oral hygiene conditions. Initial restorations by Brånemark involved the use of posts that were widely spaced. In the present case, the buccal profile was shaped in the form of a "ship's keel" and a 2-mm gap was left to allow the use of pressurized jets of water. For phonetic and esthetic reasons, buccal access is not possible in the present case. Cleaning with small brushes can only be performed from the palatal side.

Final checking and occlusal adjustments constitute an essential part of this type of treatment. The mesial marginal ridges were selectively adjusted by grinding to position the lower jaw in the direction of anterior contacts due to the severely damaged temporomandibular joint (Fig. 41).

**Fig. 42** Ideal esthetic integration

**Fig. 43** The completed restoration in situ

## Insertion and conclusion

Final placement was accomplished by tightening the screws with a torque key to 15 Ncm, in line with the instructions of the multi-post manufacturer. Then, the screw access openings were sealed with light-curing Telio CS material – a composite that is also suitable for temporary restorations.

Especially noteworthy was the highly accurate integration of the metal-ceramic bridges with the brightenings applied to the four remaining incisors (Fig. 42). In addition, an ideal simulation of the natural gingiva was achieved by means of the gingival mask made of composite (Fig. 43).

The patient received detailed instructions of how to use small brushes to ensure appropriate hygiene and care of the posterior implants. This is undoubtedly a key aspect in ensuring the success of implant treatments. It is absolutely indispensable that a brush is used for cleaning and that the areas around the posts and under the bar are cleaned.

## Acknowledgement

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## Literature

1. Bert M. Complication et échecs en implantologie: causes-traitements-prévention. Paris: CDP, 1984.
2. Beumer J, Hamada MO, Lewis S. A prosthodontics overview. Int J Prosthodont 1993;6:126-130.
3. Bränemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A. Intraosseous anchorage of dental protheses. I. Experimental studies. Scand J Plast Reconstr Surg 1969;3:81-100.
4. Cawood JI, Howell RA. A classification of the edentulous jaws. Int J Oral Maxillofac Surg 1988;17:232-236.
5. Ciers JY. Naturgetreue Zahnfleischmasken (Des fausses gencives plus vraies que nature). Technologie Dentaire 2012;309:20-28.
6. Clelland NL, Carr AB, Gilat A. Comparison of strains transferred to a bone simulant between as-cast and postsoldered implant frameworks for a five-implant-supported fixed prosthesis. J Prosthodont 1996;5:193-200.
7. Gastard Y. Fausse gencive esthético fonctionnelle en PAC. Stratégie Prothétique 2007;7:261-268.
8 Gher ME, Richardson AC. The Accuracy of Dental Radiographic Techniques Used for Evaluation of Implant Fixture Placement. Int J Perio Res Dent 1995;15:269-281.
9. Hobo S, Ichida E, Garcia LT. Osseointegration and Occlusal Rehabilitation. Berlin: Quintessenz, 1991.
10. Jemt T, Lekholm U. Measurements of bone and frame-work deformations induced by misfit of implant superstructures. A pilot study in rabbits. Clin Oral Implants Res 1998;9:272-280.
11. Lam EWN, Ruprecht A, Yang J. Comparison of two-dimensional orthoradially reformatted computed tomography and panoramic radiography for dental implant treatment planning. JPD 1995;74:42-46.
12. Lee S, Morgano SM. A diagnostic stent for endosseous implants to improve conventional tomographic radiographs. JPD 1994;71:482-485.
13. Lekholm U, Zarb GA. Patient selection and preparation. In Brånemark P-I, Zarb GA, Albrekysson T (eds.). Tissue-Integrated prostheses. Chicago: Quintessence, 1995:199-209.
14. Lewis S, Avera S, Engleman M, Beumer J. The restoration of improperly inclined osseointegrated implants. Int J Oral Maxillofac Implants 1989;4:147-152.
15. Maló P, Rangert B, Nobre M. All-on-4 immediate-function concept with Brånemark System implants for completely edentulous maxillary: a 1-year retrospective clinical study. Clin Implant Dent Relat Res. 2005;7Suppl 1:88-94.
16. Martinie S. Fausses gencives en céramique. Stratégie prothétique 2011;11:201-207.
17. Marquardt P, Witkowski S, Strub J. Three dimensional navigation in implant dentistry. Eur J Esthet Dent 2007;2:80-98.
18. Mecall RA, Rosenfeld AL. Influence of residual ridge resorption patterns on implant fixture placement and thooth position. Part 1. Int J Periodontics Restorative Dent 1991;11:8-23.
19. Mecall RA, Rosenfeld L. The influence of residual ridge resorption patterns on implant fixture placement and tooth position. 2. Presurgical determination of prosthesis type and design. Int J Periodontics Restorative Dent 1992;12:32-51.

20. Quirynen M, Alsaadi G, Pauwels M, Haffajee A, van Steenberghe D, Naert I. Microbiological and clinical Outcomes and patient satisfaction for two treatment options in the edentulous lower jaw after 10 years of function. Clin Oral Implants Res 2005;16:277-287.
21. Renouard F, Rangert B. Facteurs de risque et traitements implantaires. Paris: Quintessence International, 1999:21.
22. Rosenfeld AL, Mandelaris GA, Tardieu PB. Prosthetically directed implant placement using computer software to ensure precise placement and predictable prosthetic outcomes. Part 1: diagnostics, imaging, and collaborative accountability. Int J Periodontics Restorative Dent 2006;26:215-221.
23. Rosenfeld AL, Mandelaris GA, Tardieu PB. Prosthetically directed implant placement using computer software to ensure precise placement and predictable prosthetic outcomes. Part 2:rapid-prototype medical modeling and stereolithographic drilling guides requiring bone exposure. Int J Periodontics Restorative Dent 2006;26:347-353.
24. Sadan A, Raigrodski AJ, Salinas TJ. Prosthetic considerations in the fabrication of surgical stents for implant placement. Pract Periodontics Aesthet Dent 1997;9:1003-1011.
25. Van Steenberghe D, Glauser R, Blombäck U, Andersson M, Schutyser F, Pettersson A, Wendelhag I. A computed tomographic scan-derived customized surgical template and fixed prosthesis for flapless surgery and immediate loading of implants in fully edentulous maxillae: a prospective multicenter study. Clin Implant Dent Relat Res 2005;7 Suppl 1:111-120.
26. Zitzmann NU, Marinello CP. Treatment plan for restoring the edentulous maxilla with implant-supported restorations: removable overdenture versus fixed partial denture design. J Prosthet Dent 1999;82:188-196.
27. Zitzmann NU, Marinello CP. A review of clinical and technical considerations for fixed and removable implant prostheses in the edentulous mandible. Int J Prosthodont 2002;15:65-72.

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# Convincing bridge design

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## Screw-retained implant-supported bridge: A fixed restoration including the reconstruction of prosthetic gingiva

**Careful analysis of all the parameters influencing the restoration constitutes the basis for accurate planning and for achieving reliably predictable results. Combined with a well thought-out design, this approach enables dental professionals to achieve restorations that will stand the test of time.**

Creating an implant-supported prosthetic restoration presents a tough but stimulating challenge for both dentists and dental technicians. Welcome though these challenges may be, they are also likely to involve unforeseen complications and necessitate compromises, which may diminish the outcome and disappoint the expectations of the patient. This situation can be avoided by careful planning before the restorative procedure is commenced. A prudently planned intervention is based on a detailed review including the following parameters: structure and quality of the bone, general health of the patient, clinical situation of the periodontium, patient expectations as well as an assessment of the esthetic and functional aspects present and in need of reconstruction.

> Farsighted planning is key to a coordinated workflow and the success of a restoration.

Numerous variables may severely affect the cost and quality of the final outcome. The patient case below is intended to present our approach to accomplish an implant-supported maxillary restoration. Thorough pre-operative planning of the surgical and prosthetic treatment and the application of the resulting plan to a CAD/CAM-fabricated surgical template allowed us to effect a solution that satisfied all parties involved. This report focuses on the technical work involved in the implementation of a "Toronto bridge" – a screw-retained restoration on implants – involving the use of artificial teeth and the reconstruction of the gingiva with a gingiva-coloured lab composite.

### Patient case

A 45-year-old male patient presented to the practice with severe periodontal, functional and esthetic deficiencies (Fig. 1). The situation was so desperate that complete extraction of the maxillary teeth was necessary. The mandible was also in severe need of treatment but the intervention was postponed to a later date for financial and psychological reasons.

### Surgical phase

After completion of the initial review, the laboratory created a diagnostic wax-up to visualize the proposed esthetic, phonetic and functional results. The wax-up was then used as a basis to plan the prosthetic part of the restoration and to create a radiopaque template. The template was worn by the patient during the subsequent X-raying process. The three-dimensional data gained from the radiographs and the pre-operative plan of the prosthetic restoration enabled the operator to determine the site of the surgical implant insertion pre-operatively by

**Fig. 1** Pre-op situation: The patient presented at the practice with significant periodontal, functional and esthetic deficiencies.

**Fig. 2** A CAD/CAM-fabricated surgical template facilitates the correct positioning of the implants.

means of planning software. The CAD/CAM-fabricated surgical template resulting from this procedure facilitated the positioning of the implants during the surgical intervention (Fig. 2).

## Prosthetic phase – framework fabrication

After the implantation had healed, the prosthetic work commenced. An implant model with a gingival mask was created (Fig. 3) and the correct bite was transferred to an articulator. As the shape, position and dimension of the prosthetic restoration had already been defined in the wax-up, only few more steps were required prior to creating a framework pattern (Fig. 4).

We checked the functional and esthetic aspects of the set-up and determined the framework design of the "tertiary structure". We used a key made of type IV plaster as a visual control while we were creating the framework pattern (Fig. 5). The support structure was made of a burn-out resin (Fig. 6) and incorporated all required parameters (structural stability, retention, space requirements).

Two methods are available for constructing the metal framework:

1. Conventional casting procedure
2. Digital fabrication with CAD/CAM technology

Which of the two will be used depends on several factors. The limitations of the current technology led us to opt for the conventional casting procedure (Fig. 7). We selected the Colado® CC alloy, which offers long-term stability for implant-supported restorations. Even if a "conventional" procedure is utilized, the framework should always be processed in line with the latest scientific and evidence-based indications (Fig. 8).

**Fig. 3** The implant model with angulated secondary components

**Fig. 4** Set-up in wax (esthetic and functional reconstruction)

**Fig. 5** A plaster key was utilized to preserve the oral situation. This measure visualizes the spatial requirements for the framework.

**Fig. 6** The tertiary structure was fabricated using a burn-out resin.

**Fig. 7** Sprueing for the induction casting procedure

**Fig. 8** The framework fits accurately on the secondary components.

**Fig. 9** Opaque, gingiva-shaded acrylic resin was applied to specific areas.

**Fig. 10** Application of the gingival materials

## Prosthetic phase – completion

At the next stage, the veneering materials were applied. The fatigue strength and resistance of the framework can be increased by shot peening the surfaces in a carefully monitored process prior to applying the veneering materials. In addition, the surfaces were chemically pre-treated with an opaque pink-coloured paste from the new SR Nexco® range of lab composite materials to ensure a stable, durable bond. Another aim was, of course, to achieve a maximum level of adhesion to the prefabricated resin teeth. For this purpose, we conditioned the bonding surfaces according to the Instructions for Use of SR Nexco Paste and this allowed us to achieve an excellent chemical bond.

**Procedure:**

- Carefully sandblast the framework with $Al_2O_3$ at 2–3 bar (29–44 psi) pressure
- Remove blasting medium residues with oil-free air
- Apply a coating of SR Connect bonding agent and allow to react for three minutes
- Light-cure in a Lumamat® 100 furnace
- Make sure to leave the inhibition layer intact

The teeth were polymerized on the framework in line with the tooth set-up.

Opaque acrylic resin was applied to specific areas to provide a slight indentation (Fig. 9). In addition, this material diverts some of the masticatory forces from the teeth and thereby increases the durability of the restoration. As an additional advantage, the amount of composite material required for the gingival area is reduced. After the preparatory steps had been completed, the surface was masked with a layer of pink composite (SR Nexco Gingiva) followed by several more intense gingiva layers in various shades and opacities which were applied according to the procedure mentioned above. To achieve a harmonious and natural looking pink shade, possible discolourations were masked with Nexco Stains clear. This method allowed us to achieve the desired result relatively rapidly and straightforwardly (Fig. 10). After the gingiva had been completely reconstructed, the materials underwent final polymerization in a light furnace (Lumamat 100 / 11 minutes).

Overheating by rotating instruments should be avoided when reworking, finishing and polishing the restoration. This is particularly important for the transition between the framework and composite (Figs 11 and 12). The natural looking shiny surface finish of the materials completes the high-quality result (Figs 13 to 15). We checked the esthetics, phonetics and function of the prosthesis when inserting it in the patient's mouth. In this respect, we needed to bear in mind that the prosthetic reconstruction of the mandible should be carried out soon.

**Fig. 11** Careful completion of the composite restoration

**Fig. 12** Basal view of the completed restoration

**Fig. 13 and 14** The natural looking lustrous surface finish of the SR Nexco composite and the surrounding gingival material support the invidualized esthetic effect.

**Fig. 15** Completed prosthetic reconstruction: the restoration made of lab composite is esthetically pleasing and meets the functional requirements of the clinical situation.

## Recall

Restorative care and maintenance constitutes the last, but no less important stage in the treatment. Recalls were conducted first after 4 months and then after 6 months as part of the restorative care plan. Regular recalls serve the purpose of re-establishing and maintaining the biological, functional and esthetic aspects of the stomatognathic system in the long term.

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# Thinking outside the box

**Hans Peter Foser,**
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**Dr Ronny Watzke**
*Ivoclar Vivadent AG*

## Full denture and telescopic denture – a good choice in terms of function and esthetics

**Implants seem to be the all-important solutions in today's prosthetic restorative dentistry. Implants are placed whenever a tooth is lost. Irreverent voices have been heard to say that a natural tooth stands in the way of an implant. Nevertheless, implants are not always the right choice: for example, if a patient is afraid of the operative part of the treatment or if enough abutment teeth are available to attach a denture. Full dentures and telescopic dentures have proved to be very useful in these cases. On the basis of the following case study, the authors will show that this type of restoration is much more than simply an affordable alternative.**

Completely or partially edentulous patients who cannot be or do not want to be treated with implants do not have to look ahead to an uncertain dental future due to unsatisfactory or unsuitable restorations. They can be treated with functional and esthetic full or partial dentures. Today's advanced materials and methods offer dentists and particularly dental technicians exceptional possibilities. The following case study describes how these materials and methods can be used to the best advantage. Here the patient received a full denture in the upper jaw and a removable denture on five copings in the lower jaw.

### Pre-operative situation

The fifty-year-old patient was dissatisfied with the function and the appearance of her dentures. As a result, she was looking for a new and improved solution. The patient wore a full upper denture, which had been fitted seven years previously. In the meantime, the restoration had become worn: It no longer stayed in place without the use of a denture adhesive cream. Therefore, the patient lived in constant fear that the denture could become lose at any moment. The clasp-retained denture in her lower jaw was almost eight years old. The patient refrained from wearing it at times, because it caused her too much pain.

The patient's medical history showed that she had smoked quite heavily. In the course of the treatment, however, the patient gave up her smoking habit and has abstained ever since. Furthermore, the patient suffered from chronic inflammation of a spinal nerve in the neck area for which she took pain relieving medication. She did not have any known allergies. The clinical examination showed that she had intraoral Type 1 denture stomatitis. In the upper anterior jaw, the patient had a slight flabby ridge and the occlusal surface of the old denture sloped down towards the back. Exostosis (mandibular torus) was identified on the lingual surface on both sides of the lower jaw. Moreover, tooth 35 showed 3rd-degree loosening.

The radiological examinations revealed a damaged root canal filling in tooth 47, but no other pathological findings. Sufficient bone tissue was available for an implant-retained denture in the lower jaw (Figs 1 to 3).

**Fig. 1** Pre-operative upper jaw: Grade 1 denture stomatitis and slightly flabby anterior ridge

**Fig. 2** Pre-operative lower jaw: mandibular torus, inadequate root treatment (47) and tooth 35 not worth restoring

## Treatment plan

The patient was informed in detail and advised about the advantages and disadvantages and the costs of the different treatment possibilities. She refused to undergo implant treatment. However, she welcomed the idea of a new full denture in the upper jaw, especially once the extraoral esthetic parameters, such as lip and cheek support and the intraoral aspects of adjusted occlusal surface and optimized fit, including improved speech, had been explained to her. After the appropriate pre-treatment of the lower jaw, a telescopic restoration built up with composite resin was suggested, into which the preservable teeth could be integrated. Apart from the long-term function of overdentures, these restorations are easy to clean and check. As a result, the good health of periodontal tissue is promoted. In addition, restorations built

**Fig. 3** Portrait of the patient wearing poorly fitting and unattractive dentures

**Fig. 4 and 5** Teeth 33 and 34 and teeth 43 and 44 were prepared for the copings, and composite resin teeth were temporarily placed.

**Fig. 6** Precision putty-wash impression of the lower jaw

**Fig. 7** In order to create the custom trays, the models were placed in the articulator at the first appointment using Centric Tray (bite tray).

**Fig. 8** Try-in of the lower copings, which were made of zirconium oxide using CAD/CAM techniques

up with composite resin are easier to repair than ceramic restorations. Therefore, the patient's decision fell on a full denture in the edentulous upper jaw and a telescopic denture built up with composite resin on the abutment teeth 34, 33, 43, 44 and 47 in the lower jaw. Prior to the restoration measures, however, the old root filling in tooth 47 had to be repaired. Tooth 35 had to be extracted and the incisal edges of the remaining anterior teeth 32 to 42 had to be built up chairside. In order to adjust the shade of the two incisal teeth 31 and 41 to the adjacent teeth, tooth-whitening was undertaken.

## Dental treatment and lab fabrication process

### Preparation and provisionals

Tooth 35 was extracted and tooth 47 was repaired in accordance with the accepted standard. The abutment teeth for the telescopic denture received a groove preparation (Fig. 4). This form of preparation improves the capture of the surface structure and the adaptation of the primary components on the prepared teeth [1] (Lit: Bottino MA, Valandro LF, Buso L, Ozcan M. The influence of cervical finish line, internal relief, and cement type on the cervical adaptation of metals crowns. Quintessence Int 2007; 38:425-432). Until the final denture was ready, the abutment teeth were restored with provisional crowns, which were fabricated at the chairside with a temporary self-curing material (Fig. 5). In the lower jaw, putty-wash impressions of the prepared teeth were made using polyvinyl siloxane (Fig. 6). The upper jaw impression was taken with alginate. The preliminary bite tray impression was made with a customized tray. Subsequently, the fabricated models were placed in a semi-adjustable articulator with the help of the tray (Fig. 7).

### Primary caps and secondary crowns

The caps were designed, milled and fabricated with zirconium oxide by means of CAD/CAM techniques on the basis of the scanned model and the mock-up. The copings were finished accordingly. They showed excellent fit and marginal seal at the try-in (Fig. 8). Next, the caps were placed with temporary cement. Then an overimpression for the fabrication of the secondary telescopic crowns and the tertiary structures was made using a customized tray (Fig. 9).

**Fig. 9** Overimpression of the copings with a customized tray for the fabrication of the working model with acrylic resin preparations

**Fig. 10** First wax-up without framework. The dentures were set up on the copings and for the upper jaw.

**Fig. 11 and 12** Wax try-in (lower jaw without tertiary framework) in order to check the esthetic, speech and functional parameters

## Wax models and full denture

On the basis of the anatomic impression of the upper jaw, which was made with alginate, a customized tray was fabricated for the closed-mouth impression. Subsequently, the facebow record was made and the first maxillomandibular relationship record was taken. The patient's bite was raised by 3 mm compared with the previous denture. The characteristic facial lines, such as the smile, lip closure and the cuspid lines as well as the midline, were individually marked on the upper jaw tray. Within the course of the appointment the tooth shape and shade were also determined. A mock-up was produced for the lower jaw. The occlusal surface was ideally contoured in terms of height and morphology. The free-end gap was conventionally filled with pre-fabricated denture teeth in order to establish the new occlusal plane. These teeth can be used in the provisional denture if desired. Furthermore, the worn incisal edges of the four incisors in the remaining anterior dentition were adjusted to the new occlusal plane with wax. This new anterior situation created with the wax-up can be recorded from the lingual aspect with a silicone matrix to provide the dentist with a guideline for building up the composite material at a later stage.

The wax-up of the upper and the lower denture (Fig. 10) gave the patient an initial impression of the appearance and function of the future restorations at the first try-in appointment. The speech assessment did not reveal any problems. The inspections of the jaw relationship and the intraoral and extraoral esthetics were entirely satisfactory (Figs 11 and 12). Since the patient did not request any adjustments, the maxillary full denture was fabricated accordingly. The new IvoBase denture base system was used for this purpose. This system features a fully automatic polymerization process, which ensures custom-fit dentures containing only minimal residual monomer (PMMA).

## Tertiary structure

In the lower jaw, tertiary structures in the form of denture saddles were merely needed in the molar region of teeth 46 and 45 and of teeth 35, 36 and 37. As mentioned, the remaining abutment teeth were to be built up with composite resin. The mandibular tertiary structure featuring a lingual bar was conventionally fabricated in the model casting technique with the alloy d.Sign 30 on the basis of the wax-up (Fig. 13). A space was left in the esthetically critical cervical areas of the

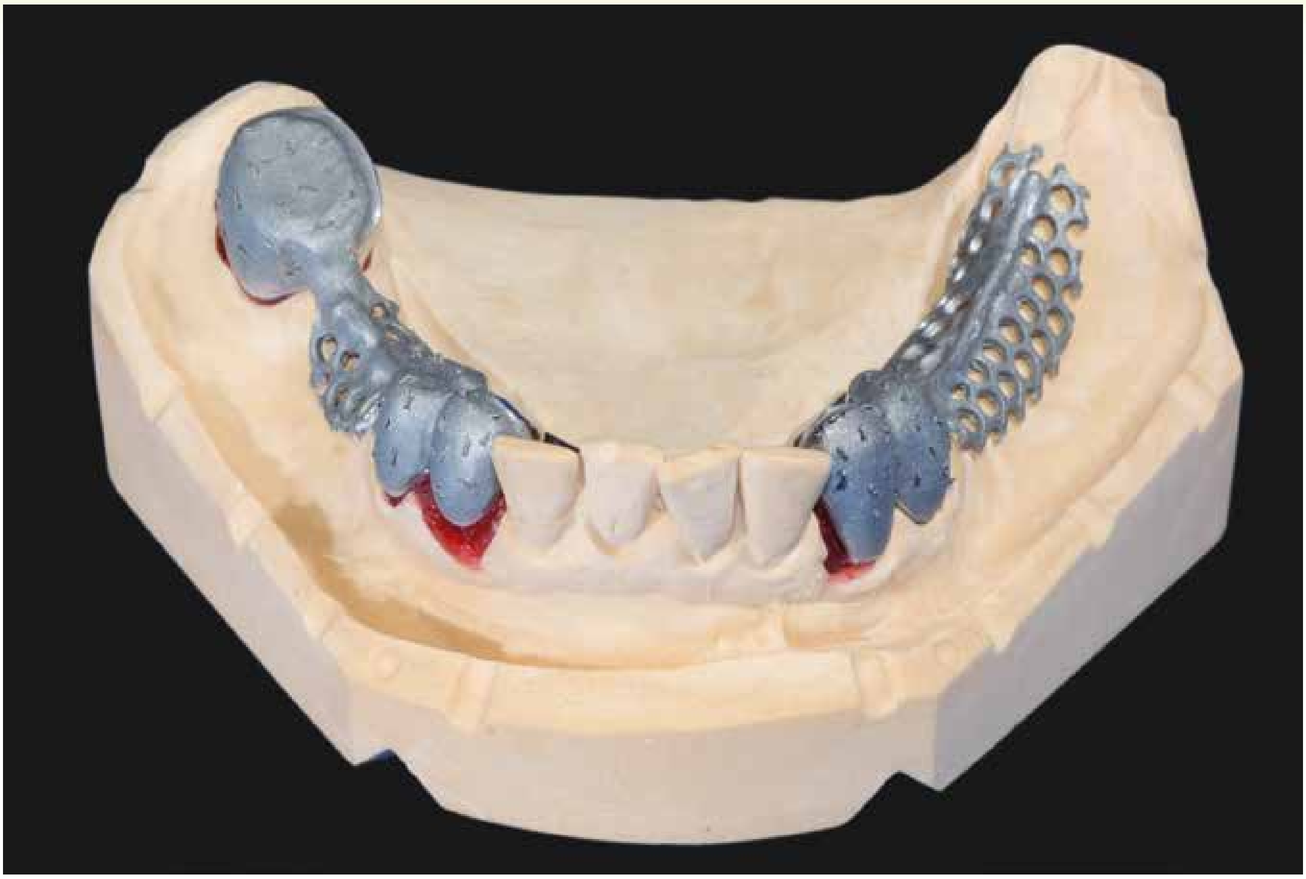

**Fig. 13** The tertiary framework was fabricated with cobalt-chromium alloy.

**Fig. 14 and 15** Wax try-in, now with caps and tertiary framework. The patient's bite was raised by approximately 3 mm compared with the previous denture.

secondary crowns. Then the secondary framework was prepared for another try-in, during which the functional parameters and the intraoral and extraoral appearance of the restoration including the patient's speech were finally checked (Figs 14 and 15).

### Build-up of telescopic teeth

Since the intention was to build up the abutment teeth with a laboratory composite, the framework had to be correspondingly prepared. For this purpose it was blasted with $Al_2O_3$ (80 to 100 µm grit) at 2 to 3 bar pressure. After this step, the blasting medium was carefully tapped off and a primer was applied with a disposable brush in order to establish a sound bond between the framework and the composite resin. Next, two solid layers of opaquer were applied and allowed to dry. Then, the inhibition layer was entirely removed with a disposable sponge without using any solvent (Figs 16 to 18). In order to ensure a smooth transition between the metal and composite resin, the opaquer edges were tapered. Furthermore, critical areas of the applied layers were checked with a probe to make sure that they had completely polymerized. Areas that were insufficiently cured were re-polymerized if necessary. In the

**Fig. 16** The first opaquer layer was applied using a brush.

**Fig. 17** The second opaquer layer fully coated the retentive beads. The opaquer layer tapered off towards the metal margin.

**Fig. 18** Disposable sponges were used to remove the inhibition layer. During the polymerization process, the opaquer obtained a shiny appearance.

**Fig. 19** Thin layers of Stain paste were applied in the cervical and interdental areas in order to reinforce the depth effect of the colours.

**Fig. 20** The dentin core was completed, including the mamelons, with the help of a lingual silicone matrix of the set-up.

**Fig. 21** The particular consistency of the composite resin used allowed the mamelon structures to be created with soft contours using a flat brush.

**Fig. 22 and 23** Cross-cut burs and fissure burs were used to create the surface texture.

**Fig. 24** The proximal and occlusal surfaces were polished with a specially trimmed star-shaped goat's hair brush.

present case, Stain pastes were applied in the marginal and interdental areas due to space reasons. As a result, the depth effect of the colours was reinforced (Fig. 19).

In order to achieve adequate shade stability in the cervical areas, Margin materials were built up in separate crescent-shaped increments, one tooth at a time. These increments were connected only once the materials had been pre-cured. Next, the Dentin materials were applied (Fig. 20). The teeth were characterized on the basis of patient photos. Since the consistency of the different products was optimally matched, the materials were easy to apply in increments and the mamelons were reproduced with a soft tapered edge using a flat brush (Fig. 21).

When the Dentin materials were applied, enough space was left for the subsequent layers of Incisal and Transpa materials. The natural colour diversity of the teeth was recreated with Mamelon and Opal Effect materials. The creation of smooth transitions was an utmost priority, since sharp edges at the transitions could produce a visible outline after polymerization and make the mamelons look too prominent. Prior to final

**Fig. 25** When the opaquer-coated restorations are placed in the light-curing device, it is important to make sure that all the surfaces requiring polymerization are adequately exposed to light (avoid casting any shadows).

polymerization, the restorations were completely coated with a thin layer of gel-like oxygen inhibitor. This product helped to minimize the formation of an inhibition layer on the surface of the composite resin and therefore improved the curing results.

The restoration surface was finalized with cross-cut burs and fissure burs (Figs 22 and 23). Then the restorations were finished with commercial polishers and polishing paste and a goat's hair brush. The contour of the goat's hair brush was trimmed to a star shape in order to optimally polish the proximal areas and chewing surfaces. The small contact surfaces enabled only the desired areas to be polished (Fig. 24). Subsequently, the cast metal denture saddles were prepared with pink opaquer (Fig. 25). The denture teeth and the composite resin saddles were completed using the matrix technique.

**Placement of the completed denture**

Once the dentures were ready (Figs 26 to 33), the provisional telescopic crowns were removed from the abutment teeth. The prepared tooth surfaces were cleaned with cleaning paste. All the parameters of the zirconium oxide copings were checked. Then the caps were permanently placed with glass ionomer cement.

Finally, the visibly satisfied patient was given instructions on how to place and remove the telescopic restorations and how to clean her mouth and take care of her dentures. At the recall two days later, slight pressure points were detected around teeth 36 and 37. Therefore, the denture base was correspondingly adjusted. At this stage, the denture stomatitis lesions had healed completely.

Furthermore, the discoloured teeth 31 and 41 were bleached chairside in order to match their colour to that of two neighbouring teeth and the telescopic crowns and the denture teeth. After the whitening procedure the incisal edges of teeth 32 to 42 were built up with composite resin using a minimally invasive technique. The new dentures ended a very difficult phase in the patient's life. Both restorations fit very well, so that the patient did not have to use a denture adhesive cream. Moreover, she was able to smile again without inhibition (Fig. 35). The change in her appearance is clearly evident when one compares the portraits taken before and after the treatment (Fig. 36).

**Fig. 26 and 27** Completed overdenture for the lower jaw. The transition between the SR Phonares II denture teeth and the telescopic teeth built up with SR Nexco in the place of teeth 3 and 4 is hardly discernible.

**Fig. 28** The patient perceived the palatine rugae to be very comfortable.

**Fig. 29** The denture base made of IvoBase High Impact Pink V is easy to polish. SR Phonares II were used as the denture teeth.

**Fig. 30 to 33** The completed maxillary and mandibular dentures. These pictures clearly show the outstanding shade match of the composite resin and the denture teeth.

**Fig. 34** The full denture and the telescopic denture in situ. Teeth 31 and 41 were bleached chairside at a later date, in order to adjust their colour to that of the two neighbouring teeth and the telescopic and the denture teeth.

**Fig. 35** The bright smile of a happy and self-confident patient

**Fig. 36** The picture of the pre-operative situation provides a direct comparison.

## Conclusion

Matching modern components and materials were used to provide the patient with natural-looking dentures. The optimal coordination of the shades of SR Phonares® II denture teeth and the telescopic teeth built up with SR Nexco® contribute to the excellent result. The SR Nexco shades (A–D shades) were produced with Opaquer and Dentin materials. They were matched to the shades of the SR Phonares II denture teeth. Restorations are easy to fabricate with SR Nexco, since the product can be applied in a variety of layer thicknesses. Furthermore, the material is available in a wide range of shades and it shows exceptionally good modelling properties. As a result, lab work is considerably streamlined. The laboratory composite shows outstanding wear resistance. Due to its homogeneity, the material features good polishing properties. It shows minimal susceptibility to plaque formation and staining. The same applies to the denture base material used. Its automated processing procedure ensures reproducible polymerization results. Therefore, the dentures show outstanding fit and compatibility with the oral environment and exceptional durability.

### List of products

| Product | Name | Manufacturer/ Distributor |
|---|---|---|
| Masking gel | SR Gel | Ivoclar Vivadent |
| Impression material | | |
| – Mandibular first impression | Virtual Putty and Light Body, Regular Set | Ivoclar Vivadent |
| – Mandibular overimpression | Virtual Heavy and Light Body, Regular Set | Ivoclar Vivadent |
| – Maxillary anatomic impression | Vival NF | Ivoclar Vivadent |
| – Functional impression | EX-3-N Gold | Meist |
| Articulator | Stratos® 200 | Ivoclar Vivadent |
| Glass ionomer cement | Vivaglass® CEM PL | Ivoclar Vivadent |
| Primer | SR Link | Ivoclar Vivadent |
| Model casting alloy | d.SIGN® 30 | Ivoclar Vivadent |
| Denture base system | IvoBase® System | Ivoclar Vivadent |
| Denture teeth | SR Phonares® II | Ivoclar Vivadent |
| Temporary composite resin | Telio® CS C&B | Ivoclar Vivadent |
| Cleaning paste | Proxyt® RDA, medium grit, fluoride-free | Ivoclar Vivadent |
| Laboratory composite | SR Nexco® lab composite | Ivoclar Vivadent |

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# Like natural teeth

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## Restorations with a new lab composite

**Restorations with composite-veneered metal frameworks are considered by many to be an inexpensive but esthetically and functionally unsatisfactory treatment option. Velimir Žujić argues that pleasing results can be achieved with a new lab composite that uses fillers and a matrix that are ideally coordinated with each other.**

Today's patients expect dental restorations to look better and last longer. Materials that are highly resistant to discolouration, plaque and wear are required to attain restorations that closely mimic the clinical behaviour of the natural dentition. A fast and straightforward processing procedure is equally essential for the technician to achieve the necessary value creation. The case discussed in this report shows the fabrication of a combined restoration involving a metal framework restored with SR Nexco (Ivoclar Vivadent Schaan, Liechtenstein). We decided to use this newly launched veneering composite on the strength of its physical properties. Given the high content of inorganic opal fillers, this composite offers clear benefits with regard to wear, discolouration, handling and surface gloss.

### Initial situation and planning

The patient presented at the practice with a defective metal-ceramic bridge in need of repair in the maxilla. Pieces of ceramic material had chipped off in region 23 and the crown in region 24 had become decemented. Slight mobility of the bridge was identified as the cause of the chipping. This mobility was caused by the absence of teeth 16 and 27, which both used to act as the distal abutments for the bridge but then were extracted two years ago. The bridge had been separated alio loco to compensate for the removal of the original abutments. This, however, resulted in the bridge being cantilevered in the region of tooth 15 as well as 25 and 26, causing the stability of the remaining bridge abutments to be somewhat undermined (Fig. 1).

Following appropriate preliminary measures, the remaining abutment teeth 14, 13, 11, 21, 22, 23 and 24 were sufficiently stabilized and built up to be included in the prosthetic planning of the restoration. Given the initial clinical situation, the restoration had to be rebuilt rather than only repaired as required by the patient. In consultation with all the stakeholders, we decided on a composite-veneered combined prosthesis involving a fixed bridge spanning from tooth 14 to 24, bilateral CeKa anchors, milled brace support and a distal groove with a transversal band from tooth 15 to 16 and from tooth 25 to 26. This design was intended to ideally absorb and offset the chewing loads. Another reason for using a composite-veneered restoration in the upper jaw was given by the fact that the lower jaw contained a metal-ceramic bridge.

### Aspects of framework design

A few basic principles guided us in designing the framework to achieve the optimum results required. To ensure that occurring chewing loads would be transferred to the framework rather than the veneering composite, we designed a fully anatomical framework to provide appropriate cusp support. A silicone key was utilized to check the space conditions and achieve an even layer thickness. The connectors were positioned at the height of the contacts to create ideal

**Fig. 1** Preoperative situation: bridge separated in region 15 and 26

**Fig. 2** Wax-up of fully anatomical bridge with retention beads

**Fig. 3** Cast bridge framework at the intraoral try-in

**Fig. 4** Metal framework after having been reduced for the application of Margin materials

conditions for attaining an esthetic restoration that can be easily cleaned. After finishing, the minimum wall thickness of the metal frameworks of the bridge abutments did not fall below 0.5 mm – a basic requirement to ensure the stability of the metal framework and a reliable bond with the veneering composite. Creating gentle transitions and rounding out sharp internal line angles and edges were additional measures to prevent chippings from occurring. As sufficient space was available, the ridge lap of the pontic at the site of tooth 12 could be veneered in its entirety. With its low affinity for plaque accumulation, SR Nexco presents a clear advantage in such cases. In order to prevent inclusions at the bridge pontic due to solid cast parts, the pontic was hollowed out. Mechanical retentions were applied in the regions of the two upper canines and premolars to support the chemical bond mediated by SR Link between the metal framework and opaquer. Only a thin layer of retention bead adhesive was applied to prevent the beads from sinking in too deeply. Subsequently, the framework was cast in metal.

## Preparation for veneering

The cast framework was sufficiently reduced to prevent shadow areas and to achieve an esthetically natural looking soft-tissue transition in the labial region. After that, the casting was blasted with aluminium oxide ($Al_2O_3$, 80 – 100 µm) at 2 bar pressure. Sandblasting improves the mechanical bond because it roughens the surface and therefore substantially increases the surface of the alloy. Possible aluminium oxide residue can be easily tapped off and should never be removed with steam or an air gun.

Before application of the opaquer, SR Link bonding agent was applied to the areas to be veneered using a clean disposable brush and allowed to react for 3 minutes. Next, the first opaquer layer (wash) was applied thinly using the ready-to-use opaquer paste. Given its low curing depth, the opaquer was applied in very thin film thicknesses using a brush. It is essential that the wash is applied in a homogeneous coating and that the retention beads and veneering areas are completely levelled and/or covered. This is all the more important because the wash presents the most important bond between the metal and composite. The second opaquer layer is applied in such a way that the framework, and in particular the retention beads, are completely covered. Next, the hollowed out space on the bridge pontic was built up to the level of the abutment teeth using Pontic Fill and precured. Then, a layer of opaquer was applied directly onto the Pontic Fill layer, precured and then directly polymerized in the polymerization appliance. All precuring and polymerization stages were conducted in compliance with the manufacturer's directions. The polymerization parameters indicated must be achieved to prevent chippings later on.

**Fig. 5.1** Application of SR Link bonding agent

**Fig. 5.2** Application of the first layer of opaquer

**Fig. 5.3** Shading of the opaquer layer on the cervical and proximal surfaces

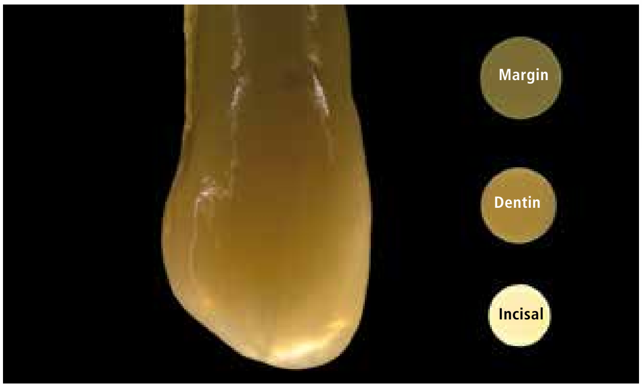


**Fig. 6.1** Opalescence and transluscence in transmitted light


**Fig. 6.2** Fluorescence and brightness in incident light

**Fig. 7** After application of Margin materials (Pontic Fill under the pontic)

After removing the resulting inhibition layer on the opaquer with a disposable sponge (without solvent), the cervical and interdental areas were characterized with a 50:50 mixture of SR Nexco Stains clear and Effect orange (Fig. 5). This characterization enhances the in-depth effect.

At the same time, the master model was sealed by applying a thin coating of Model Separator to all areas that may come into contact with the composite materials. This step prevents the composite from sticking to the model. The Model Separator was allowed to react for a short time and then surplus material was removed with compressed air.

## Veneering with SR Nexco®

The layering procedure of the SR Nexco® Paste materials can be carried out either according to the layering diagram or individually, as in the present case. In our particular case, we had to bear in mind that the characteristics, physical features and texture achieved with the veneering material should blend in with the SR Phonares® II denture teeth used for the restoration of the posterior region.

The optical properties of SR Nexco Paste can be seen in the juxtaposition of two images showing a layered tooth. From the incisal edge and dentin body down to the tooth neck, the opalescence, translucence, fluorescence and brightness of the veneering material closely resemble the light dynamic characteristics of the natural dentition.

Taking full advantage of the material's optical effects, we first applied Margin material in a half-moon shape to the cervical and pontic area to stabilize the shade; Pontic Fill was used to achieve this step in the pontic. The materials were adapted firmly and smooth, rounded transitions were created between the layers using modelling instruments. The well-coordinated consistency of the materials ensured that the modelled contours were maintained, enabling an easy layering technique. By adhering to the manufacturer's recommended minimum layer thickness of 1 mm and maximum layer thickness of 2 mm, we achieved an accurate shade reproduction (Fig. 7).

**Fig. 8.1** SR Nexco clear applied as foundation along the incisal edge

**Fig. 8.2** Subtle characterization with a mixture of Stains clear and Stains blue

The basis of the incisal edge was built up with SR Nexco. In this context, it is vital to bear in mind that the optical qualities of the veneering are affected by the way light diffuses into the incisal edge. Likewise, the brightness value of the restoration varies in relation to the thickness of the incisal layer. In the present case, the light paths were slightly accentuated by applying first a mixture of Stains clear and Stains blue, followed by a thin layer of a mixture of Stains white and Stains orange to create a translucent brightening effect.

**Fig. 8.3** Characterization with a mixture of Stains white and Stains orange

After the dentin body and the proximal sides had been built up, Opal Effect OE 2 was applied to the mesial and distal parts. The incisal edges were reduced, the shape of the mamelon remained outlined in the dentin. Since the dentin and incisal materials are highly coordinated with each other, even delicate transitions can be subtly designed. Fracture lines can be realistically mimicked using Stains White. Importantly, these materials are not made to be wear resistant and to prevent accretions and should therefore always be covered with a final layer of Transpa or Incisal material.

Whilst the palatal aspects of the incisals were also veneered, the palatal areas in the upper canines (canine guidance) and the occlusal surface in the region of tooth 24 remained unveneered (Fig. 9). An opalescent effect was created in the area of the incisal edge (Figs 9 to 10). Prior to final polymerization, SR Gel was applied to the veneered framework to minimize inhibition layer formation and achieve an optimum depth of cure. This layer should cover the entire framework but should not be too thick. After completion of the final polymerization procedure, the gel was removed and the restoration was finished and provided with an appropriate surface texture.

**Fig. 9.1** Layered dentin before …

**Fig. 9.2** … and after the application of Opal Effect OE2 on the mesial and distal aspects

**Fig. 9.3** Fracture lines mimicked with Stains white

**Fig. 9.4** Framework with palatal veneers and attachment (view from palatal)

## Completing

After completing the model casting, the SR Link bonding agent and Opaquer A2 were applied to the veneering surfaces of the secondary components in region 5 and Opaquer Pink was applied to the retention surfaces. We were able to integrate the removable part harmoniously into the overall appearance as the fixed part in the area of the secondary components of tooth 15 and 25 featured an identical layering pattern. Given their texture and shade, the denture teeth harmoniously blended in with the layered neighbouring teeth and, therefore, did not necessitate any modifications. Using SR Nexco Gingiva paste, we amended the gingival portions of the transversal band to resemble the natural gingiva of the patient. Final polishing was performed carefully as micro-roughness on the veneering surface is conducive to plaque accumulation.

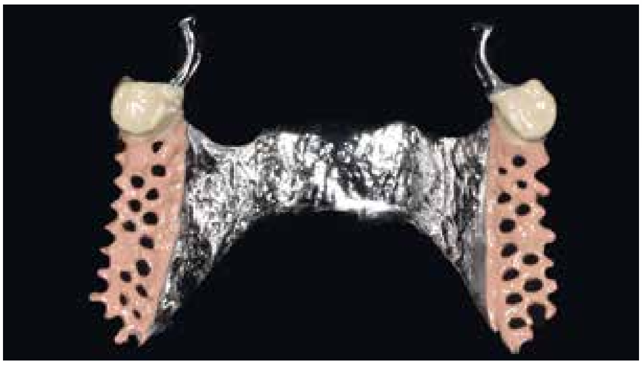

**Fig. 10.1** SR Nexco Opaquer A2 in region 5 and SR Nexco Opaquer Pink on the retention surfaces

**Fig. 10.2** Completely camouflaged CeKa anchor due to identical layering pattern

**Fig. 10.3** Denture margins harmoniously adapted to the natural gingiva and identical effect of the layered teeth and the SR Phonares tooth at site 16

**Fig. 10.4** Restoration after final polishing, showing a lifelike surface finish and natural light reflection pattern

**Fig. 11** Harmonious, natural-looking esthetic result

**Fig. 12** A happy and highly satisfied patient

## Final observations

The case discussed in this report shows how closely the natural tooth structure with all its variations and characteristics can be mimicked by using the SR Nexco lab composite. It is no surprise that the characteristically distinctive surface texture of the restoration reminds the patient of the appearance of her natural upper dentition.

We were impressed with the wide choice of highly coordinated materials, the stability of the materials during contouring, high shade stability and the tooth-like light transmission of SR Nexco. This lab composite offers a favourable resistance to wear and good polishing properties. These qualities result in a reduced affinity for plaque and discolouration and facilitate dental hygiene for the patient.

On the strength of the properties described above, we use SR Nexco for various indications in our laboratory, preferably for framework-supported fixed prostheses as well as for framework-free anterior crowns, inlays, onlays and veneers. Given the large offering of Gingiva materials, SR Nexco is also eminently suitable for the fabrication of prosthetic gingiva.

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### Tips regarding individual layers

- Avoid mixing and overlapping the pastes to prevent air from being trapped before layering the materials. Do not dilute the pastes with SR Modelling Liquid or low-viscosity components. As a general rule, use only small amounts of SR Modelling Liquid.
- It is advisable to apply highly opaque pastes to the pontic rest to ensure adequate shade stability. After that, these areas should be layered with Margin or Dentin material.
- Opal Effect pastes provide a lifelike opalescent effect in the incisal third.
- Use the shaded Transpa materials to complete and enhance the vitality in the incisal area. Transpa blue is suitable for the mesial and distal aspects.
- Use Mamelon materials to create a lifelike shade effect in the incisal third. Avoid edges at the transitions because they may look like stubs after polymerization and the mamelons may appear too pronounced.

# Lab composite offers lifelike appearance

**SR Nexco is a purely light-curing lab composite that imparts a true-to-nature appearance to restorations. The advantage of this composite is that it provides a consistent shade match even if the restoration consists of varying layer thicknesses. The composite can be cured with many customary curing devices.**

SR Nexco is designed for the conventional layering technique and cures exclusively by light. Dental technicians may use the composite to veneer framework-based and framework-free dental prostheses, including inlays, onlays, crowns, bridges and implant-supported restorations.

The light-curing lab composite SR Nexco Paste is suitable for framework-based and framework-free dental prostheses.

## True-to-nature restorations

The micro-opal fillers contained in SR Nexco endow the restorations with a natural-looking appearance. The material enables users to achieve a consistently accurate and harmonious shade match because it is tolerant of varying layer thicknesses. With its range of Gingiva materials, SR Nexco is also suitable for prosthetic gingival reconstructions.

## Not tied in with any particular curing device

Thorough and reliable curing of SR Nexco is possible with many customary curing devices. In the course of the polymerization process, the material develops the desired physical properties and acquires a homogeneous surface. The results are restorations that show a lasting shade stability and glossy surface finish over the entire wear period.

## Versatile applications

SR Nexco forms part of a comprehensive prosthetic solution from Ivoclar Vivadent. In conjunction with the SR Phonares II denture teeth and the IvoBase denture base material, SR Nexco provides dental prostheses that show excellent shade coordination and high esthetics. This has a practical advantage, particularly for gingiva modifications and combination prosthetics.

### Shade stability testing after five-week storage

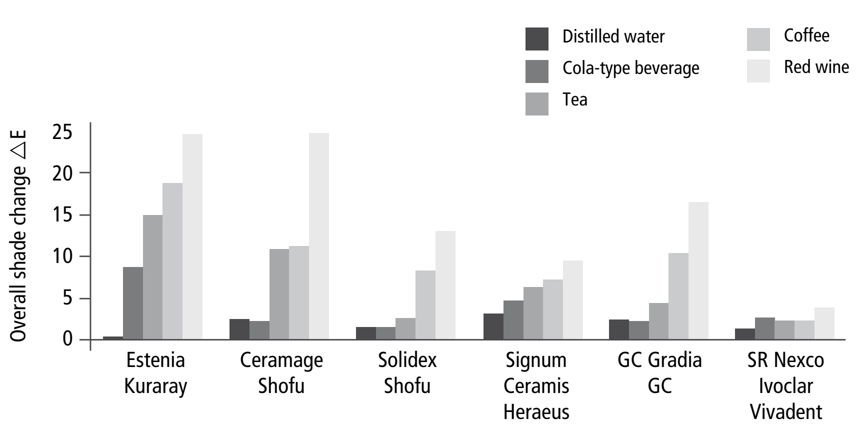


Photo: Ivoclar Vivadent

Shade stability testing after storage for five weeks. SR Nexco showed the highest shade stability of the lab composites examined in this investigation.

Source: Nippon Dental University School of Life Dentistry, Tokyo, Dr Shinya, 2012

**For more information please visit www. Ivoclarvivadent.com**