SR Nexco®

special feature

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- Research and Development and Materials Science
- Press Technique
- Pink and White Esthetics

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passion vision innovation

Editorial

Christian Brutzer
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Ivoclar Vivadent AG

Dear Reader

Roughly a year had passed since the introduction of SR Nexco®, our light-curing lab composite, when we issued our publication SR Nexco Special Feature I (previously SR Nexco Style Book). The collection of specialized articles on this innovative product has been well received. SR Nexco has developed into one of the most important benchmark products for dental technicians over the past few years. It has become the lab composite of choice for the veneering of framework-based and framework-free prosthetic reconstructions. Given its versatile use, the composite is suited for the fabrication of esthetic inlays, onlays, crowns and bridges as well as implant-based and combination restorations. Its range comprises a wide variety of shades and even includes gingiva-coloured materials. SR Nexco can be applied onto various materials, including modern materials such as zirconia. Its physical properties - e.g. wear resistance and shade stability - are optimally balanced and speak for themselves. We are very pleased with the over-whelmingly positive feedback we have received from our customers, whether they are based in a laboratory close to our headquarters in Liechtenstein or in other parts of Europe, Asia or even Australia.

With SR Nexco Speical Feature II, we would like to offer you an updated collection including new and inspiring case reports, additional details on the material and success stories from colleagues around the world.

We are confident that the passion that other dental technicians feel for this innovative product will not leave you untouched. It offers users tangible advantages: By means of an efficient, reliable and economical workflow, they are able to create restorations that are distinguished by brilliant shade effects and a superior level of quality.

In a constantly evolving market, SR Nexco provides a reliable answer to current esthetic needs. We are committed to introducing new and extended indications and applications - such as the press technique with a flask - on an ongoing basis. SR Nexco Flask has been developed in response to the input we received from well-versed customers. The flask increases the efficiency when over-pressing frameworks with the light-curing SR Nexco lab composite.

I would like to thank all authors of this publication for their contributions, which provide a broad overview of the many possibilities that SR Nexco and its material properties offer.

See for yourself and let yourself be inspired by what the authors have accomplished with SR Nexco.

Best regards

Christian Brutzer
Member of the Corporate Management
Ivoclar Vivadent AG

Contents

* Note: unless otherwise stated, the products used are products from Ivoclar Vivadent.

An exploration of the properties and applications of laboratory composites on the basis of SR Nexco

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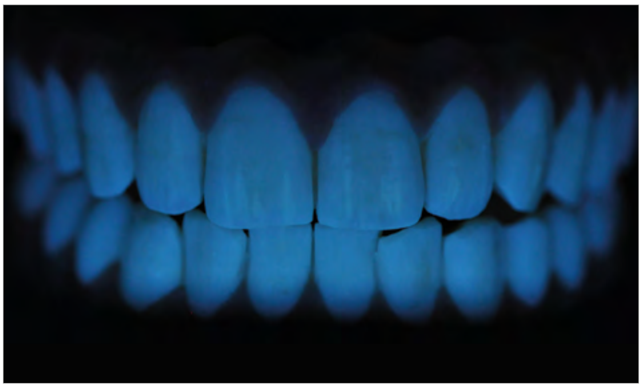
Laboratory composites are highly versatile. They are gentle to the antagonists and can therefore be used on implants, where the well-balanced distribution of chewing forces is of major importance. These materials are elastic and tough and they have a long-lasting shine. They are available in natural-looking opalescent and fluorescent forms. As a result, highly esthetic results are possible with minimum effort.

Over the years, the variety of dental materials on the market has grown quite considerably. During the past 20 years alone, the choice of new framework materials has increased remarkably. The traditional market of precious and base metal alloys and titanium has been supplemented by other materials. They include zirconium and aluminium oxide, lithium disilicate and composite resins, such as state-of-the-art machinable PMMA materials, composite blocks and polyether ether ketones (PEEK).

As the number of different materials has grown, so have the requirements that veneering materials have to fulfil. In addition, the processing criteria that have to be taken into consideration have also increased. For example, the different ceramics on the market need to be carefully matched to the coefficient of thermal expansion and the composition of the framework materials used. By contrast, laboratory composites are more tolerant materials. Generally speaking, any type of framework material can be veneered with composite resin and any laboratory composite can be combined with any framework material. Nevertheless, certain material-related properties need to be taken into account, because composites can differ in their filler content, flexural strength and elastic modulus. These characteristics in turn influence the flexural behaviour and therefore the brittleness of the material. When a composite is extremely brittle it has a heightened risk of breaking or tearing when the framework material is deformed. The ideal laboratory composite, therefore, should be capable of establishing a bond to all types of framework materials. This would save a lot of trouble in having to look for different composite resins to meet different clinical requirements. Furthermore, this material has to be adequately elastic and tough and show a permanent shine, natural-looking colour and brilliant shade effects. The good news is that all these attributes are combined in the light-curing laboratory composite SR Nexco. Due to the high percentage of micro-opal fillers, the material exhibits lifelike optical and esthetic properties that successfully mimic the natural tooth structure. These fillers are responsible for the true-to-nature opalescent effect and the fluorescent properties of the material. As a result, the appearance of the material harmoniously adapts to different light conditions and restorations (Figs 1 and 2). SR Nexco employs the same colour scheme as the all-ceramic IPS e.max and the metal-ceramic IPS Style systems. If needed, therefore, the materials can be combined to produce a harmonious overall result in certain cases. This offers dental professionals a high level of flexibility. The esthetic needs of the patients and the functional requirements of the restorations are easier to fulfil.



Figs 1 and 2 Fluorescence and opalescence of SR Nexco

Fig. 3 Implant-supported restoration made of SR Nexco laboratory composite

Fig. 4 Implant-supported provisional denture made of Telio CAD

SR Nexco in implant dentures

There is a growing demand among patients for highly esthetic restorations. In many cases, implant-supported options offer an ideal solution. Nonetheless, the strong forces of the masticatory system pose a considerable challenge in this type of restoration. Due to a lack of natural feedback, these tooth replacements and restorative materials are often exposed to very high stresses. Ceramic restorations are often incapable of resisting these forces. In implant-supported restorations in the posterior region in particular, a brittle and hard material may represent a drawback rather than a benefit. In the long-term, therefore, a slightly abrasive laboratory composite may be more suitable, since it is capable of attenuating very strong forces (Fig. 3). Because it is a relatively soft material, it assumes the role of a type of buffer, which hard ceramic material could not accomplish. Laboratory composites show more even distribution of forces and abrasion. Cracking and chipping, in other words, fracturing of the veneers, which is often found in ceramic materials, can be avoided. This helps to spare the masticatory apparatus. In the long term, laboratory composites are gentler to the antagonists. The wear facettes on the crowns and on their antagonists are similar. If adjustments are necessary, these can be made within the oral cavity with relatively little effort. This increases the longevity of the restorations. Due to the excellent reproducibility of the restorations, the material is also suitable for the fabrication of provisionals (Fig. 4). Nevertheless, it is important to note that the surface quality and wear resistance of the material is decisively influenced by the way in which it is finished. Therefore, it is important to finish the restoration surfaces very carefully and polish them to a high gloss.

Fig. 5 The gingival parts of implant-supported restorations made of laboratory composite can be lined or augmented if necessary.

Fig. 6 The gingival materials are individually layered. This allows the pigmentation and colouration of the gingiva to be accurately reproduced.

The Gingiva Solution system

Today, the design and creation of soft tissue in implant-supported restorations is subject to very high standards. However, over longer periods of time, the soft and hard tissue situation often changes. Biological factors such as abnormal biomechanical stress and excessive stress on the chewing apparatus or a change in the facial muscle tone cannot be predicted and may lead to damage or the need to adjust the restoration. Laboratory composites allow you to take suitable action in these cases. The Gingiva Solution shade range has been specially developed for the creation of the prosthetic gingiva. It is matched to the SR Nexco, IPS Style and IPS e.max systems from Ivoclar Vivadent. The components correspond to the different coordinated Gingiva and Intensive Gingiva materials of the systems. In terms of hygiene, gingival parts made of fired ceramic are superior compared to those made of composite resin. Nonetheless, composite resin compensates for this aspect by having a much wider range of applications. In implant-supported restorations in particular, the possibility of lining or augmenting the gingival elements as needed is of major importance (Fig. 5). Because they are difficult to adjust and repair, ceramic materials are often unsuitable for recreating the gingiva. The large selection of SR Nexco gingiva materials allows gingival areas to be layered individually. Different pigmentations and colour variations can be faithfully imitated (Fig. 6). When the gingival part of a restoration is created with composite, it is important to make sure that the components can be cleaned easily and thoroughly. If these criteria are observed, the previously mentioned hygiene concerns voiced by the ceramics proponents do not have to be taken seriously. There is nothing that speaks against using a composite resin. The SR Nexco Dentin and Incisal pastes and the Gingiva Solution materials follow the same comprehensive shade scheme. The different restorative systems of IPS Style (metal-ceramic), SR Nexco (laboratory composite) and IPS e.max (all-ceramic) are all based on the same shade system. This is especially beneficial in the fabrication of large restorations.

Fig. 7 The PMMA material is cut back as required.

Fig. 8 Subsequently, the cut-back areas are built up with the laboratory composite.

Fig. 9 Provisionals can be characterized and individualized with laboratory composite in many different ways.

SR Connect – The key to combining different materials

The planning involved in the fabrication of tooth replacements is becoming more complex. As a result, the standards of temporary restorations have also risen. These days, patients are expected to wear provisionals for periods of several months and up to one year. The components selected for the temporary restorations can be esthetically improved with laboratory composite to make them look more attractive. For example, full-contour milled, highly cross-linked PMMA restorations made of Telio CAD can be cut back and subsequently built up again with the appropriate SR Nexco composite materials (Figs 7 and 8). This method opens up many new possibilities for characterizing and modifying provisionals (Fig. 9). The SR Nexco Incisal and Effect materials and SR Nexco Stains are available for the individual adjustment of natural-looking colour transitions. The simplicity and clarity of the product range is one of the strong points of this laboratory composite. SR Nexco incorporates the shade system that was introduced with IPS e.max. The Opal Incisal materials and pigmented translucent Effect powders are a highlight of this shade range. The bond between the composite resin and the temporary restorative material is generated by the light-curing SR Connect bonding agent.

Complete dentures can be enhanced by customizing and modifying the prefabricated denture teeth used to make them. For this purpose, the incisal part of the denture teeth, for example SR Phonares, is cut back, as was done in the previously mentioned provisional restorations. Subsequently, the SR Connect bonding agent is applied to the ground surfaces in order to establish a bond between the denture teeth and the laboratory composite SR Nexco. The final shape of the denture teeth is created with the Incisal, Effect and Stains materials. The Effect powders impart the restorations with a natural-looking opalescence (Fig. 10).

Fig. 10 Lifelike opalescence produced with Effect materials

SR Phonares and SR Nexco are carefully matched and they use the same shade system. Due to the convenient, spreadable consistency of the laboratory composite, the transition between the denture teeth and the characterized areas is smooth and even. Polishing further enhances the outstanding surface texture. In the two cases described – the adjustment of PMMA restorations made of Telio CAD laboratory composite and the customization of SR Phonares prefabricated teeth – only one material is needed to bond the different materials: The bonding agent SR Connect is the key to combining the various components.

SR Nexco on zirconium oxide

Experience has shown that laboratory composites play an important part in improving the appearance of provisional restorations. They are also taking on an increasingly significant role in the veneering of zirconium oxide frameworks. Nowadays, zirconium oxide frameworks in conjunction with composite veneers are being used not only for implant-supported partially removable tooth replacements, but also for removable restorations. In cases where space is very tight, tooth-coloured zirconium oxide represents a very popular option. This material is highly accepted by patients, since it offers a welcome alternative to metal-based frameworks due to its biocompatibility (Fig. 11). Using zirconium oxide

Fig. 11 Zirconium oxide framework with laboratory composite veneers

Fig. 12 Application of the SR Link bonding agent on a zirconium oxide framework

frameworks with laboratory composite veneers offers two decisive advantages over ceramic materials. Firstly, the comparatively soft composite resins are less susceptible to chipping than ceramics. Secondly, this type of restoration can be veneered again if required after a lengthy period of use. This is a cost-effective solution for the patient. Furthermore, in partially removable implant restorations, such as those mentioned, small repairs can be done in situ by the dentist directly in the patient's mouth. In all the cases described, the adhesive bond between the zirconium oxide framework and SR Nexco is generated in the same way as it is done between metal and ceramic materials. For the veneering process, the frameworks are also prepared in the same way as metal frameworks. Since zirconium oxide is classified as a metal, it can be treated accordingly. Therefore, the metal bonding agent SR Link is highly effective on zirconium oxide frameworks (Fig. 12). The product generates a sound bond between the framework and the veneering material. In the first step, the framework is sandblasted with aluminium oxide (Al_2O_3) with a grit size of approx. 100 µm at a low pressure of maximum 1 bar. Next, the residue is carefully tapped off the framework. Then the bonding agent is applied with a disposable brush. After a reaction time of three minutes, a shiny, slightly greasy-looking layer forms. Subsequently, the first fine layer of opaquer is applied. It is comparable to the wash layer used when working with ceramics. This first layer is cured for a very short time of only 20 seconds per segment. The next covering layer of SR Nexco Opaquer is light cured in the Lumamat 100 unit for 11 minutes. SR Nexco can be light cured in all the approved Ivoclar Vivadent light-curing units. The inhibition layer which forms is removed with a disposable sponge.

Since the surface of the material is homogenous, it is very easy to polish. The restorations maintain their original colour and shine even after long periods of service. This considerably reduces the susceptibility to plaque formation of the restorations.

The experience gathered with the various SR Nexco veneering materials over the past four years has confirmed their excellent properties. The restorations fabricated with them are of

Fig. 13 The long-term success of a zirconium oxide restoration veneered with a laboratory composite also depends on the good oral hygiene of the patient.

exceptional high quality. Nevertheless, in order to ensure the longevity of these restorations, they have to be kept meticulously clean. Their good condition stands or falls by the oral hygiene and cleaning habits of the patient. It is the job of dental technicians to create the best possible restorations, but it is the task of patients to look after them properly. Dental technicians and dentists, therefore, must make sure that their patients understand the responsibility of ensuring the success of their restorations (Fig. 13).

Fabrication techniques: manually layered or pressed

In the past, we only had one working method at our disposal and that involved layering the composite resin by hand with the help of a spatula. In the meantime, another technique has become available. That is, SR Nexco veneers can now be applied to the framework using what is known as the press technique. The procedure entails using a dedicated flask called SR Nexco Flask. With the help of this flask, restorations of any type or size are veneered with composite resin. The flask is

Fig. 15 The flask is loaded with the clear silicone Transil F

Fig. 14 The SR Nexco Flask

characterized by numerous small details, which are specially tailored to meet the many different challenges of routine laboratory work (Fig. 14). The tooth shape of restorations made of metal or zirconium frameworks with pressed veneers is anatomically built up on the framework with wax. Alternatively, the full-contour restoration is milled from a composite resin or wax material. Digital and analog techniques ideally complement each other in this process. In both cases, the framework is then placed in the flask to start the veneering procedure. The restoration is invested in the flask base with mounting putty. Next, the flask is closed and then filled with Transil F clear silicone (Fig. 15). Once the silicone has set, the flask is opened and the wax is removed from the framework. Then, the cleaned framework is prepared for the application of the veneers. It is coated with the metal-composite bonding agent SR Link and subsequently with the opaquer (Fig. 16). After having cured the opaquer, the transparent counter mould, which was produced with the cured clear silicone in the flask cover, is loaded with the chosen dentin material (Fig. 17). This material is then pressed on the prepared framework. For this purpose, the two flask halves are tightly closed with three screws and the flask is placed in

Fig. 16 Application of the SR Link bonding agent to the zirconium oxide

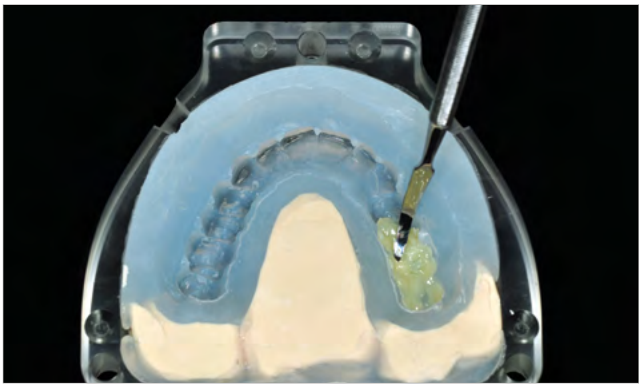


Fig. 17 Loading of the counter mould in the flask with dentin material

Fig. 18 Examination of the pressed dentin

Fig. 19 The restoration is cut back to make space for the incisal material

a light-curing unit. Since the silicone and the flask cover are both clear, the composite resin cures completely. Next, the flask is opened and the full-contour dentin core is removed (Fig. 18). Space for the incisal material is created by cutting back the composite, following the same approach as that used for ceramic materials (Fig. 19).
The Effect and Effect Transpa materials are used to customize the appearance of the restoration. Additional characteristics are applied with the Stains materials.

In the next step, the incisal material is pressed on the restoration in the same way as the dentin material was applied. Due to the special composition of the materials, surface conditioning is unnecessary before the incisal layer is placed. In other words, a special adhesive or similar material is not needed to bond the incisal materials to the cured dentin layer.
Once the incisal material has been pressed on the restoration, the anatomical shape and texture of the teeth has to be finished and the restoration polished.
The ability to press composite materials on framework structures in the specially designed flask saves a considerable amount of time compared with the manual layering technique using a spatula, particularly in the case of long-span bridges. This new method allows the information gathered from the diagnostic model to be faithfully transferred to a mock-up or set-up model and then to the final restoration with minimal discrepancy in the individual steps. This technique allows patients to obtain a reliable preview of the final result. In addition, they can become involved in the assessment and adjustment of the restorations in terms of design and phonetics at an early stage.

Conclusion

The choice of laboratory composites on the market is immense and so are their applications. SR Nexco features exceptional mechanical and esthetic properties which can solve a myriad of dental problems. The material is highly antagonist-friendly and it is therefore suitable for implant-supported restorations on which the well-balanced distribution of chewing forces is of utmost importance. The material ensures minimized risk of chipping or cracking and it is gentle to the temporomandibular joint. These features set the material apart from ceramics, which are often considered to be the product of choice in these situations.

The laboratory composite SR Nexco is elastic and tough and it has a long-lasting shiny appearance. It contains micro-opal fillers, which are responsible for imparting the material with lifelike opalescent and fluorescent effects. The bonding agent SR Connect is the key to producing a sound bond between

Product list

Product	Product name	Manufacturer
Composite	SR Nexco	Ivoclar Vivadent
Metal-free veneering ceramic	IPS e.max	Ivoclar Vivadent
PFM veneering material	IPS Style	Ivoclar Vivadent
PMMA material (provisionals)	Telio CAD	Ivoclar Vivadent
Staining materials (composite)	SR Nexco Stains	Ivoclar Vivadent
Bonding agent (composite)	SR Connect	Ivoclar Vivadent
Denture teeth	SR Phonares	Ivoclar Vivadent
Bonding agent, composite-metal	SR Link	Ivoclar Vivadent
Flask	SR Nexco Flask	Ivoclar Vivadent
Silicone, casting (clear)	Transil F (clear silicone)	Ivoclar Vivadent

different materials: that is, PMMA materials or prefabricated teeth and the laboratory composite.

Additional esthetic and lifelike characteristics can be imparted to veneers with the large selection of Effect and Stains materials. The system is characterized by its simplicity and efficiency and its ease of use in conjunction with the all-ceramic IPS e.max and the metal-ceramic IPS Style systems. The Dentin and Incisal materials as well as the pink esthetics assortment follow standardized shade schemes. The products of the Gingiva Solution system are focused on the restoration of pink esthetics with the objective of fulfilling the esthetic demands of this segment.

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1:1 transfer of the wax-up to the final restoration

Fabián Soto Briones, MDT
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A new flask technique providing a fast and easy route to the result

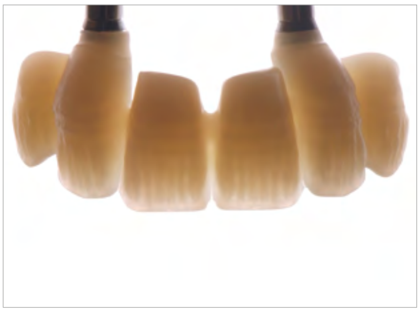
The author of this report, Fabián Soto Briones, describes an efficient technique to transfer the wax-up into the final restoration. If the entire restoration or veneer is implemented in composite, an easy transfer method is now available using the press technique in conjunction with the light-curing lab composite SR Nexco® and the specially designed SR Nexco Flask.

During our day-to-day work, we often spend a lot of time on designing the wax-up. It tells us which procedure will lead to the desired result. For me, the challenge has always consisted of the fact that a reliable, precise and efficient method has not been available to implement the wax-up, prepared with so much care, accurately in the final restoration. However, this situation has now changed with the introduction of the flask technique for SR Nexco from Ivoclar Vivadent (Schaan, Liechtenstein) (Figs 1 and 2). SR Nexco is a lab composite with micro-opal fillers. In my opinion, it is exactly suited for this type of work. We associate it with the following advantages:

- No details are lost during the transfer from the wax-up to the composite due to the flask technique.
- The composite has convincing mechanical properties.
- The final result is comparable with ceramic restorations in terms of esthetics.
- Minor modifications and corrections can be applied even after the restoration has been seated.
- The material is easy to polish.
- Using it means that we can considerably reduce the weight of our restorations.

In addition, the flask technique enables us to verify at any time that the spatial dimensions of the restorations are in line with the actual space available and that the substructure is adequately covered with veneering material. We can be confident that the restoration will result in an excellent fit. As we use the wax-up as a basis for a 1:1 copy, it has to be very accurate – this really is decisive. You have to bear in mind that the result implemented in the final material will be an exact copy of the wax-up.

Figs 1 and 2 With the SR Nexco Flask, a 1:1 copy of the wax-up can be easily achieved in the final composite restoration.



Figs 3a to c CAD/CAM framework made of PMMA

Fig. 3b

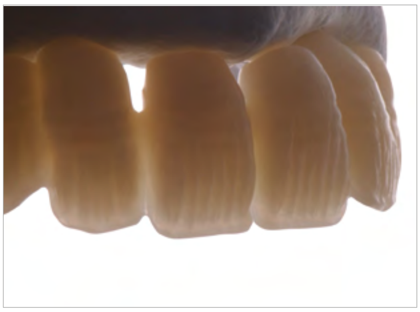


Fig. 3c

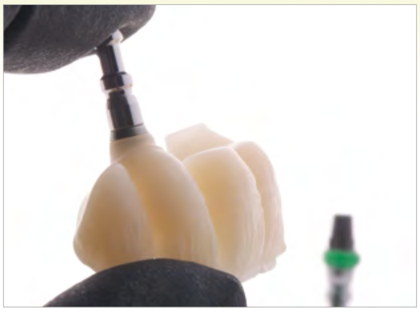
Figs 4a and b Preparing the mesostructure for cementation

Fig. 4b

In addition to manually creating the wax-up, you can now also use a framework structure milled from PMMA (Figs 3a and b). In the course of fabricating the restoration, the framework structure will simply be cemented to the mesostructure on one side (Figs 4a and b) while on the side of the implant, the titanium base and PMMA framework will be bonded using an adhesive (Fig. 5).

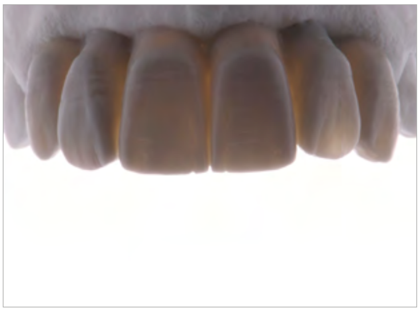
Creating a showcase restoration

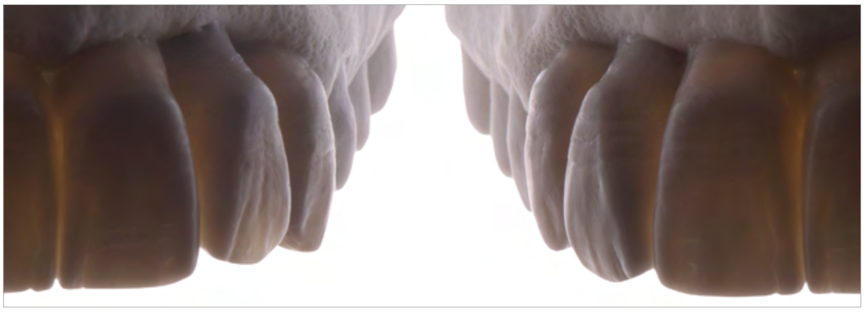
Described below is the fabrication of a model restoration to demonstrate the work procedure. For this purpose, we used an imaginary clinical case. As the preoperative situation, we imagine a patient that has lost his teeth from 13 to 23 and shows severe bone resorption. He received implants in the region of tooth 12 and 22. The prosthetic reconstruction should consist of a fixed restoration: metal framework, PMMA



Figs 5a and b The titanium base is cemented to the PMMA framework using Multilink Hybrid Abutment

Fig. 6 The Bruguera wax kit for the adaptation of the PMMA framework structure





Figs 7a and b Wax-up on the PMMA framework

Fig. 7b

Fig. 8 Silicone keys are instrumental in checking the space during the fabrication of the restoration.

Fig. 9 The wax-up created on the PMMA framework is positioned in the flask.

Fig. 10 Virtual silicone putty is used for investing the wax-up.

mesostructure and composite veneering. Whenever we work on an implant, we first create a silicone key to validate the target situation. Once we are sure that we have achieved an adequate working model, we can begin to design the wax-up. In this case, we use the "GEO Expert Wax Set A. Bruguera" wax kit (Fig. 6) from Renfert (Hilzingen). The wax-up will be used as a basis to create a final composite restoration with the help of the flask technique. The wax-up needs to be accurate and impeccable, not only functionally but also esthetically.

Once the wax-up is finalized (Figs 7a and b), we create a silicone key of the palatal and vestibular aspect to evaluate the spatial conditions (Fig. 8). Next, the wax-up is placed in the flask (Fig. 9) and invested using Virtual putty (Fig. 10).

A mould is created from clear silicone (Fig. 11). This will allow us to polymerize the composite material of the restoration through the silicone in the flask. The flask halves are fitted together and screwed in place securely to ensure that they are immobilized during the press procedure (Fig. 12). After polymerization, the mould is ready for use. The mould will play a central part in the next steps to create the final restoration.

As the purpose is to achieve a metal-based restoration, we now need to prepare the metal framework for the over-pressing procedure with light-curing composite (Figs 13a to c). A thin layer of opaquer is applied as a wash, followed by a second application of opaquer in a thicker coating to completely cover the metal framework (Fig. 14).

Fig. 11 Transil F clear silicone will be filled into the flask to create a mould.

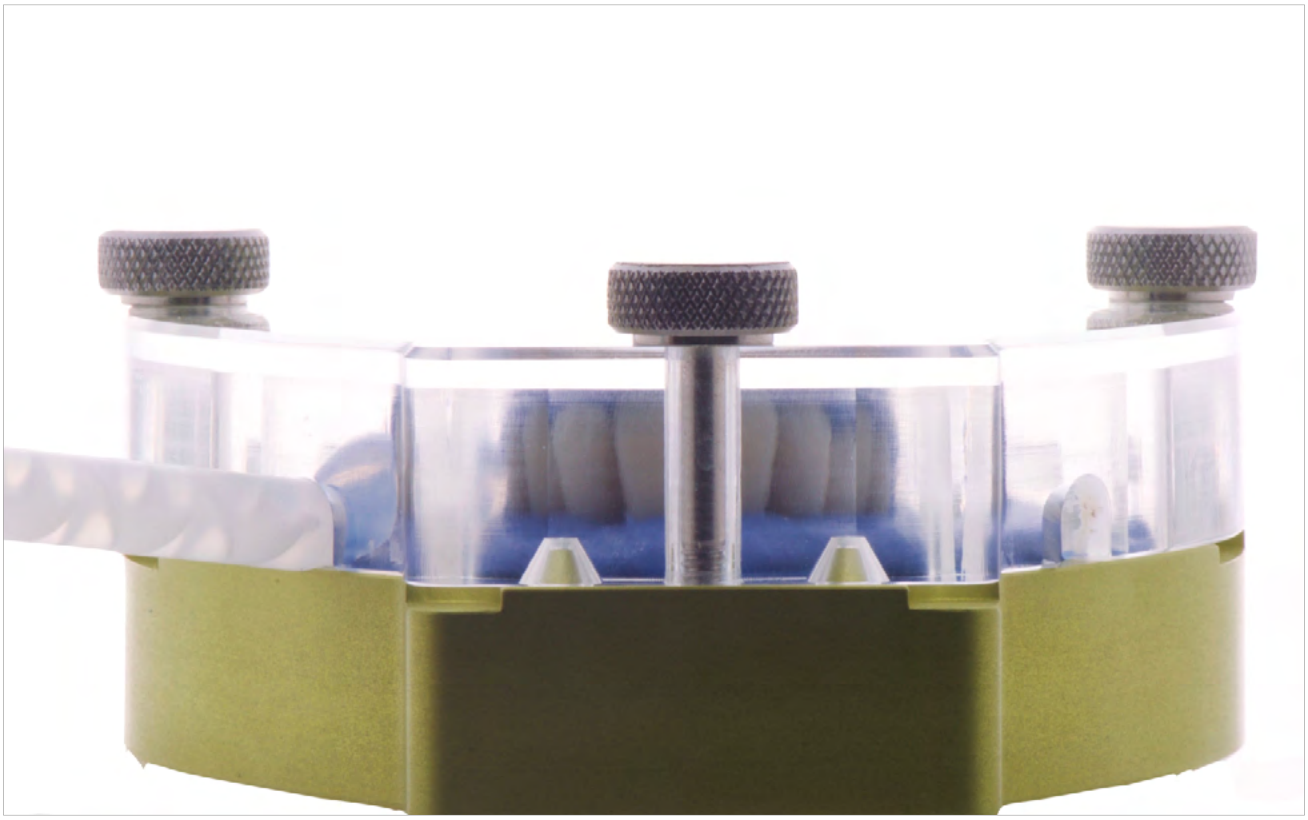


Fig. 12 Fitted flask halves with the wax-up in place. The mixing tips of the clear silicone fit exactly into the filling openings in the flask lid.

Fig. 13a Milled framework structure

Fig. 13b Pre-sintered metal framework for the fabrication of the final restoration

Fig. 13c Application of the SR Link metal-composite bonding agent

Fig. 14 Application of the opaquer in a first thin coating and then in a second covering layer

Next, the wax-up in the flask is replaced with the metal framework and then the framework is invested. Now, the composite materials are filled into the previously prepared mould and then pressed onto the metal framework. Once the framework is over-pressed with composite, we need to check, with the silicone key, how much space is available on the vestibular aspect for the characterizations. A natural appearance is created with the help of Effect and Stains materials (Fig. 15).

After the shade characterizations have been applied, it is once more necessary to check the remaining space with the help of the silicone key. If you do not check the space at this stage, you may run the risk of ending up with inadequately large dimensions when the vestibular aspect is veneered with the Incisal and Transpa materials. This would mean that exactly that vital precision that can be achieved with the press technique would be lost.
Let's assume that our imaginary case requires the gingival areas to be reconstructed. In this case, it is important to keep the morphology of the completed work in mind and to contour the gingival parts with a brush until they are perfect. Pink portions are created with the Gingiva materials of the composite system, beginning with the basic gingival shade (BG 34) and then creating the natural gingiva by mixing various shades (Fig. 16). Additional minor effects are added using Stains. This increases the optical depth and ensures that the restoration accurately imitates the pigmentation of the natural gums. Once completed, the restoration is polished with various pastes. I always use the same range of polishers for this task (Universal Polishing Pastes from Ivoclar Vivadent and Opal L high gloss polisher from Renfert) and always follow the same method (Fig. 17). At the end, the composite restoration is polished with Universal Polishing Paste.

Conclusion

SR Nexco Flask allows us to transfer the waxed-up work accurately to the composite restoration, irrespective of the framework structure being used. The flask provides a convenient auxiliary for the fabrication of large long-span restorations in particular. Given the sizes and shapes of some of these cases, it would be extremely complicated and troublesome to transfer the wax-up to the composite without auxiliaries. The press technique allows us to create restorations that are exact copies of our wax-ups with ease (Figs 18a to c).

Fig. 15 Application of Stains (here in the shade "chili")

Fig. 16 Application of Gingiva using a brush

Fig. 17 In the last step, the composite restoration is polished using Universal Polishing Paste.

Figs 18a to c Final restoration made of SR Nexco lab composite: lifelike reconstruction of the gingival portions.

Fig. 18b

Fig. 18c

Product list

Product	Product name	Manufacturer
Luting composite	Multilink® Hybrid Abutment	Ivoclar Vivadent
Bonding agent; composite/metal	SR Link	Ivoclar Vivadent
Impression material	Virtual	Ivoclar Vivadent
Silicone, pouring	Transil F	Ivoclar Vivadent
Polishing paste	Universal Polishing Paste	Ivoclar Vivadent
Composite		
– teeth	SR Nexco Paste	Ivoclar Vivadent
– gingiva	SR Nexco Paste Gingiva	Ivoclar Vivadent
Modelling wax	GEO Expert Wax Set A. Bruguera	Renfert
High-gloss polishing paste	Opal L high gloss polishing paste	Renfert

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See list for further reading at www.ztm-aktuell.de/literaturlisten

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Deluxe composite resin

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Using SR Nexco Flask to fabricate implant-supported, zirconium oxide-based restorations

Master Dental Technician Annette von Hajmasy jokingly describes herself as the "Acrylics Fairy", since her speciality of composite resins still has an aura of impermanence about it in prosthetic restorative dentistry. Nevertheless, her courses are always booked to capacity and the topic of composite resins is beginning to make a mark on dental congress programs around the world. To some degree, this growth in popularity can definitely be attributed to the flask-press technique and the laboratory composite SR Nexco. Together, they produce results that are difficult to match in terms of esthetics, durability and function in particular.

Introduction

As a result of the growing availability of different dental materials and the increase in their applications, the types of implant-supported restorations that can be manufactured are becoming more varied. The importance of thoroughly knowing the materials one is using, including their physical properties, is becoming an utmost necessity. Furthermore, a precise assessment of the patient's situation is gaining in importance. In this context, the following issues need to be clarified: In which biological system will the replacement teeth be inserted? Does the implant-supported restoration have to be veneered with ceramic, or would composite resins also offer a viable option under today's circumstances? Composite resins offer numerous advantages due to the fact that restorations made of these materials can be repaired or adjusted by relying on a purely chemical bond. In addition, because the material is not as brittle, it tends to show more lifelike wear and less chipping than ceramics.

Regardless of these general observations, it is always a great challenge to establish the needs of the patient and produce a corresponding waxed up version of the desired restoration with the teeth set up accordingly and then to reproduce all this information in the final restoration without any loss of vertical dimension. The press technique using composite resin and SR Nexco Flask provides an ideal solution in these cases. With the help of the flask, composite resin is pressed onto metal and zirconium oxide frameworks. The flask is suitable for the production of implant-supported restorations and it can accommodate entire models.

Fig. 1 The preoperative situation in the upper jaw: The treatment plan involved the fabrication of partially removable dentures which would incorporate customized zirconium oxide abutments on ten implants and a zirconium oxide framework covered with composite resin (tooth 17 to 27).

Fig. 2 The plan was to restore teeth 35 to 37, 33 to 43 and 44 to 47 in the lower jaw with three implant-supported, ceramic-covered zirconium oxide bridges on customized zirconium oxide hybrid abutments. A zirconium oxide-based, individually layered all-ceramic crown would be fabricated for tooth 34.

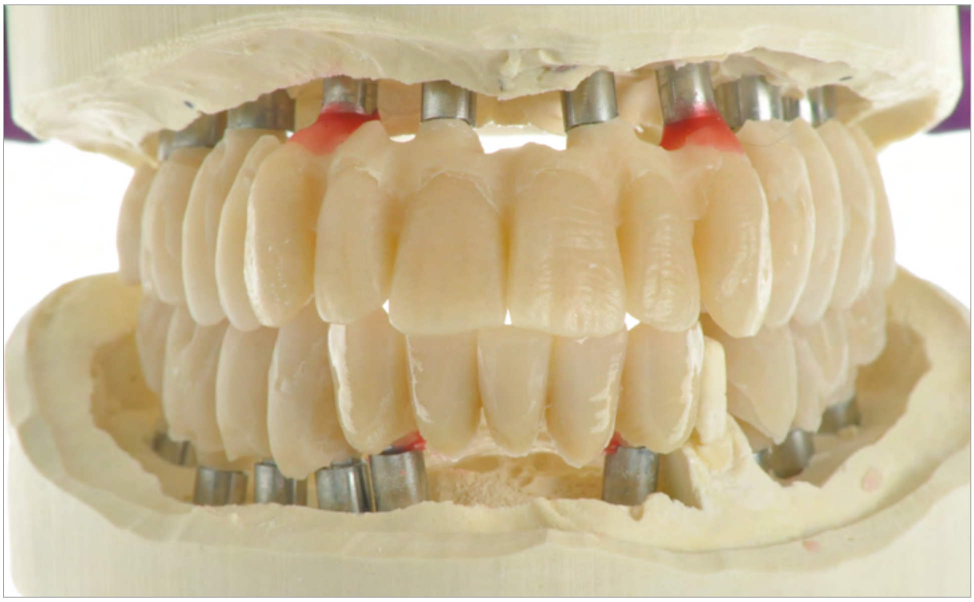


Fig. 3 The anterior teeth in the upper and lower jaw were positioned according to the dental and skeletal requirements and the phonetics of the patient. The posterior teeth were set up in the articulator. This approach established a sound reference for all the future working steps and the final product.

This article shows how to press a composite resin material on a partially removable, implant-supported zirconium oxide bridge. Since this article focuses on the topic of the press technique, the required preliminary working steps will not be extensively described, but simply summarized.

Procedure
Initial situation and planning phase

Upper Jaw (Fig. 1): Partially removable tooth replacements on ten implants with customized zirconium-oxide abutments; zirconium oxide framework extending from tooth 17 to 27, covered with composite resin; the gum areas would be reproduced with artificial gingival tissue; each quadrant would be directly secured by means of occlusal screws (tooth 16 and 26).

Lower jaw (Fig. 2): Tooth 35 to 37, 33 to 43 and 44 to 47; three implant-supported zirconium oxide bridges with ceramic veneers on customized zirconium oxide hybrid abutments; a zirconium oxide-based, individually layered all-ceramic crown for tooth 34.

A bite record was taken and transferred to the articulator. The teeth were set up together with the patient using suitable set-up templates. These templates were secured in the mouth by means of two ball anchors. This ensured good retention in the mouth and enabled the function of the denture to be reliably assessed. Furthermore, the templates were easy to remove and reinsert.

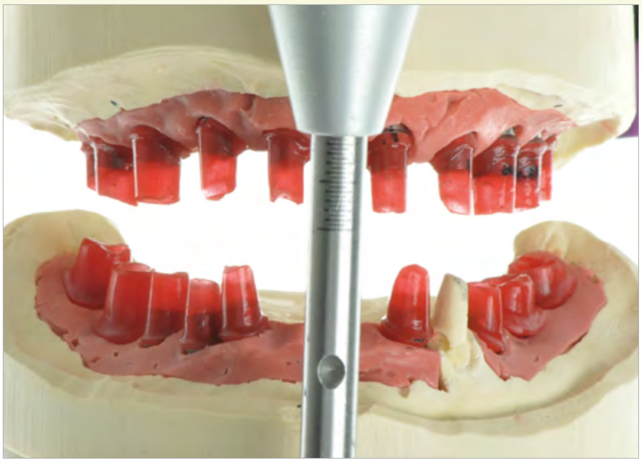


Fig. 4 The abutments in the upper jaw were first produced with a pattern resin and then later with zirconium oxide.

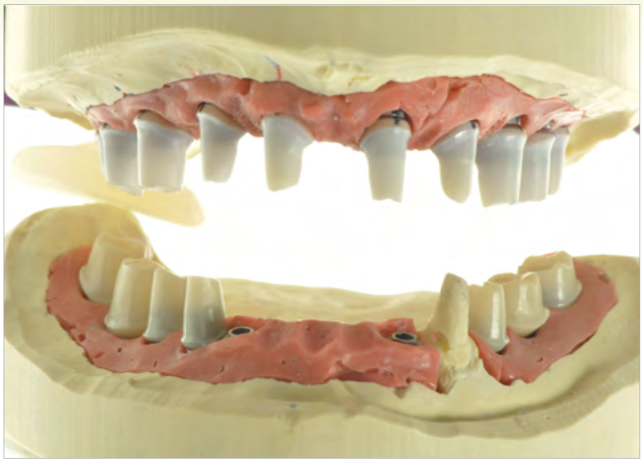


Fig. 5 The abutments were reproduced with zirconium oxide using CAD/CAM methods. They were bonded with the titanium bonding bases in the dental laboratory.

Figs 6 and 7 A CAD/CAM milling system and a composite resin disc were used to fully reproduce the upper jaw set-up with composite resin.

The anterior upper and lower teeth were set up according to the dental and skeletal requirements and the phonetics of the patient. The posterior teeth were added in the articulator. This approach allowed the restoration to be set up using composite resin (Fig. 3). As a result, a sound reference for all the future working steps towards the final product was obtained.

1. Planning and manufacture of the customized abutments in the upper jaw with pattern resin (Fig. 4)
2. CAD/CAM-fabrication of the abutments using zirconium oxide and bonding with the titanium bonding bases in the dental laboratory (Fig. 5)
3. CAD/CAM production of the upper jaw set-up:
   a) full-contour using composite resin (Figs 6 and 7)
   b) transfer of the full-contour situation to the zirconium oxide framework by reducing the scanned composite prototype.

CAD/CAM milling of the set-up with composite resin offers two advantages. Firstly, the composite resin bridge functions as a full-contour spacer or mock-up during the flasking process. As a result, the necessity of placing a full-contour wax-up on the zirconium oxide framework is eliminated. Secondly, once the permanent restoration has been completed, the composite resin bridge can be adapted and used as a replacement denture.

If a replacement denture is not desired, the previously described mock-up can also be fabricated from a wax blank. This wax-up is invested for the flasking process with SR Nexco Flask in the same way as the composite resin bridge.

Fig. 8 For the press technique, a duplicate of the study model together with the screwed-on abutments and the milled composite resin mock-up was invested in the lower flask half in a hard silicone putty (Shore hardness of at least 90-95).

Fig. 9 Since the anterior teeth in the present case showed some protrusion, the model had to be slightly tipped in a labial direction when it was invested. The undercuts were filled with clear silicone after the silicone putty had set.

Fig. 10 The silicone used for the investment process can be smoothed out while it is setting. Once it has set, it can be smoothed out by grinding. It is advisable to remove the composite resin mock-up from the model before it is ground.

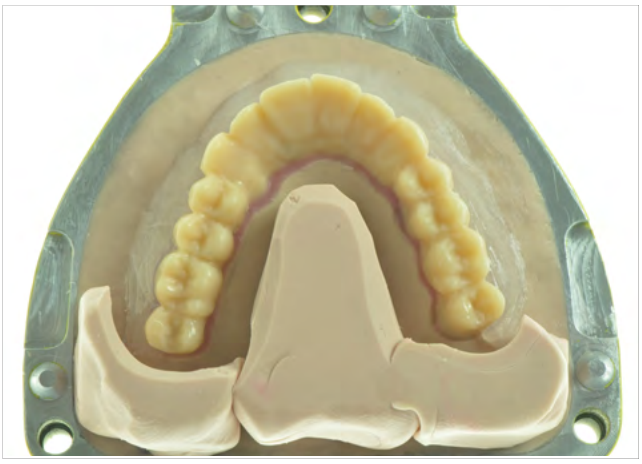


Fig. 11 The dorsal areas of the flask were blocked out with silicone putty in order to reduce the amount of clear silicone needed to load the flask for the curing process.

Composite press technique

In the first step of the press technique, a second study or investment model with the attached abutments was invested. The model was embedded in the bottom flask half using hard silicone-based putty with a Shore hardness of at least 90-95. The previously described mock-up was placed on the abutments. The soft gingival analog was removed for this step (Fig. 8).
The underside of the hollow bridge was fully supported by the silicone. In this context, it is important to ensure the correct height of the restoration and the inclination and position of the teeth. In the present case, the anterior teeth showed some protrusion. As a result, the model had to be slightly tipped towards the labial aspect. Once the putty had cured, the undercuts were filled with clear silicone (Fig. 9). This clear material allows you to make sure that all the areas have been properly embedded. The two silicone materials should be capable of bonding with each other. Furthermore, the bridge must fit firmly and securely on the abutments. This applies to both wax and composite resin bridges. If something does not fit properly at this stage, then an error will be incorporated into the permanent restoration.
The surface of the investment silicone can be smoothed out during the curing phase. Alternatively, it is ground smooth after curing with the corresponding grinding instruments. If the material is ground, it is important to remove the composite resin mock-up from the model beforehand (Fig. 10). This will also show whether or not all the areas have been properly embedded.

Subsequently, the dorsal parts of the silicone were blocked out. This helped to reduce the amount of Transil F clear silicone necessary for covering the framework in the flask (Fig. 11).

Before we filled SR Nexco Flask Transil F clear silicone, we checked to make sure that the upper flask half fitted properly and firmly on the base in order to prevent subsequent inaccuracies of the press results. Excess silicone that had spread onto the edges of the flask was carefully removed. Next, the surface of the silicone in the flask base was isolated with Vaseline. The transparent upper flask half was placed on top and secured with the three screws. We made sure that the two flask halves were flush without any space between them before we firmly tightened the screws. These aspects were important to observe in order to prevent any changes in the vertical dimension when the composite is pressed.
The transparent flask half has special openings on the side into which we introduced the Transil F mixing tips for the purpose of loading SR Nexco Flask with clear silicone (Fig. 12). This particular product in the cartridge delivery has a Shore hardness of 72. After a short setting time of 12 to 15 minutes (Fig. 13), we released the screws and separated the two flask halves. After the setting process, the transparent flask half containing the clear silicone and the spacer silicone should have the appearance shown in Figure 14.
In the next step, we replaced the composite resin mock-up which was used for the investment process in the flask with the zirconium oxide framework (Fig. 15). Prior to starting the press-on process, we checked the dimensions of the zirconium oxide framework against the previously fabricated silicone matrix (Fig. 16). Adjustments could still be made to the framework at this stage.

Fig. 12 The transparent flask half has openings on the side, into which the mixing tips are introduced for the purpose of injecting the Transil F clear silicone into SR Nexco Flask.

Fig. 13 The clear silicone Transil F has a Shore hardness of 72. The screws are released after a short setting time of 12 to 15 minutes and the two flask halves are separated.

Fig. 14 This picture shows what the transparent upper flask half with the clear silicone and the silicone spacer should look like after curing.

Fig. 15 In the next working step, the invested composite resin mock-up was exchanged for the suitably conditioned zirconium oxide framework.

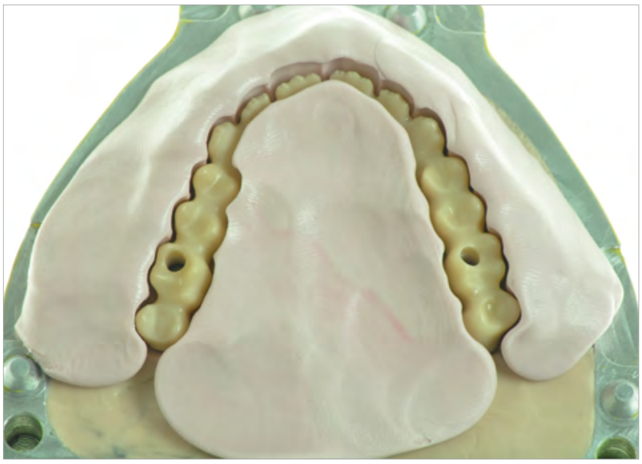


Fig. 16 Before the composite resin was pressed on the zirconium oxide framework, all the dimensions were checked against the previously fabricated silicone matrix. At this stage, the framework could still have been adjusted if necessary.

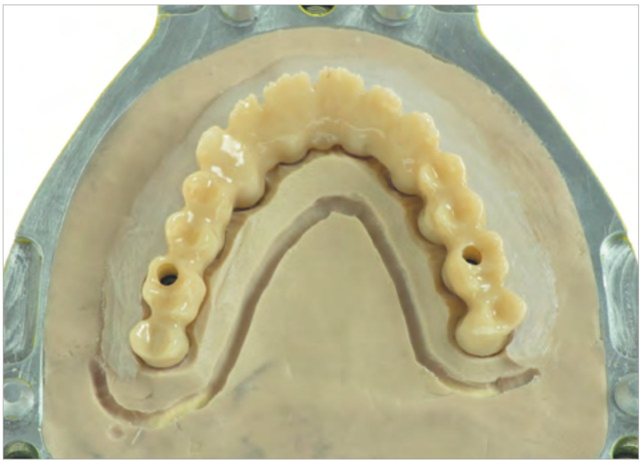


Fig. 17 A spill groove for excess composite resin was ground into the cured silicone putty of the base at a distance of approx. 1.5 to 2 mm from the restoration.

Next, a channel was ground into the hardened silicone putty in the flask base at a distance of 1.5 to 2 mm from the restoration. This channel allowed excess composite resin to flow away and therefore prevent any increase in the vertical dimension (Fig. 17).

Before the light-curing laboratory composite SR Nexco was pressed to the zirconium oxide, the framework was sand blasted with Al_2O_3 (80 to 100 µm) at approx. 1 bar pressure. Subsequently, the metal-composite bonding agent SR Link was applied on the conditioned framework with a disposable brush. After a reaction time of 3 minutes, SR Nexco Opaquer was brushed on the restoration: first a thin wash layer, followed by a full-coverage second coating. Thereafter, the prepared zirconium oxide framework was firmly placed in the correct position in the flask base with tweezers. Then SR Nexco Paste Dentin was loaded in the opposing mould with a spatula in preparation for the first composite press-on procedure.

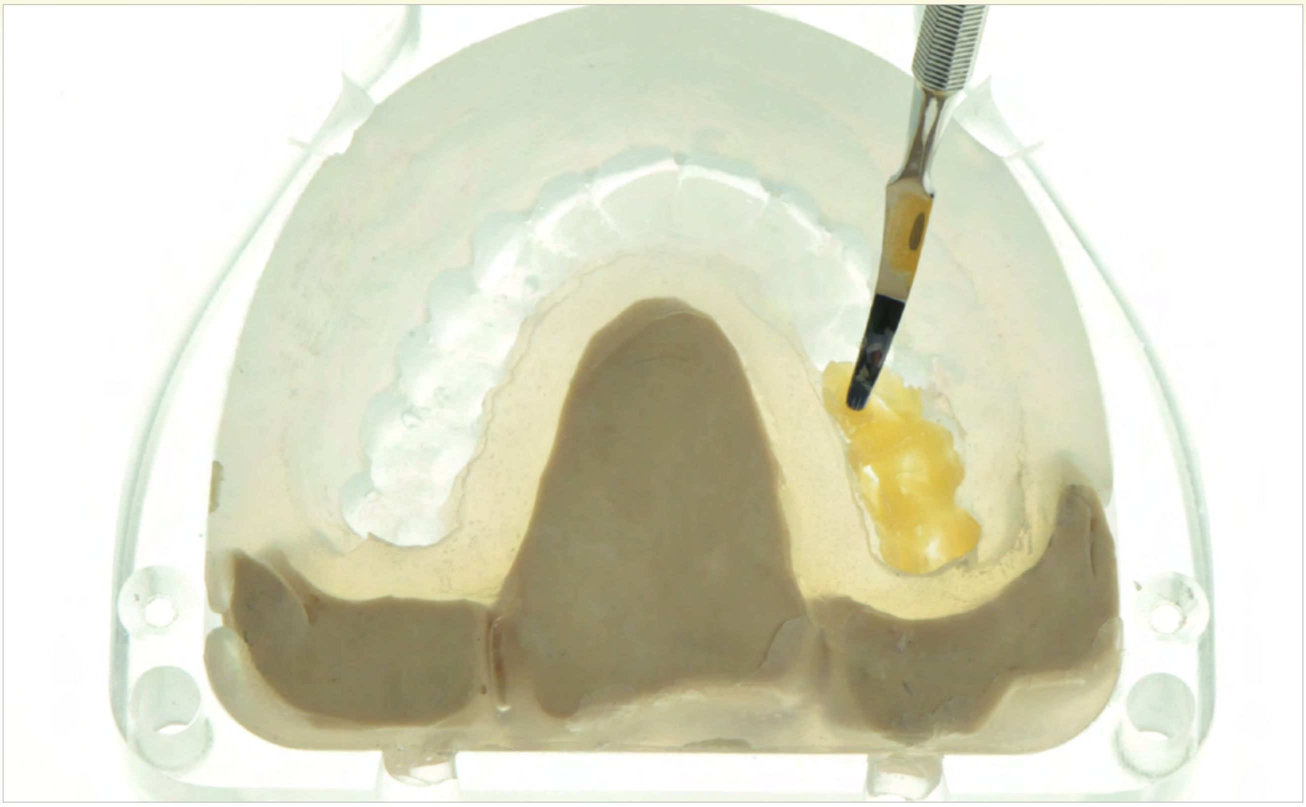


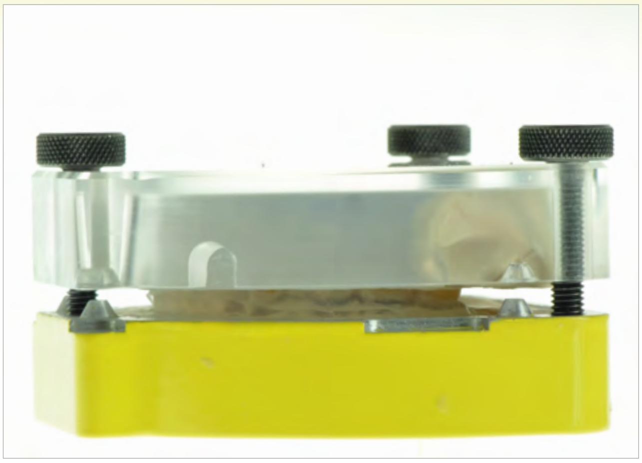
Fig. 18 It is important to make sure that adequate amounts of material are loaded in the opposing mould to prevent the formation of voids and allow adequate pressure to build up during the pressing procedure.

Attention:

- Do not contaminate the prepared surface and make sure that the framework is mounted exactly and firmly.
- Do not overlap the material or entrap air when you place the composite resin, in order to ensure a homogenous and bubble-free press result.

At this stage, it was important to make sure that enough material was loaded in the opposing mould (Fig. 18). The flask was closed by placing the two flask halves onto each other until a perceptible resistance was felt. Then the three screws were slowly and carefully tightened, one after the other, by giving each of them one to three turns. This ensured that the flask was closed gradually and evenly, and the composite resin was homogenously distributed within the flask (Figs 19 and 20). Once the three screws had been firmly tightened, the flask was left to rest in a warm and dark place for about 10 to 15 minutes. Subsequently, it was placed in the Lumamat 100 and the composite contents were polymerized with program P2.

After the polymerization process (Fig. 21), SR Nexco flask was opened and the first dentin press results were checked (Fig. 22). The bridge was removed from the flask and then cured separately, without the flask, in the polymerization device. This step is advisable, as it ensures full curing of the material. A thin line of press flash on the restoration indicates that the opposing mould was loaded with an adequate amount of composite resin (Figs 23 and 24).




Figs 19 and 20 The flask is closed by placing the top half onto the bottom half. When a perceptible resistance is felt, the three screws are inserted and slowly and carefully tightened one by one, giving each screw one to two turns.

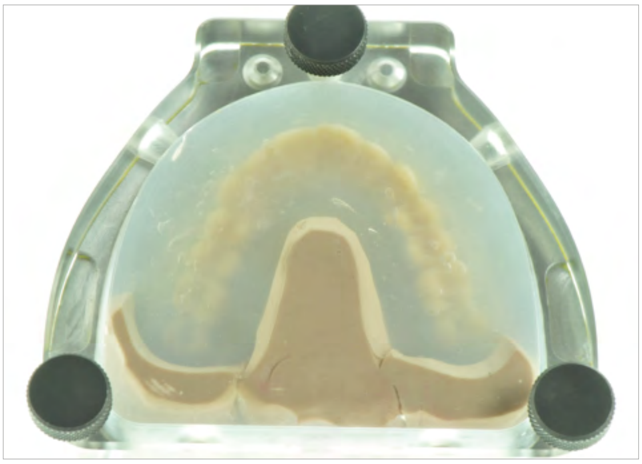


Fig. 21 The restoration was light-cured in the Lumamat 100 (program P2). Then SR Nexco Flask was opened.

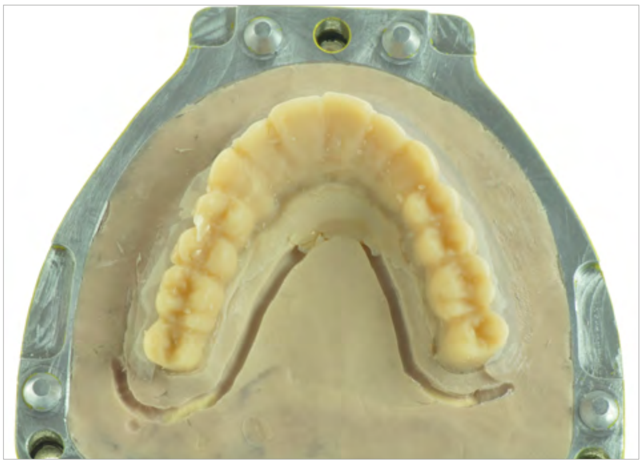


Fig. 22 The result of the first dentin press cycle. It is advisable to remove the bridge carefully and light cure it once again separately.


Figs 23 and 24 An optimum amount of composite resin has been used in the opposing mould if a thin line of press flash is visible.

Fig. 25 If all the previously mentioned steps were followed properly, the base of the restoration will be clean and bubble-free.

Fig. 26 When the press flash has been removed and the pressed dentin layer suitably ground (in the articulator), the bridge is sent to the dental practice where its esthetics and function will be checked.

If the previously described preparations were done properly, the base of the restoration will show clean press results (Fig. 25). The press flash was removed and the bridge was placed on the articulated master cast and then ground. As many abutments as possible were set up on the master cast to ensure the stability of the dentin-covered bridge on the model. The restoration was now ready for trying in (Fig. 26).

The approach used in this case, which involved reproducing the manually set up dentition as a full-contour composite mock-up using a CAD/CAM process, formed a sound basis for achieving an excellent fit. The exact correspondence of the occlusal surfaces and incisal edges of the originally set up teeth with the full-contour CAD/CAM-fabricated mock-up and the pressed-over zirconium oxide framework was established with the help of an occlusal silicone matrix in the articulator (Figs 27 to 29). The examination confirmed the high level of accuracy of the manual press procedure using SR Nesco Flask. A direct comparison of the three structures attests to this conclusion (Figs 30 to 32).

Since the dentin-covered restoration could be tried in directly, additional esthetic and functional adjustments were easy to make (Fig. 33). The pressed-on dentin was subsequently cut back to create space for the enamel layer, which would be pressed on the restoration with SR Nexco Paste Incisal using SR Nexco Flask. A labial silicone matrix was produced for this purpose. It was used to check the spatial requirements (Fig. 34).

Figs 27 to 29 The accuracy of the set-up (left) and the full-contour CAD/CAM-fabricated composite resin mock-up (centre) as well as the pressed-over zirconium oxide framework (right) was compared with the help of an occlusal matrix. The comparison showed the high accuracy of the manual press procedure using SR Nexco Flask.

Figs 30 to 32 A direct comparison of the set-up situation (left) with the full-contour CAD/CAM-fabricated mock-up (centre) and the pressed-over zirconium oxide counterpart (right) shows that the flask press technique accurately reproduces the objectives of the treatment plan in the final restoration.

Fig. 33 The zirconium oxide framework with the pressed-on composite resin can be tried in directly. As a result, esthetic and functional adjustments are easy to make.

Fig. 34 The spatial requirements were checked by placing a labial composite resin matrix against the teeth prior to the reduction of the pressed-on dentin layer.

Fig. 35 The pressed-on dentin layer was selectively cut back in order to make room for the enamel layer made of SR Nexco Paste Incisal.

As an additional aid, the structure of the teeth was drawn on the restoration with coloured pencils (Fig. 35). The dentin material is best cut back by starting on one side of the restoration and then systematically working from one tooth to the next (Figs 36 to 38). In any case, the results of the cut-back process should be checked on the model intermittently and at the very end with the help of the silicone matrix. This ensures the correct dimensions of the restoration (Fig. 39).

Next, the framework with the cut-back SR Nexco Paste Dentin layer was blasted with 50 µm aluminium oxide at approx. 1 bar. This eliminated the need for any pre-treatment (in other words the use of a bonding agent) and allowed the restoration to be characterized with the corresponding SR Nexco Stains (Figs 40 and 41). The range of products for customizing the restoration includes SR Nexco Paste Incisal materials, SR Nexco Paste Effect Opal and SR Nexco Paste Effect Transpa (Fig. 42).

Figs 36 to 38 The restoration should be cut back one tooth at a time, starting from one end and moving to the other. This method ensures a consistent reduction of the dentin layer.

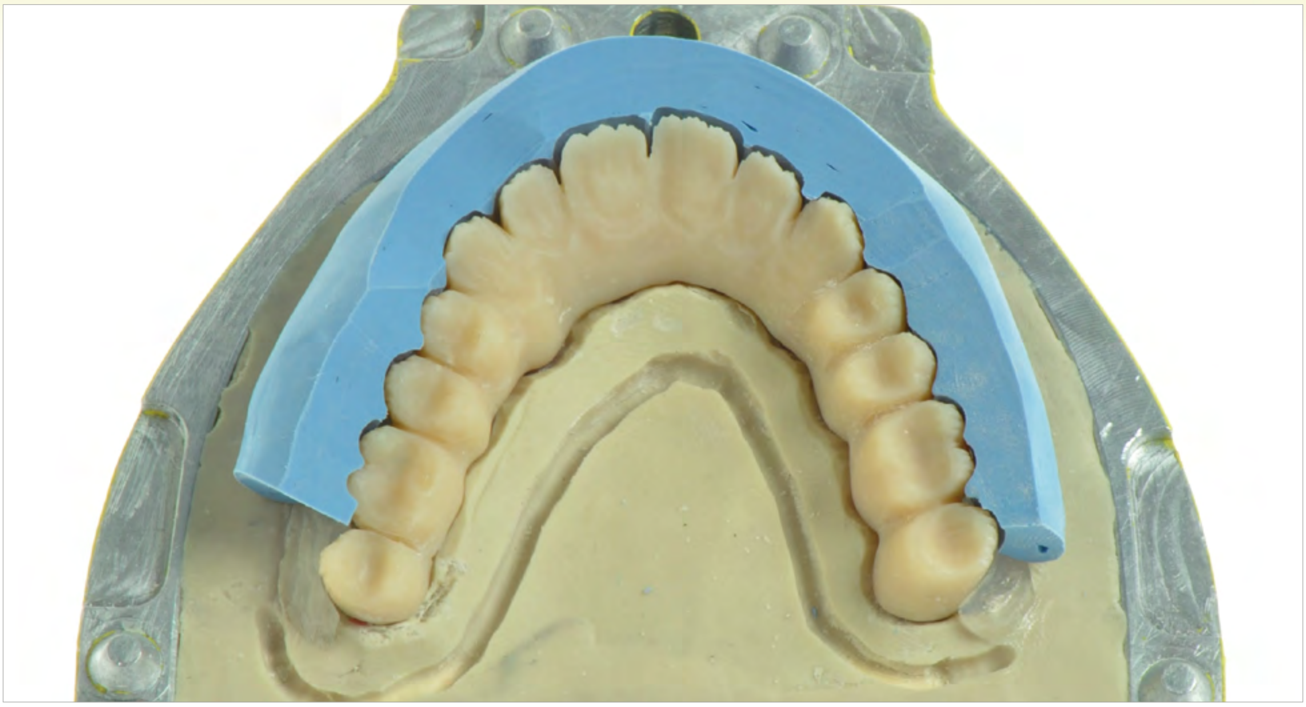


Fig. 39 The cut-back restoration is checked on the model with the help of a silicone matrix to ensure the correct dimensions of the restoration.

Figs 40 and 41 The framework with the cut-back SR Nexco Paste Dentin layer was blasted with 50 µm aluminium oxide at approx. 1 bar pressure. This eliminated the need for any pre-treatment (bonding agent) before the restoration was characterized with SR Nexco Paste Stains.

Fig. 42 In addition to SR Nexco Stains, the range of customization materials includes SR Nexco Paste Incisal, SR Nexco Paste Effect Opal and SR Nexco Paste Effect Transpa.

The incisal material press process is identical to the procedure used to apply the dentin layer. Therefore, the counter mould was loaded with the corresponding SR Nexco Paste Incisal material (Fig. 43). The two flask halves were placed on top of each other and the flask was carefully closed with the screws as previously described. The flask containing the framework covered with incisal material was subsequently placed in the Lumamat 100 for light-curing.

Once the material was cured, the flask was opened and the restoration was divested. Then the restoration was placed in the Lumamat 100 again, but this time separately, and light polymerized (Fig. 44). This ensures a full cure of the composite resin. Subsequently, the press flash was removed and the occlusion was checked again. The tooth surfaces were carefully finished and textured. Next, the SR Nexco composite resin veneers were prepolished with goats' hair brushes and Universal Polishing Paste. The preliminary polishing results are shown in Figure 45.

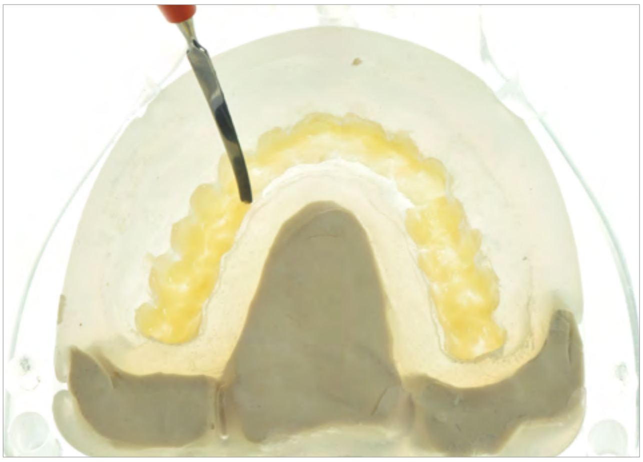


Fig. 43 The incisal material was pressed to the cut-back dentin as previously described. For this purpose, the counter mould was loaded with the corresponding SR Nexco Paste Incisal material. The flask halves were closed and the flask screws were carefully tightened.

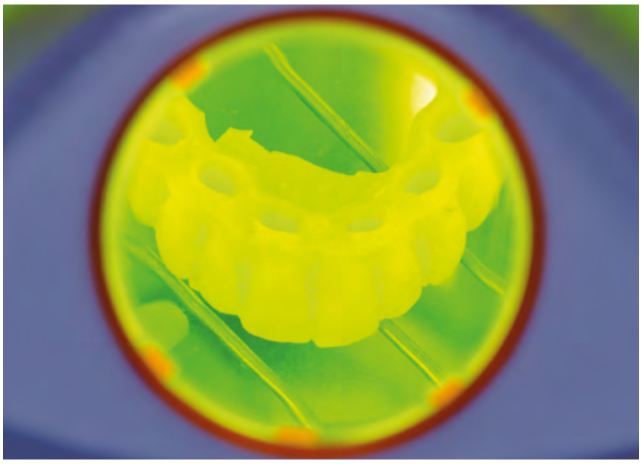


Fig. 44 The flask containing the framework covered with the incisal material was placed in the Lumamat 100 unit for light-curing. After the bridge was divested, it was separately light cured in the Lumamat 100.

Fig. 45 The teeth were finished and then prepolished with goats' hair brushes and Universal Polishing Paste.

Figs 46 and 47 SR Nexco Gingiva materials were applied to the masked gingival parts of the restoration using a flat modelling brush. Various gingiva materials were placed in layers to achieve natural-looking artificial gums. If the gingival segments are shaped and modelled with a brush, they do not have to be mechanically finished or adjusted.

The gingival areas of the denture were recreated once the tooth-coloured parts of the restoration had been completed. In preparation for the application of SR Nexco Paste Gingiva, the gingival areas were blasted with 50 or 100 µm aluminium oxide at approx. 1.5 bar pressure. Sandblasting residues were carefully removed with an air syringe and any remaining debris was carefully tapped off the restoration. The metal-composite bonding agent SR Link was applied on the denture and allowed to react for 3 minutes. SR Nexco Paste Gingiva Opaquer was applied according to the same procedure as that used in the creation of the tooth segments. In other words, a thin wash layer was brushed on first, followed by a full-coverage coating of the opaque.

Next, SR Nexco Opaquer was polymerized and then various SR Nexco Paste Gingiva materials were selectively applied. SR Nexco establishes an excellent bond without having to apply a bonding agent. This represents an immense advantage, since a dry and non-sticky surface is considerably less susceptible to contamination by minute particles in the air or on the instruments.

All the gingival portions were carefully shaped with a flat modelling brush. The individual layers and different gingiva colours produced a natural-looking result. SR Gel was applied before the gingival materials were polymerized in the Lumamat 100 to minimize the formation of an inhibition layer. Mechanical finishing of the restoration is unnecessary, if the artificial gingiva is shaped and contoured with a brush (Figs 46 and 47). The restoration was polished to a final high gloss with goats' hair brushes and cotton buffing wheels and a suitable polishing paste (Figs 48 to 50).

Figs 48 to 50 Goats' hair brushes, cotton buffing wheels and a suitable polishing paste were used to polish the restoration to a high gloss.

Product list

Product	Product name	Manufacturer
Composite	SR Nexco	Ivoclar Vivadent
Flask	SR Nexco Flask	Ivoclar Vivadent
Light-curing unit		
– preliminary polymerization	Quick	Ivoclar Vivadent
– final polymerization	Lumamat 100	Ivoclar Vivadent
PMMA, milling disc	Premiotemp multilayer	primotec
Polishing paste	Universal Polishing Paste	Ivoclar Vivadent
Silicone, clear	Transil F/Clear silicone, 75 Shore	Ivoclar Vivadent
Silicone, putty	Silicone in paste form plus hardener/ fulfils requirements of Ivoclar Vivadent	Briegeldental
Zirconium oxide	Zenostar MO	Ivoclar Vivadent

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Integration of digital and manual techniques

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CAD/CAM manufacture of a telescope denture

A telescopic crown-retained restoration is a well proven method of anchorage for removable dentures. The conventional method of producing double crowns is a technique sensitive procedure; even the smallest errors in the procedure can have serious consequences. The CAD/CAM production method can be a valuable alternative. This article describes the digital production of the primary and secondary crowns and the esthetical completion of the framework by hand using efficient working methods.

Fig. 1 The patient consulted the treatment team with unsatisfactory, fixed prosthetic restorations. She was unhappy with both function and esthetics.

Fig. 2 The anamnesis showed that it was necessary to extract a few individual teeth. The patient was provided with a chairside temporary restoration until the long-term temporary was ready.

The patient consulted the treatment team with unsatisfactory, fixed prosthetic restorations (Fig. 1). They did not meet the patient's requirements, neither functionally nor esthetically. She was distraught, had problems going out in public and no longer believed in successful dental treatment after suffering several bad experiences. Several teeth had to be extracted due to the extent of the damage. This resulted in an unfavourable distribution of abutment teeth, which meant that it was no longer possible to ensure secure anchorage for a fixed dental restoration. Implant treatment to create more abutment teeth was not an option for the patient. A simple chairside temporary restoration was made to join up the patient's remaining prepared teeth so that she was able to leave the practice without being edentulous (Fig. 2). A telescope bridge was discussed as a treatment option to restore the patient's occlusal function. Before a final decision was made, we prepared a wax-up (Fig. 3) and virtual dental imaging. The first pictures of the potential esthetic restoration gave the patient new hope. She agreed to a long-term temporary restoration. For this purpose, a long-term temporary

Fig. 3 Due to the fact that the patient refused an implant in the maxilla, a telescope restoration was discussed. The basis for discussion was a wax-up, which had preceded the virtual dental imaging.

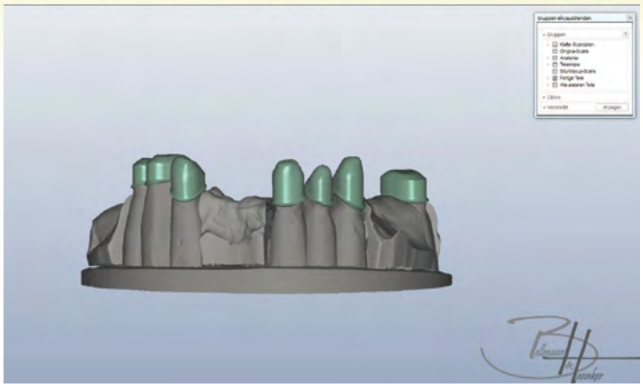


Fig. 4 The primary path of insertion of the model was defined in the CAD software according to the shaft of a bur which was placed in the parallelometer. In this way, the situation corresponded exactly to the insertion direction defined in the parallelometer.

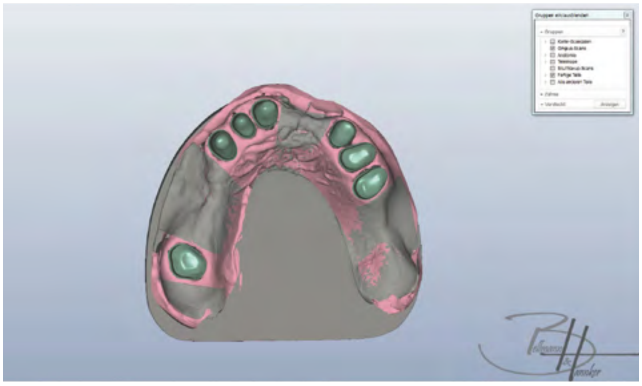


Fig. 5 As gingiva components can be shown in the software, the shoulder height of the telescopes could be determined precisely.

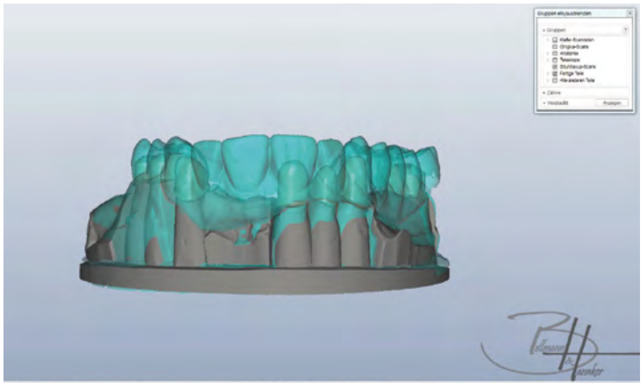


Fig. 6 The option of visualizing/superimposing the scanned wax-up over the telescope crowns means that they can be designed in the correct dimension.

restoration (LTT) was prepared on the basis of the information obtained from the wax-up and the DI. The patient was very happy with the solution. This situation should be transferred as precisely as possible into the final dental restoration. Whilst the LTT was in the upper jaw, two implants were placed in the anterior region of the mandible. The very narrow arch required pre-implant bone-splitting. After this, two implants could be inserted.

Production of the primary parts

Once the impression had been taken and the model had been cast, the evaluation was carried out according to functional and esthetical guidelines. The path of insertion for the seven abutment teeth was determined manually using the parallelometer. As the primary parts were to be designed digitally, the manually determined path of insertion had to be transferred to the CAD software. For this purpose, we drilled into the model at the exact path of insertion and fixed a bur here with wax. This position was then transferred via the gingiva scan. The model was digitized in the laboratory scanner, and the data was imported into the design software (Exocad). In determining the primary insertion direction, we positioned the model in the CAD software in such a way that only the end of the drill bit could be seen. Therefore, the situation corresponded exactly to the previously defined path of insertion (Fig. 4). It was possible to determine the height of the telescope shoulder by superimposing the gingiva components (Fig. 5), and it was possible to construct the correct telescope dimensions by superimposing the scanned wax-ups (Fig. 6). After having completed the construction, we transferred the data to the CAM program, which calculated the milling paths for the primary parts. Once the milling machine had been fed with the NC file (NC = numeric control), the primary parts could be milled from a non-precious metal blank. The fit of the seven crowns after milling was outstanding. In the usual manner, the crown was checked under the microscope to ensure an accurate fit and the edges were polished to a high gloss. In order to prevent the primary telescopes from remaining on the prepared abutment dies or falling out when removing the tray after having taken the impression, we lasered fine retention beads to the incisal third of the primary crowns (Fig. 7). Together with an individual

Fig. 7 In order to prevent the CAD/CAM-milled primary telescope crowns from twisting or falling out when the impression was taken, retention beads were lasered.

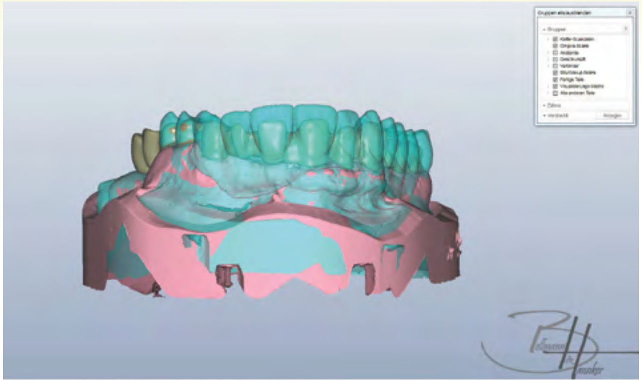
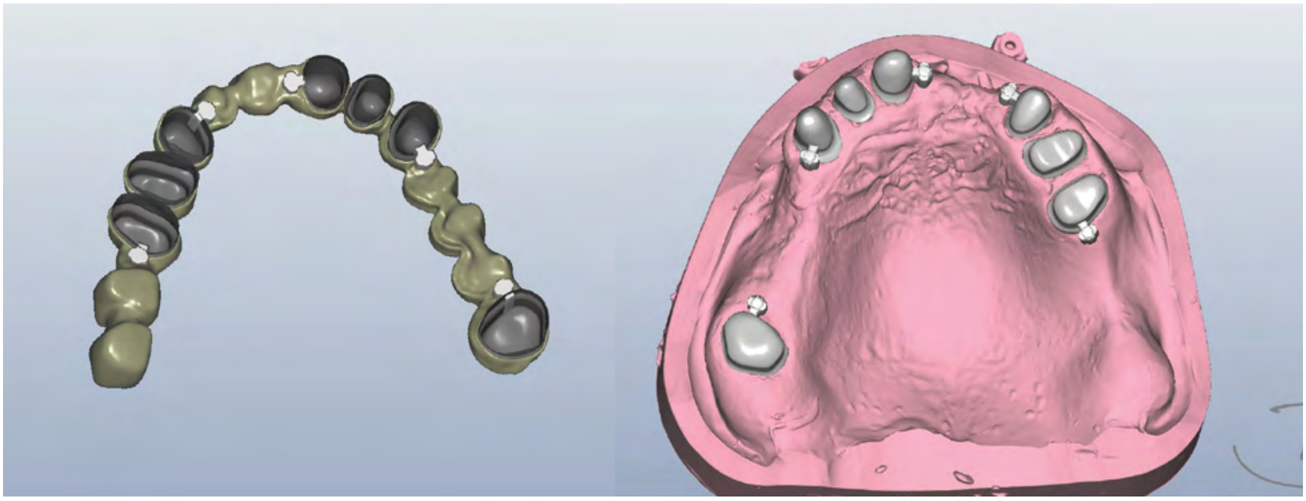


Fig. 8 The secondary crowns were designed according to the usual requirements, however in a virtual construction. The hardness of milled NP alloys is lower than that of cast NP cast alloys, which means a stronger framework must be designed.



Figs 9 and 10 In order to allow for possible loss of friction during the construction of the framework, small spacers for friction attachments were added to the primary telescopes. The virtual attachment parts were loaded into the design software as so-called mash-ups for visualization from the database. Mash-ups are applications which cannot be provided by the actual software, however, they can be added.

tray, the primary telescopes were handed over to the dental practice. The dentist checked the fit of the crowns *in situ* and took a collective impression of the telescopes.

Producing the secondary framework

The model was cast in the usual manner. The primary telescopes were given acrylic dies and the impression was cast in class III plaster. The model was produced in the conventional manner, so that the primary parts could be milled to the minimum thickness on the parallelometer using 0° burs, and then polished.

In this case, the plan was to also produce the secondary framework digitally, which posed a variety of challenges. For example, it is not possible to capture the reflecting surfaces of the highly polished primary parts precisely with a strip light or laser scanner.

Basically, a scanning spray has to be applied to cover the glossy surface, but when it is sprayed by hand it usually creates an uneven layer thickness. The resulting inaccuracies cannot be accepted, especially with double crowns. In addition, it can also be difficult to determine the path of insertion. It was due to these reasons that a hybrid scanning method was used in this case. The primary telescopes were scanned directly on the milling model with a contact scanner (tactile scanner). The tactile measuring probe measures the position and angle of the objects with extremely high precision. The gingiva and the opposing model were scanned with a conventional strip light scanner. After digitization, the data from the strip light scan and the tactile scan were superimposed in the CAD software and aligned exactly using best-fit matching. This approach combines a precise fit with efficiency and high speed, as the large gingival areas do not have to be recorded by tactile means.

The virtual design of the secondary structure was carried out in the usual manner. Care was taken to ensure a balance between providing sufficient framework support and maintaining enough space for the veneer (Fig. 8). An esthetic composite veneer ideally requires 1.5 to 1.8 mm space. The framework thickness must be no less than 0.35 mm and the connectors must have adequate dimensions. In general, it is important to note that the hardness of non-precious milled alloys is lower than that of non-precious cast alloys. Therefore, it is important to construct a more stable framework than with the conventional casting process.

In order to prevent a possible loss of friction later on, small spacers for friction attachments (TK Soft) were integrated into the primary telescopes at this working step (Figs 9 and 10). The attachments were loaded into the design software as so-called generic mash-ups for visualization from the database. According to the path of insertion, the spacers were positioned at strategic points on the primary crowns. Currently, dental CAD programs do not yet allow holes to be punched into crowns. Therefore, after completion of the design, the "mash" was transferred into an industrial CAD program and punched out using what is known as "Boolean operation".

Now the final framework design could be transferred to the CAM program. The inserts for the cavities were aligned in the specially developed telescope milling strategy. We then adapted the construction to fit in the appropriate blank and attached holding pins. The milling path calculation began, and milling paths were generated from the 3D model, which were transferred to the milling machine via NC file. In order to prevent nasty surprises after milling, it is useful to perform a rapid simulation in the CAM software. This way, areas which cannot be milled can be seen in advance via a colour table. After the last milling step, we tested the fit of the primary parts in the framework. If the secondary crowns are too tight, a new calculation can be made in the CAM and indicated with an undersize allowance. In this case, the milling paths for those areas are repeated and the fit of the primary crowns is checked again. After milling, the double crowns should have a fitting accuracy of approximately 95%. This means that the dental technician still has some material for the final polish and can adjust the desired friction individually.

Fig. 11 The CNC-milled secondary framework was fitted and the friction of the telescopes was adjusted with graphite powder.

Fig. 12 The framework is now ready for completion of the restoration. First of all, the situation evaluated by the wax-up had to be...

Finishing the restoration

After the CAD/CAM-milled secondary framework was fitted and the run of the telescopes had been adjusted with graphite powder (Fig. 11), we began with the completion of the restoration (Fig. 12). First, the dental situation which had been evaluated via the wax-up or set-up was transferred to the framework using a silicone wall and a wax injector. In order to establish the situation, which had been defined in the planning phase and was expected by the patient, we first made a silicone template of the planned situation. Subsequently, we connected a filler pipe for wax to it and repositioned the silicone template onto the framework on the master model. The wax was inserted into the cavity with a syringe. This procedure enabled us to produce an identical copy of the planned restoration (wax-up) on the secondary framework. The gingival areas of the wax model were removed and the contours of the teeth were built-up in detail.

In order to avoid reproduction errors when veneering the restoration, we used a flask system (SR Nexco Flask) especially designed for this procedure. The flask system allows frameworks to be overpressed with a light-curing veneering composite, such as SR Nexco. In particular, large-spanned restorations can be veneered effectively and quickly. The previously prepared set-up can therefore be accurately transferred to the final restoration with this flask technique. In an ideal case, neither tooth position nor dimension will deviate from the planned situation.

The secondary framework with the wax-up was lifted from the master model and a holding model was made from modelling acrylic. This, together with the framework, was placed into the lower half of the flask (Fig. 13). As an alternative to the acrylic, it would have also been possible to use silicone putty. Next, the structure was invested in an appropriate silicone putty. Previously, transparent silicone had been applied to all bridge pontics to ensure a complete light cure in these areas. In order to facilitate the repositioning of the reconstruction for the incisal pressing procedure later on, we applied a layer of the transparent silicone Transil F up to the equator of the teeth (Fig. 14).

Fig. 13 … transferred to the framework using a silicone template and wax injector. The gingival areas were removed. The modified framework was placed with a holder on the lower half of the flask.

Fig. 14 In order to be able to reposition the overpressed framework precisely, the framework, which was placed on a base made of silicone putty and covered with wax, was covered with a layer of transparent silicone up to the equator of the teeth.

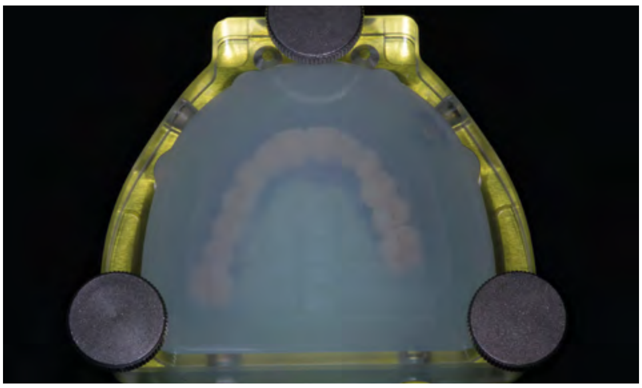


Fig. 15 The two flask halves were closed tightly with the three generously sized screws, and the flask lid was filled with the clear silicone Transil F (75 Shore).

Fig. 16 Once the transparent silicone had set, the flask was opened, the secondary framework removed, freed from wax and then cleaned and sandblasted with 110 µm aluminium oxide in preparation for the application of the SR Nexco system opaquer.

Fig. 17 The metal-composite bonder SR Link was applied to the sandblasted framework, allowed to evaporate and then opaquer was applied. In order to ensure that the opaquer is fully cured, it should be applied in two thin layers.

Fig. 18 For the press procedure (Dentin material), drainage channels were cut with a scalpel in the vestibular region to accommodate the excess composite.

Figs 19 and 20 After removing the framework with the overpressed dentin, the incisal areas were carefully cut back in preparation for the incisal. The incisal areas of the teeth are completed in a second press procedure.

Both flask halves were closed tightly with the three SR Nexco Flask locking screws. The top of the flask was filled with transparent silicone Transil F. It is advisable to use a hard silicone (75 Shore hardness). To cure the silicone, the flask was placed in a pressure pot (pressure: 5 bar) in order to prevent any air entrapments (Fig. 15). The flask was then removed and the two flask halves separated. The secondary framework was divested, cleaned and conditioned in preparation for the SR Nexco opaquer. We sandblasted the framework with 110 µm aluminium oxide (Fig. 16) and applied a metal-composite bonding agent (SR Link). After the bonder had evaporated, the first layer of opaquer was applied. In order to ensure that the opaquer is fully hardened, we generally work with two thin layers of opaquer (Fig. 17).

The laboratory composite used for this situation together with the SR Nexco Flask is the light-curing laboratory composite SR Nexco. It can be polymerized in almost all commercially available light-curing units. The corresponding curing times for the respective device should be taken from the manufacturer's instructions.

Prior to pressing with dentin in the flask, the inhibition layer of the opaquer had to be removed with a synthetic sponge. Then we heated all the components to a temperature of 50°C to simplify the application of the material in the counterpart. The fact that the SR Nexco composites are coordinated with the flask means they can be evenly applied directly, without additional heating.
Before the two flask halves were reassembled, a "reservoir" had to be created in the form of channels to accommodate the residual material. We cut a channel in the vestibular region of the lower flask half to provide the necessary space for excess material (Fig. 18). When pressing composite there is always a slight excess of material, which can be collected by the excess channels. In order to ensure that the pontic area of the opaque framework is completely pressed and without bubbles, SR Nexco Dentin material was applied first to this area. Subsequently, the framework was placed into the flask base. Then, the dentin was placed homogeneously in the counterpart of the flask lid and the two flask halves were closed together. After the two halves had been reassembled, the flask was placed into the warm pressure pot for ten

Fig. 21 In addition to the mamelon structures in the incisal area of the dentin body, layered Opal Incisal, Transpa and Mamelon materials also help to achieve a vital appearance.

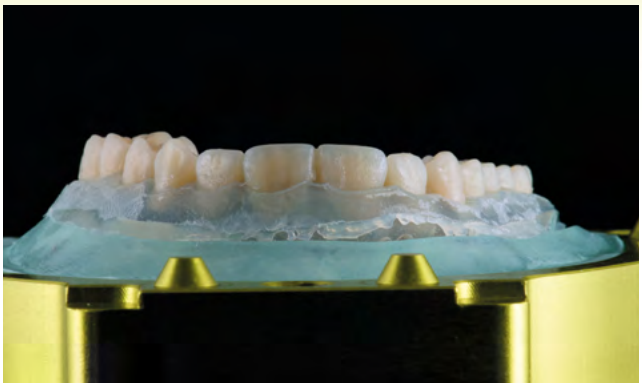


Fig. 22 The reduced and individualized dentin body was repositioned in the flask and overpressed with transparent incisal material. After the removal of the flask lid, the excess material showed in the form of a press flash, which is characteristic of a successful press procedure.

Fig. 23 In order to characterize the gingival area individually, the SR Connect bonding agent was applied to the cold cure polymer in that area, so that various differently coloured gingiva composites could be applied.

minutes. The silicone was able to set in its original position; excess material accumulated in the reservoir provided for this purpose. Once the setting time had elapsed, the flask was placed in the light curing unit in order to completely polymerize the composite. A good indicator which shows that the bite has not increased, i.e. the ideal amount of composite was used, is a thin press flash at the point of separation.

Veneering and finishing

After having removed the finished dentin press from the flask (Fig. 19), we created sufficient space for the incisal press with a cut-back. The incisal area is completed with a second (over-) press procedure, identical to the dentin press method (Fig. 20). Cutting back the incisal area with a mamelon structure helps to achieve a vital appearance. This effect can be supported with Opal Incisal, Transpa and Mamelon materials. With the SR Nexco effect materials - such as SR Nexco Paste Effect Transpa, Opal and Occlusal Dentin - it is also possible to achieve a natural appearance in the posterior area (Fig. 21). After the individualization of the dentin body, it was inserted into the flask again. As with the dentin material, the transparent incisal material was layered in the same counterpart and, as before, processed in the pressure pot and the light-curing unit. After the removal of the flask lid, the thin press flash, a characteristic which shows the press procedure was successful, could be seen. The base of the restoration was completed with cold-cure polymer (ProBase Cold) to facilitate a possible reline later.

The patient's high smile line made it necessary to individualize the gingival area as well. For this, the gingival area between the two premolars was reduced, coated with the SR Connect bonding agent and placed in the light-curing unit (Lumamat 100). This created a bond with the cold-cure polymer and allowed various different gingival colours to be applied. SR Nexco offers a wide range of shades for natural gingival design, e.g. with the SR Nexco Paste Gingiva or SR Nexco Intensive Gingiva materials (Fig. 23). For the final polymerization, the denture was coated with a covering layer (but not too thick) of the oxygen-blocker SR Gel and placed in the light-curing unit (Lumamat 100). After removal of the denture and before polishing, the inhibition layer had to be completely removed. Tungsten carbide and diamond burs are best suited for trimming the material. The pre-polishing was carried out with silicone rubbers, the high-gloss polish was carried out with polishing brushes and woollen buffs (Figs 24 and 25).

Figs 24 and 25 Before the denture was polished to a high gloss with brushes and woollen buffs, the inhibition layer had to be completely removed.

Figs 26 and 27 The patient is still very happy with her upper telescope restoration to this day. The smooth cooperation between practice and the laboratory, the production of a very good long-term temporary restoration and the choice of an appropriate dental reconstruction were key to this success.

Conclusion

The life-like reconstruction of the function and esthetics of lost complex oral structures is not only a challenge for the dental technician but also for the material. The restoration should blend inconspicuously with the existing oral and natural environment, provide good chewing comfort, be efficient to produce and have a long-service life.

Decisive for the success of this type of reconstruction is the ability of the dental technician to see the patient's individual tooth shades and shapes as well as soft tissue zones, and to use the materials accordingly, in order to produce a dental restoration resembling the natural dentition. The very good clinical properties and problem-free processing of the light-curing lab composite SR Nexco offer the necessary prerequisites. The different materials available for the tooth and gingival reconstruction allow the characteristics of shade, translucency and dimension to be harmoniously coordinated to produce a long-term restoration. Based on this, it is possible to produce a restoration according to the patient's wishes and requirements. This, in turn, is the foundation for a high degree of patient acceptance and satisfaction; it creates trust - which is ultimately the key to long-term success.

Our patient, whose case was presented in this report, is still very happy to this day. The key to success was the smooth collaboration between the practice and the laboratory as well as the production of a very good long-term temporary restoration. The treatment was carried out over a period of three years. It was certainly a long time, but it was worth it (Figs 26 and 27).

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Product list

Product	Product name	Manufacturer
CAD software	Exocad DentalCAD	exocad
CAM software	DS CAM V3	Dental Softworks
CNC machine systems	DC5	Dental Concept Systems
CoCr blank	Quattro Disc NEM Soft	Goldquadrat
Burs, CNC machine	Burs NEM	Bellmann & Hannker
Bonder, composite/metal	SR Link	Ivoclar Vivadent
Cold-cure polymer	ProBase Cold	Ivoclar Vivadent
Composite		
– teeth	SR Nexco Paste	Ivoclar Vivadent
– gingiva	SR Nexco Paste Gingiva	Ivoclar Vivadent
Flask	SR Nexco Flask	Ivoclar Vivadent
Laser	Neolaser LT 35	Amann Girrbach
Light-curing unit	Lumamat 100	Ivoclar Vivadent
Polishing paste	Universal Polishing Paste	Ivoclar Vivadent
Oxygen blocker	SR Gel	Ivoclar Vivadent
Scanner		
– strip light	D800	3Shape
– tactile	DS10	Renishaw
Silicone, casting (transparent)	Transil F / transparent silicone	Ivoclar Vivadent
Silicone, putty	Zetalabor Platinum 85	Zhermack

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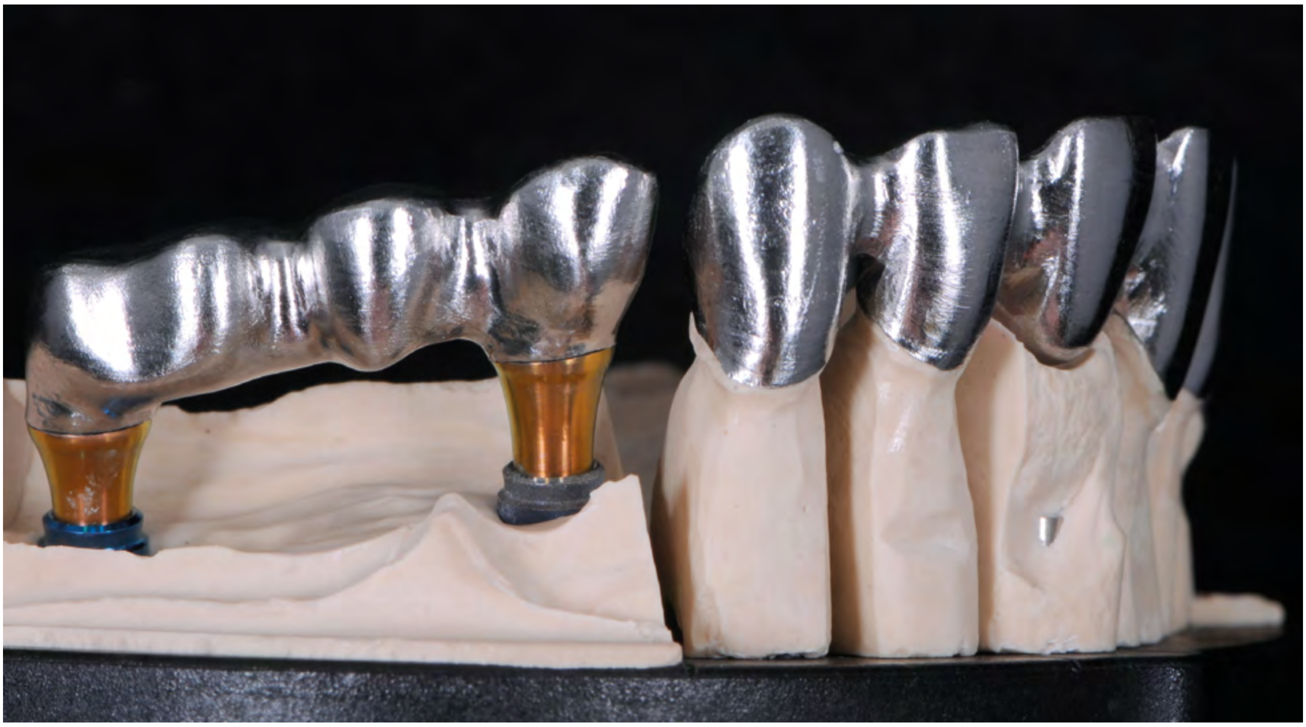
Analog and yet so fast

Cristian Petri, CDT
(Cluj-Napoca, Romania)

Every artist needs information to be able to develop, in all areas. Technology gives us extra time to concentrate on other areas. A combination of new techniques and high quality materials opens up new perspectives for an individual approach. This rule also applies in dental technology. We are not only able to provide dental technicians with faster dental procedures of high quality but we can also add value to our dental services.



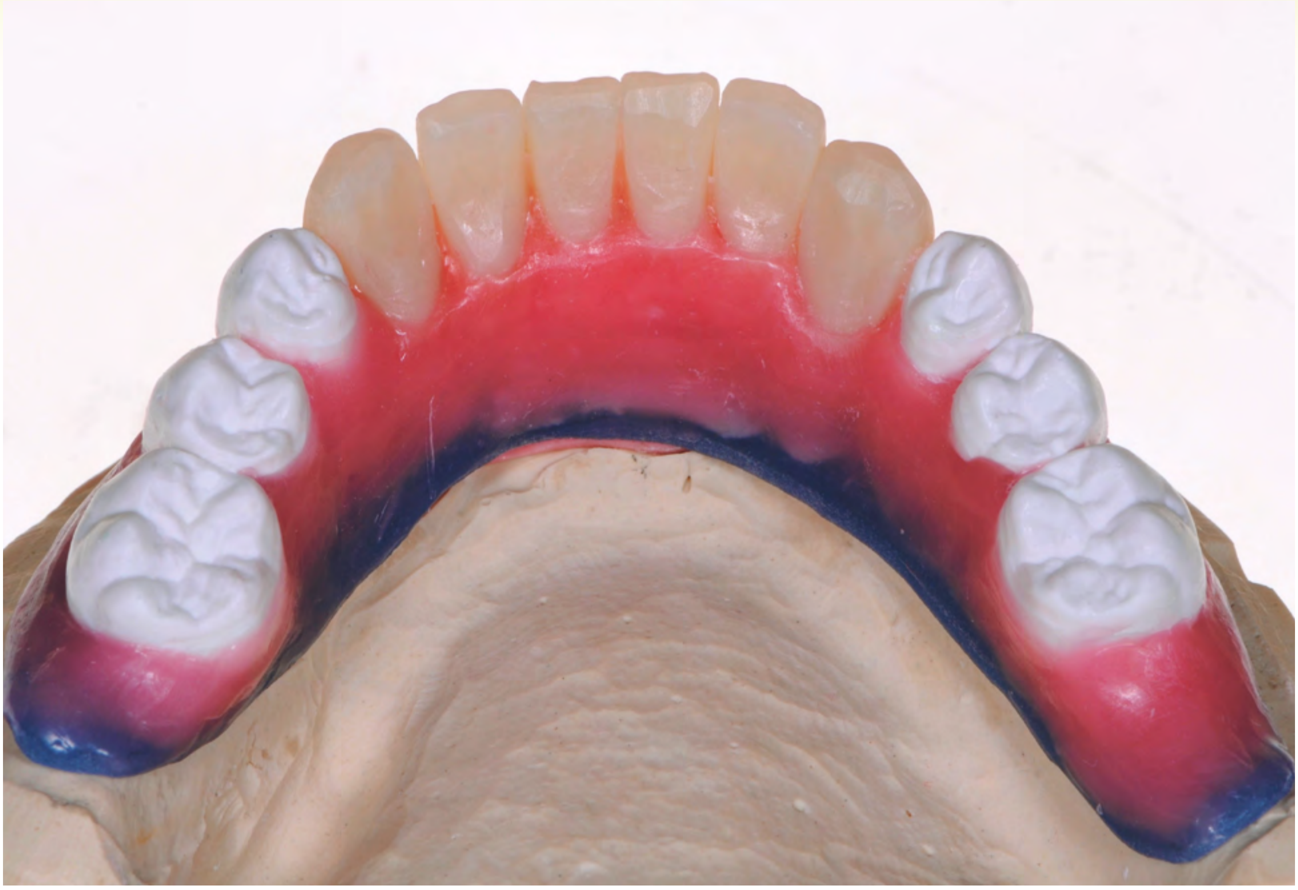
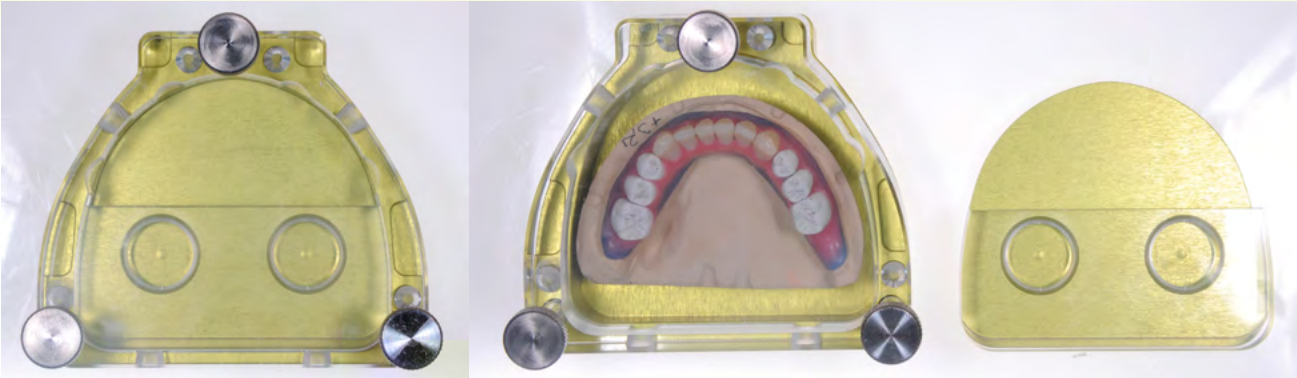


Fig. 1 For the esthetic set-up in the lower jaw we used SR Phonares II prosthetic teeth for the anterior region and plaster teeth from our own library for the posterior region.

Nowadays, more and more technicians are looking for procedures to produce dental work as quickly as possible. At the same time, however, they still want to offer good quality. Under these aspects it is often difficult to design a suitable and functional occlusal surface or to reproduce the shade, texture and shape of anterior teeth correctly. Bearing these points in mind, we observed the following case from various different angles. In the maxilla we produced three metal frameworks using the CAD/CAM technique. One periodontal-supported anterior bridge (from tooth 13 to 23) and two three-unit implant bridges in the posterior region (teeth 14/24 to 16/26) which were then veneered. In the mandible, we opted for an implant-supported, screw-retained CAD/CAM titanium structure and veneered it using the light-curing laboratory composite SR Nexco.

Case report

After the working models had been cast and transferred into the articulator, the first step was to create an upper and lower jaw set-up. This was produced to help discuss the possibilities with the patient. At the same time, it also served to check the functionality of the dental work and the corresponding esthetic aspects.
The set-up is used to define the shape of the finished work. At this point in time, it is possible to make any changes that may be required in tooth position and therefore achieve the desired esthetic appearance and the associated phonetics. In addition, possible errors can also be identified and corrected in this early stage. The costs at this time are low; in fact, they are insignificant in comparison to the price of a repeated framework.



Figs 2 and 3 We wanted to retain the prefabricated prosthetic teeth in the anterior region, whereas in the posterior region we decided to transfer the teeth in the light-curing laboratory composite SR Nexco directly to the titanium framework using the flask technique (SR Nexco Flask).

Figs 4 and 5 After the dentist had checked the set-up and confirmed the position and fit, the working models together with the set-up were scanned and the substructure was designed anatomically. CAD/CAM technology helps us to design implant superstructures of an outstanding quality. This would have been very difficult with the conventional casting technique.

For the mandibular set-up we used prosthetic teeth (SR Phonares II) in the anterior region and teeth from our own library for the posterior region (Fig. 1). We decided on this approach because we planned to use the prefabricated teeth to complete the anterior region and to press the posterior teeth directly onto the titanium framework in the light-curing laboratory composite SR Nexco using the flask technique (Figs 2 and 3). After the dentist had checked the set-up and consent had been given to continue work, the working models including the set-up were scanned. The substructures were designed according to the set-up and the implant holes were positioned digitally. The titanium structure was reproduced in a reduced form. However, it was still strong enough to produce the esthetic components made from SR Nexco composite. Technology helps us to design dental restorations and implants of outstanding quality in a short time. This would have been difficult to realize using conventional casting techniques (Figs 4 and 5). Once we received the milled structure from the milling centre, we simply sent it to the dentist for the final examination. An x-ray image was taken to check the fit of the structure. The result met our expectations: a stress-free structure on implants, which wouldn't cause any problems. The finished structure was sandblasted with aluminium oxide (100 µm) at a pressure of 2 bar. The remaining Al_2O_3 residues were removed by tapping, not with compressed air or steam cleaning. The metal-composite bonder SR Link was applied to the sandblasted structure and allowed to activate for 3 minutes. Then the first opaque layer was applied. The mechanical retention of the opaque was improved by sandblasting, while the metal-composite bonder additionally ensured a chemical bond between the metal framework and the opaque.

The ceramic build-up of white esthetics in the mandible

In the first step, an opaque layer of SR Nexco opaque in the shade A2 was applied to the entire framework surface and polymerized for 20 seconds with the light-curing device Quick. Then, a second layer of the same opaque material was applied to the areas of white esthetics, and SR Nexco Gingiva opaque was applied to those areas where missing soft tissue was to be replaced. Once each segment had been polymerized with the Quick unit for 20 seconds, the final polymerization was performed in Lumamat 100. The inhibition layer was then removed with a disposable sponge. Then the artistic part of the procedure began. For this we needed a press flask and the overpress technique. This method allowed us to create an esthetic and functional dental restoration quickly. We used the SR Nexco Flask to make a copy of the set-up by producing a mould using transparent Transil F silicone with a Shore hardness of 75. For the anterior region, which we set-up with SR Phonares II prosthetic teeth, we decided to fix the ground teeth labially to the framework using the SR Nexco laboratory composite (Fig. 6). In order to prevent the set-up tooth position from being changed, the anterior teeth were transferred to the framework by means of a vestibular matrix.

Fig. 6 The ground SR Phonares II prosthetic teeth were attached to the opaque framework using a vestibular key and the SR Nexco laboratory composite.

Figs 7 and 8 The posterior teeth were transferred to the framework using the flask technique. In this way, we were able to copy the set-up exactly, whereby the posterior teeth were still completely in dentin material.

Fig. 9 We used the cut-back technique to create the space required for the incisal build-up.

Fig. 10 The occlusal surfaces were individualized using SR Nexco Stains orange before overpressing. This way, a natural appearance of depth can be achieved in a simple manner.

Then, the model and framework were placed in the SR Nexco Flask. In addition, the silicone key was also placed in the flask to ensure the correct position of the teeth. Both flask halves were closed and we were able to maintain the teeth in the same position. As already mentioned, in the posterior region we built the teeth up completely with SR Nexco, but without using instruments. For this we used SR Nexco Paste Dentin A2, which was inserted into the matrix made from Transil F clear silicone. Then both flask halves were closed together again and the light-curing laboratory composite was polymerized, first in the flask and then the framework again separately. In this way, we were able to copy the set-up exactly, whereby the posterior teeth were still completely in dentin material (Figs 7 and 8). In order to provide the required space for the incisal build-up, we used the cut-back technique (Fig. 9). The occlusal surfaces of the reduced posterior teeth were individualized with SR Nexco Stains orange before pressing the incisal area (Fig. 10). This is how we finished the “white areas of the restoration”, which we did not have to treat any further - the area simply required polishing (Fig. 11).

Fig. 11 After overpressing the white esthetics were finished. Apart from polishing, no other adjustments were required.

Fig. 12 The natural gingiva was reproduced with the gingiva-coloured laboratory composite SR Nexco Paste Basic Gingiva (BG34), SR Nexco Paste Gingiva and SR Nexco Paste Intensive Gingiva materials and suitable SR Nexco Stains (orange, chili).

Fig. 13 The entire restoration was polymerized in the Lumamat 100 for 11 minutes according to the manufacturer's instructions. Once the oxygen blocker gel residues had been removed, the gingival region was trimmed with rotating instruments.

Figs 14 to 16 The lower anterior teeth did not need to be corrected as prefabricated prosthetic teeth were used. The gingival region was individualized with SR Nexco Paste Basic Gingiva (BG34), SR Nexco Paste Gingiva and SR Nexco Paste Intensive Gingiva materials.

The pink esthetics in the mandible

Depending on its position in the mouth, natural gingiva has varying pigmentation. It has different thicknesses and in areas it has more, in other areas less blood supply. These aspects make it difficult to reproduce the natural gingiva and create a dental restoration which is not obvious. However, with the gingiva-coloured SR Nexco Paste Basic Gingiva (BG34) and various SR Nexco Paste Gingiva and SR Nexco Paste Intensive Gingiva materials together with a few SR Nexco Stains (orange, chili), we were able to imitate the natural soft tissue as well as possible (Fig. 12).
For the white esthetics, we used the SR Nexco Flask with the press technique as described above. Therefore, during polymerization, there was no need for isolation. However, the gingival areas, which had been applied by hand, required an isolation layer of SR gel before polymerization, in order to avoid an uncontrolled reaction with the oxygen. The final polymerization of the entire restoration was then carried out for 11 minutes in the Lumamat 100 according to the manufacturer's instructions. After the isolation residues had been completely removed, the gingival areas were trimmed with rotating instruments (Fig. 13). In the lower anterior area, I did not have to make any adjustments, since prefabricated prosthetic teeth had been used, as described above. In the lower posterior region, the result was also perfect due to the "reproduction" by pressing in the SR Nexco Flask. The set-up can be copied almost exactly (Figs 14 to 23).

Figs 17 to 23 Using the flask overpress technique, it was possible to reproduce the set-up in the posterior region perfectly according to functional aspects and convert into composite.

Figs 24 to 26 In a fixed or partially removable implant restoration, it should be noted that the basal surface of the dental restoration must be designed in such a way that it can be cleaned well.

Figs 27 to 29 There are three metal-ceramic bridges in the upper jaw. The metal frameworks were CAD/CAM-milled according to a set-up. The anterior bridge was veneered with the metal-ceramic IPS d.SIGN.

And yet: Of course, creating beautiful and natural-looking dental restorations is not our only duty. In particular in the field of implant restorations, various other aspects also have to be considered. As we have created partially removable dental restorations with large gingival areas, care must be taken to ensure that the basal surfaces are designed in a way that they can be easily cleaned (Figs 24 to 26).

The metal-ceramic bridges in the maxilla

The maxilla was restored with three metal-ceramic bridges. The metal frameworks were also CAD/CAM-designed and milled on the basis of a set-up (Fig. 27). The periodontally supported anterior bridge had a pontic in region 21. The classic metal-ceramic IPS d.SIGN was used to veneer the bridge (Figs 28 to 29). Both implant-supported posterior bridges (each ranging from the first premolar to the first molar with one pontic) were overpressed with IPS InLine PoM (Press-on-Metal) (Fig. 30), characterized with the corresponding layering ceramic materials and a small gingival area was fired (Figs 31 and 32).

Conclusion

On the one hand, nature has always been a source of inspiration for inventors, artists, poets and architects. On the other hand, technology has always simplified the lives of these creative people and, together with new ideas and techniques, has given them some true creative moments. There is no way of knowing what technology still has to offer us, but the added value it gives, which we combine with our technical skills, makes everyone happy, especially the people we provide dental restorations for (Figs 33 to 35).

Figs 30 to 32 The two implant-supported posterior bridge frameworks were pressed with IPS InLine PoM (Press-on-Metal) and characterized with the corresponding layering ceramic. A small gingival area was made.

Figs 33 to 35 Nature has always been the source of our inspiration. However, new technologies have made life easier for us. For example, the increased value it provides, enables us to make the people, who we produce dental restorations for, happy.

My special thanks go to Dr Cristina Dinu, who specializes in implant prosthetics, esthetic dentistry and complex oral rehabilitation. Dr Dinu has a Master of Science in Oral Rehabilitation and is the founder of Med Artis Dent, a private clinic for oral implantology, esthetic dentistry and periodontology. She specialized in implant prosthetics at the BEGO Academy (Germany) and is a member of the Romanian Society of Esthetic Dentistry (SSER) and the International Congress of Oral Implantologists (ICOL).

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Product list

Product	Product name	Manufacturer
Set-up wax	Set-Up StarWax	S&S Scheftner
CAD/CAM system		
– upper framework	Coritec 350i	imes.icore
– lower framework	Coritec 350i	GF Machining Solutions
Implant system		Megagen
Bonder, composite/metal	SR Link	Ivoclar Vivadent
Composite		
– teeth	SR Nexco Paste	Ivoclar Vivadent
– gingiva	SR Nexco Paste Gingiva	Ivoclar Vivadent
Ceramic furnace	Programat P510	Ivoclar Vivadent
Flask	SR Nexco Flask	Ivoclar Vivadent
Light-curing unit		
– interim polymerization	Quick	Ivoclar Vivadent
– end polymerization	Lumamat 100	Ivoclar Vivadent
Stains, Composite	SR Nexco Stains	Ivoclar Vivadent
Model plaster	Plast Rock	Techim Group
Opaque	– SR Nexco Opaquer A2	Ivoclar Vivadent
	– SR Nexco Gingiva Opaquer	Ivoclar Vivadent
Prosthetic teeth	SR Phonares II	Ivoclar Vivadent
Press ceramic, PoM	IPS InLine PoM	Ivoclar Vivadent
Silicone, casting (transparent)	Transil F / transparent silicone, 75 Shore	Ivoclar Vivadent
Veneering ceramic, PFM	IPS d.SIGN	Ivoclar Vivadent
Gingival mask, soft	GingiStar (Automix)	S&S Scheftner

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White and pink with laboratory composites

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Implant-prosthetic rehabilitation of an edentulous maxilla

When producing an implant-supported dental restoration for an edentulous patient, there are two aspects in particular within the laboratory workflow which must be taken into consideration: apart from perfect planning and implementation of each individual working step, it is also the precisely coordinated and reliable materials which influence long-term success. A harmonious dental appearance and the life-like reproduction of soft tissue – in particular the transition from natural to reconstructed gingiva – are essential components and decisive criteria for an esthetically pleasing restoration. This case presents a composite build-up on a titanium implant bridge. The dental and gingival reconstruction was fulfilled to the complete satisfaction of the patient.

Introduction

Abrasion resistance, discoloration resistance and low plaque affinity are material characteristics which until now were primarily assigned to ceramic veneered restorations. The modern micro-filled composite SR Nexco, as described by the author in this case, with its inorganic opalescent fillers, offers similar advantages in terms of abrasion, discoloration, plaque resistance, surface shine and light transmission. In addition, the light-cured laboratory composite is very easy to use, which means laboratory processes are faster and efficient. The special consistency of the paste-like material gives the sculpted contours stability, making the layered build-up easy. The shade effect is consistent even when there is a difference in thickness. Both, dental veneers and gingival areas can be produced using SR Nexco laboratory composite components. It is, however, essential to follow the instructions for use in order to achieve the desired result. In particular, it is imperative that the curing depths, stipulated by the manufacturer for all polymerization procedures, including procuring intermediate hardening and fixation, must be observed. Otherwise, inadequately cured material may result in chipping.

Step by step to the restoration

The dentist inserted six implants into the patient's upper edentulous jaw, in a polygonal and prosthetically ideal oriented position (Fig. 1). This ensured sufficient support for the planned implant-based restoration. As a superstructure, the patient decided on an occlusally screw-retained composite veneered implant bridge made from titanium. An individual wax-up or so-called mock-up was specially made for the patient, with reconstruction of the lost vertical tissue structures,

Fig. 1 Six optimal prosthesis-oriented implants in the maxilla provide the implant bridge with polygonal support.

Figs 2 and 3 Wax-up and mock-up to compensate for lost tissue structures

Fig. 3

in order to illustrate the esthetic appearance. The SR Phonares II tooth line was used for the teeth set-up (Figs 2 and 3).

Framework design

When producing a large implant restoration which spans over the entire jaw, it is essential to consider that the patient's active and passive occlusal tactility is limited in comparison to natural dentition and that their masticatory forces can therefore only be partially controlled or influenced. This is where the force-absorbing composites have a positive effect compared to ceramic. The framework was therefore designed in a full anatomic shape in order to support the veneer in the area of the cusps. After the mock-up had been approved by the patient and the clinician, it was duplicated, reduced accordingly and scanned. Using the scan data, the bridge framework was then milled accurately in the milling centre (Nobel Biocare, Sweden). The framework try-in with the Sheffield Test showed an excellent fit, and it was not necessary to re-adjust. Therefore, the framework could be sent to the laboratory directly for further processing (Fig. 6). At this stage, the advantage of a removable gingival mask became obvious, as it allowed the fit of the framework to be constantly checked (Figs 7 and 8).

Another precaution taken in order to protect the veneer from chipping and cracking was to ensure that the transition areas were smooth flowing and any sharp edges or sides were rounded off. The plan included veneering the basal area of the implant bridge which was to lie directly on the gingiva. This option was possible due to the low plaque affinity of the SR Nexco laboratory composite. Another advantage is the fact that if soft tissue atrophy occurs at a later stage, it can be extended and compensated for with this composite.
An issue of great esthetic importance is the marginal edge,

Figs 4 and 5 Full anatomic trimmed implant bridge

Fig. 5

Figs 6 to 8 Exact fit also at the gingival implant interface

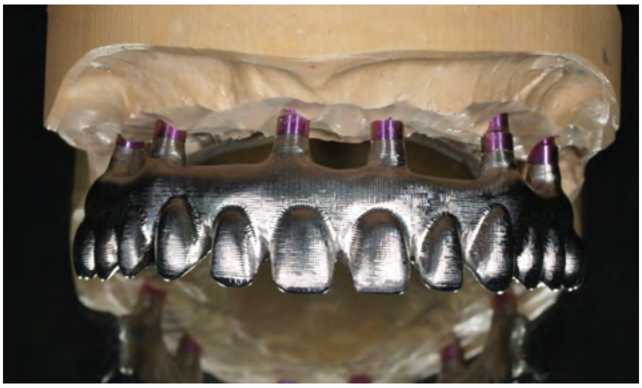


Fig. 7

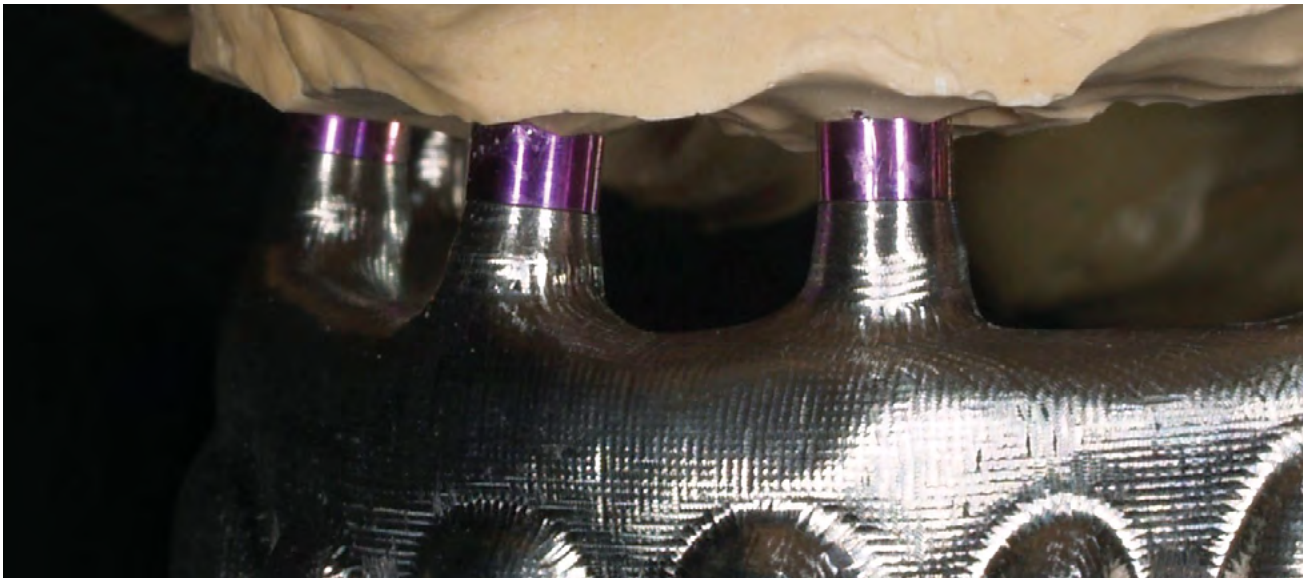


Fig. 8

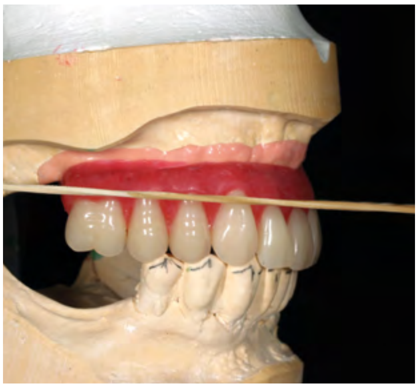
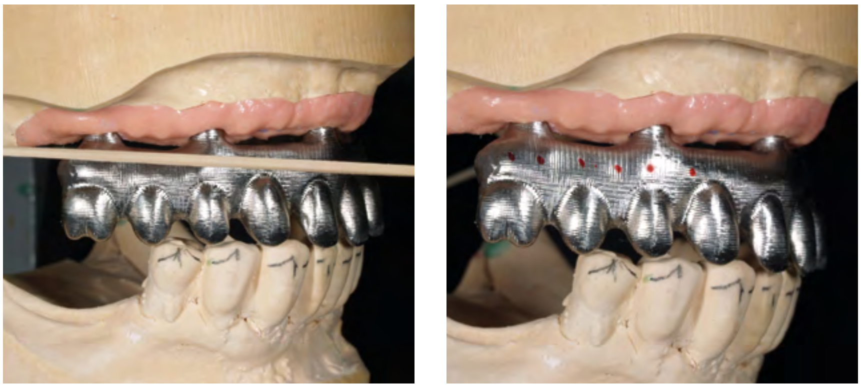


Fig. 9 Defining the transition area on the wax model using a rubber band



Figs 10 and 11 Transferring and marking the determined area. This transition area was then transferred to the titanium framework. The lowest points were marked with red dots.

Fig. 12 Trimming the marginal edge with a carbide bur

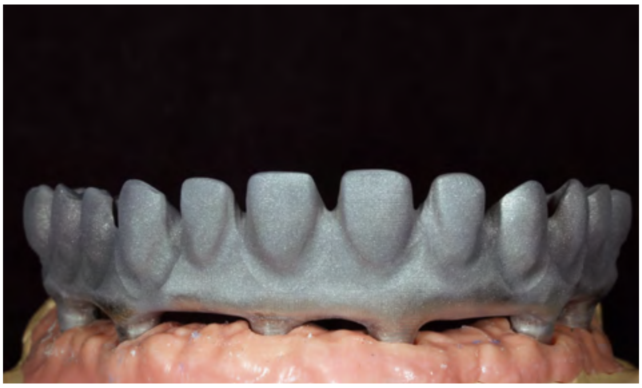


Fig. 13 The titanium framework, sandblasted with aluminium oxide (Al_2O_3, 50–110 µm) at under 2 bar, ready for composite veneering

Fig. 14 Thin application of bonding agent to create a chemical bond between the titanium framework and the composite

which in natural dentition runs circumferentially around the dentin-enamel line of the tooth and into the interdental spaces. This especially enhances the physical dimensions and the three-dimensional effect of the tooth. The transition area between the neck of the tooth and the soft tissue was indicated in the wax-up phase using a rubber band, then transferred to the framework (Figs 9 to 11) and trimmed with a suitable tungsten carbide bur (Fig. 12).

Preparing for the build-up

The finished framework was sandblasted using aluminium oxide (Al_2O_3, 50–110 µm) at 2 to 3 bar pressure. Any possible residues of aluminium oxide can be simply knocked off. They must under no circumstances be steam cleaned or blown off with compressed air.

The bonding agent SR Link was applied in a thin layer to the prepared framework, between metal and composite, using a disposable brush. By sandblasting the metal framework, the mechanical bond of the opaque is increased – the surface is microscopically roughened and enlarged – but the bonding agent creates a chemical bond between the metal framework and the opaque. It is important to ensure that the entire metal surface is covered with the bonding agent and that it is allowed to take effect for sufficiently long – approx. 3 minutes (Figs 13 and 14).

Fig. 15 Application of tooth coloured paste opaque in the cervical area to create a clean transition

Fig. 16 After the second opaque application, before the dental build-up

Fig. 17 The dental build-up with dentin materials

Fig. 18 Cut back with defined mamelons in preparation for incisal layering

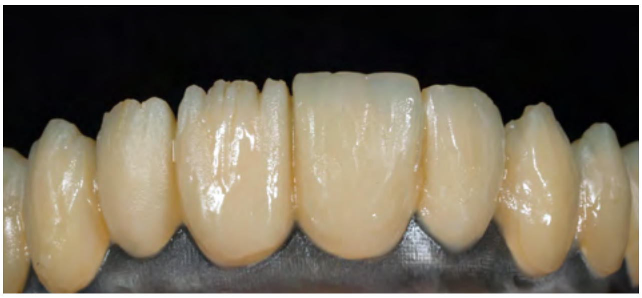


Fig. 19 Individualization with stains

Building up the dental areas

First, starting in the cervical region, two layers of paste opaque were applied to the dental areas of the framework in the relevant dental shade (Fig. 15) and intermediate curing was carried out (Fig. 16). The final polymerization was carried out in the Lumamat 100 according to the manufacturer's instructions. The oxygen inhibited layer was removed with a disposable sponge. Next, the tooth body was built-up generously using the dentin materials from the SR Nexco system (Fig. 17), then reduced using the cut-back method and the mamelon structures were defined (Fig. 18). The key is to maintain the desired tooth shape at all times and check using the matrix. The tooth was individualized with characteristics such as dentin and enamel blemishes or fractures using the SR Nexco stains in orange and white. The mamelons were defined using SR Nexco Paste incisal materials (Fig. 19). As the dentin and enamel materials are well coordinated with one another, even the most subtle transitions can be successfully achieved. Even though the materials were used sparingly, the esthetic outcome was very satisfying. Before polymerization, the built-up framework was completely covered with a thin layer of SR Gel. This reduces the oxygen inhibited layer to a minimum and ensures that the framework material cures completely.

Building up the gingival structures

It's not easy to reproduce natural looking gingiva due to the differences in thickness, blood circulation and pigmentation. The SR Nexco system has a variety of components to offer. The materials available for recreating individualized patient-specific gingiva are SR Nexco gingiva opaque (pink), a special basic gingiva shade (BG 34), five gingiva shades (G1 – G5) and five intensive gingiva materials (IG1 – IG5). With the SR Nexco stains, the soft tissue area can be individualized even further. Before that, the metal surfaces were sandblasted with the aluminium oxide again, then SR Link bonding agent was applied (Fig. 20) and polymerization was carried out.
The pink coloured opaque that was subsequently applied formed a basis for the required, realistic gingiva design (Fig. 21). The basal surfaces and the subgingival areas in particular require the utmost care during application. At this point, the stain materials can already be used to achieve different shade effects (Fig. 22). Please note that the stain materials must always be covered with layering materials such as the SR Nexco Paste Effect Transpa clear. The basis for a life-like reconstruction is the basic gingiva shade layer (BG 34). Its light

Fig. 20 Painting the sandblasted metal surfaces with the bonding agent prior to reconstructing the gingival areas

Fig. 21 Applying the pink coloured opaque onto the gingival areas

Fig. 22 Shade effects on the basal surfaces with SR Nexco Stains chili. Thus shade effects can already be incorporated in the opaque layer.

Figs 23 and 24 The basic gingiva material BG 34 as a basis for the reconstruction of the gingival areas

Fig. 25 Adapting the flexible mucosa with a mixture of materials. Areas with varying blood supply were mimicked.

Fig. 26 Reproducing the venules and arterioles with SR Nexco stains.

Fig. 27a Different attached gingival areas were accentuated with a mixture of SR Nexco Gingiva IG5 and SR Nexco Intensive Gingiva IG3.

Fig. 27b Reconstruction of the frenulum

colour tone with mostly light pink to whitish shades corresponds to that of natural soft tissue in areas where the gingiva is attached and with less blood supply (Figs 23 and 24).
Moving more towards the flexible mucosa, the soft tissue has a stronger blood supply and darker colour tones are required. The distinctive structure of the vestibular mucosa is typical. In order to reproduce this area, another application using a mixture of SR Nexco Intensive Gingiva IG 1 and Stains chili was required. When mixing two pastes together always ensure that no air bubbles are created within the material. The bluish-violet shimmering venules and the reddish arterioles were quite easy to reproduce by applying SR Nexco Stains red and SR Nexco Stains chili in the areas of flexible mucosa. This makes the gingiva appear very life-like and "vibrant" (Figs 25 and 26). The materials SR Nexco Intensive Gingiva IG 5 and SR Nexco Intensive Gingiva IG 3 were mixed to reconstruct the attached gingiva (Fig. 27a). Again the materials were mixed taking care not to create any air bubbles. This material was used to shape the alveolus mounds and gingival margin and reconstruct the lip frenulum (Fig. 27b). Before the final polymerization, SR Gel was applied thinly to the entire restoration to prevent the oxygen inhibited layer from forming (Fig. 28). The end polymerization was carried out in the Lumamat 100 according to the manufacturer's instructions. Once the residual inhibited layer had been entirely removed, the dental and gingival areas were trimmed and finished. The contouring, surface structure of the tooth and the orange skin stippling effect was carried out using cross-cut carbide burs.

Finishing

The final polish with the universal polishing paste was carried out in two steps: pre-polishing with a rubber polisher and silicone polishing wheel to smooth the surface, high-gloss polish with a goat hair brush, cotton and/or leather buff and the universal polishing paste. Micro-roughness on the veneering surface and difficult to reach basal areas is conducive to plaque accumulation; therefore the polishing procedure was carried out with extreme care and attention. A homogenous, high-gloss surface was achieved (Figs 30 and 31).

Conclusion

The patient's justified wish to receive a natural-looking dental restoration does not necessarily mean that only ceramic can be used. There are excellent, promising alternatives available to the dental technician, such as the SR Nexco laboratory composite (Fig. 32). With its compatible and well-coordinated

Fig. 28 Well covered application of SR Gel before the final polymerization

Fig. 29 Final finishing with a cross-cut carbide bur

Fig. 30 The finished, veneered and polished implant bridge made with SR Nexco laboratory composite

Fig. 31 From the side it is possible to see the three dimensional structures in the alveolar area.

Fig. 32 The inserted restoration with a harmonious and hardly recognizable transition into the natural gingiva

Fig. 33 A happy and highly satisfied patient with his "natural" composite solution.

veneering materials it is possible to produce natural-looking teeth and gingiva whilst at the same time being economically interesting for the laboratory. The materials can be mixed and implemented differently according to each individual patient situation (Fig. 33). Processing SR Nexco laboratory composite is easy and uncomplicated with its stable consistency throughout the build-up and reliable shade accuracy.
From the patient's perspective, the wear characteristics are not the only advantage. Polished to a high gloss, the composite is largely resistant to plaque and discoloration, which noticeably improves the oral hygiene for the patient. Last but not least, the SR Nexco veneer can be extended at any time should soft tissue atrophy occur.

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.

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Product list

Product	Product name	Manufacturer
Implant System	Replace	Nobel Biocare
Prosthetic teeth	SR Phonares II	Ivoclar Vivadent
Framework	Implant bridge titanium	Nobel Biocare
Bonding agent	SR Link	Ivoclar Vivadent
Laboratory composite		
– teeth	SR Nexco Paste	Ivoclar Vivadent
– gingiva	SR Nexco Paste Gingiva	Ivoclar Vivadent
Oxygen blocker	SR Gel	Ivoclar Vivadent
Polishing paste	Universal Polishing Paste	Ivoclar Vivadent

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Implant-prosthetic restoration of an edentulous maxilla

Creating an esthetically pleasing smile in an edentulous patient is no easy task. Effective collaboration, combined with suitable materials and procedures, empowers dental professionals to address this challenge effectively.

Rehabilitation of the edentulous jaw can be achieved with various treatment modalities. Removable implant-supported overdentures can provide a comfortable, esthetic and functional option even in circumstances where only a reduced number of implants can be used. This treatment option is frequently practised due to the fact that the number of patients wishing to find an alternative to complete dentures is rising. The patients' expectations regarding their prosthetic tooth replacements are similarly high as for fixed ceramic veneered restorations. With the emergence of new materials and their combination with CAD/CAM technology, outstanding outcomes can be achieved for this indication. An adequate solution can be found for almost every patient and budget. Generally, overdentures offer several advantages over conventional removable prosthodontics. These advantages include stability, functionality, wear comfort, confidence in the ability to interact socially, straightforward rehabilitation and easy maintenance for the patient, or, simply put: a significant improvement in quality of life.

Clinical case

A 58-year-old patient presented at the practice with discomfort caused by her complete upper denture. At history taking, we found a prosthetic restoration retained on six implants in the lower jaw and a complete maxillary denture that was esthetically and functionally inadequate (Fig. 1). An initial esthetic evaluation revealed that the shape and shade of the teeth were inappropriate. In addition, the midline was misaligned and the curvature of the maxillary anterior group was shaped incorrectly. The poor stability of the denture was caused by insufficient prosthetic support and by the method of manufacture. Taking into account the patient's requirements, financial possibilities and clinical condition of the maxillary prosthetic field, we decided in favour of an implant-supported prosthetic treatment modality. The plan was to insert four

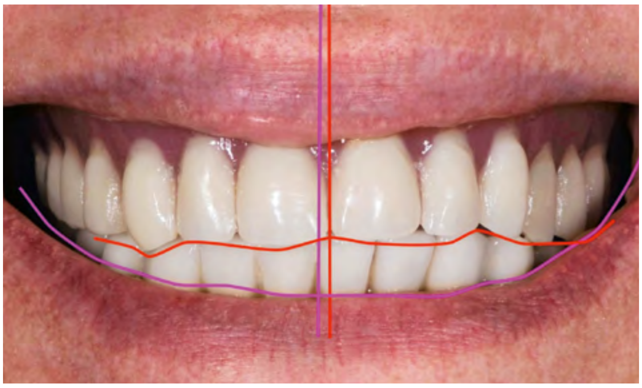
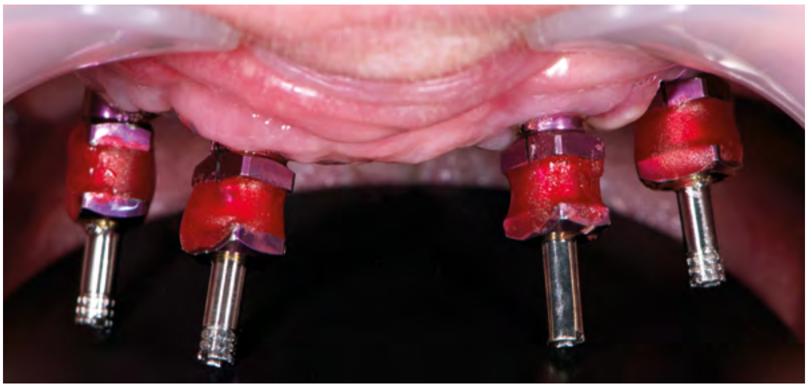
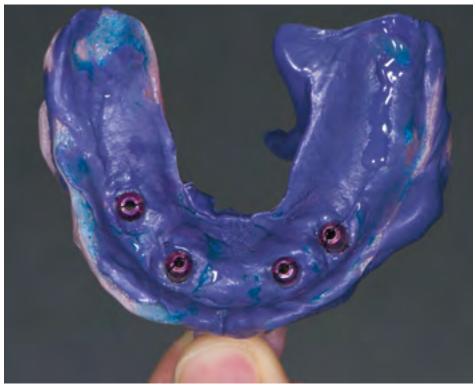


Fig. 1 Esthetic evaluation prior to commencing the treatment: an edentulous upper jaw had been provided with a conventional complete denture.

maxillary implants to retain an overdenture prosthesis using the double-crown method. This procedure is frequently practised in such cases and has been improved with the emergence of new technologies and materials. Our protocol required primary telescope crowns milled from zirconia at an incline of 2° and secondary copings obtained by galvanoforming. This approach combines the advantages of zirconia (primary telescopes) with the advantages of hydraulic retention (galvanic copings). The tertiary structure imparts the removable denture with the required stability. In this way, a tension-free, implant-retained restoration can be produced.

Following a complication-free period of healing and osseointegration, the four implants were uncovered and a preliminary impression was taken. From the resulting model, a customized tray was created. Next, a functional impression that would transfer the exact position of the implants was required to proceed to the next stage of the treatment. The four impression posts were splinted together on the custom tray using composite material (Figs 2 and 3). After creating the working models (Fig. 4), we determined the patient's vertical dimension of occlusion (VDO), length of future teeth and gingival smile line by means of an occlusal plate (bite rim). In the upper jaw, the occlusal rim was shaped in such a way that two millimetres of the edge were visible when the upper lip was in rest position. The lower edge of the rim was aligned in parallel to the bipupillary plane and smoothly followed the curve of the lower lip when the patient smiled. On the maxillary rim, the midline, the smile line and the line of the canines were outlined. A facebow was used for the transfer of the maxillary position in relation to the base of the skull.





Figs 2 and 3 Following the healing and osseointegration process of four implants, an impression of the oral situation was taken. The impression posts were splinted together prior to impression taking.

Fig. 4 Implant model for the reconstruction of the overdenture

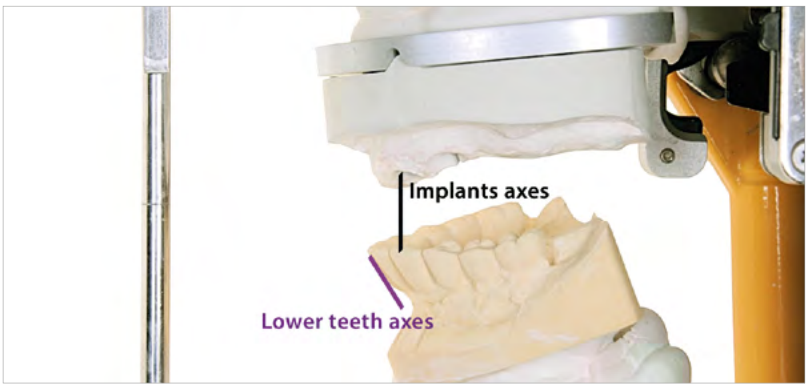


Fig. 5 The models mounted on the articulator clearly demonstrate the challenges involved in this clinical case.

Fig. 6 Try-in of the wax set-up and evaluation of the esthetic parameters

Fig. 7 Customized titanium abutments

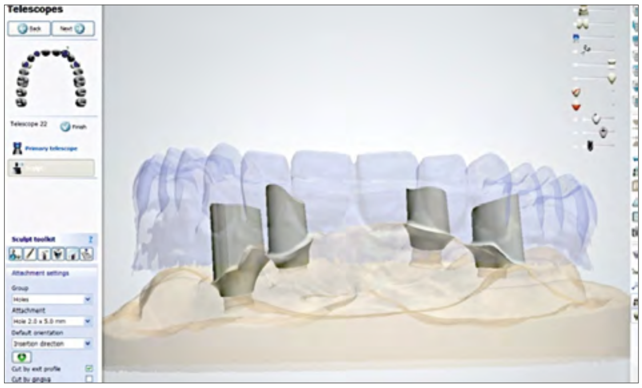


Fig. 8 Reconstruction of the primary structure after scanning the model, abutments and set-up

Once the relevant ratios had been obtained, the models were mounted on the articulator (Fig. 5). The difficulty of this case was that we had to make allowance for the existing mandibular restoration in the design of the maxillary rehabilitation. The implant axes of the mandibular prosthesis in particular posed some problems. Shade selection was dictated by the mandibular restoration and, consequently, our room for decision-making was reduced to deciding on the shape of the teeth. To this end, a photo of the patient as a young adult came in handy, as it was her wish that the shape and size of her teeth as they were when she was young should be maintained in the prosthetic reconstruction. With the aim to attain as perfect a prosthesis as possible and to make the most of the available space, we created a wax set-up using prefabricated denture teeth (SR Phonares II).

Primary structure

A try-in of the set-up was performed to check the phonetics, esthetics and occlusion (Fig. 6) and then a silicone key was created over the set-up. The silicone key acted as a guide in the subsequent working steps. To manufacture the primary structure, the four titanium abutments were customized (Fig. 7), the resulting abutments were scanned together with the model and set-up (double scan) and these data sets were imported into the design software. The CAD program proceeded to suggest the shape, height and angulation of the telescope crowns, which we adjusted and optimized as required (Fig. 8). The primary telescopes were milled from zirconia and sintered to their final density at 1500°C. After checking the accuracy of fit, the zirconia crowns were permanently bonded to the titanium abutments (Multilink Hybrid Abutment). Next, the zirconia telescopes were adjusted using a lab turbine and parallelograph. The walls of the telescopes were given a 2° incline and smoothed out using appropriate diamond grinding tools and sufficient water cooling (Figs 9 and 10).

Secondary structure

The primary crowns could now be prepared for the manufacture of the secondary crowns by means of the galvanoforming technique. For this purpose, the zirconia surfaces were covered in a thin coating of conductive silver using the airbrush method and the galvanoforming process was commenced. Upon completion of the galvanoforming process,

Figs 9 and 10 Grinding and smoothing of the primary structure made from zirconia in a milling unit using CAD/CAM technology

Fig. 11 Intraoral bonding of the galvanoformed secondary crowns with the tertiary structure

the galvanized gold crowns were detached from the telescopes and the conductive silver coating was removed with a nitric acid containing solution. In the process, a highly accurate secondary structure was obtained.

Tertiary structure

All the components were repositioned onto the working model. Before the tertiary structure was fabricated, the galvanoformed crowns were covered in a thin layer of wax to create the space necessary for the cement that would later be used. The tertiary structure was invested, cast in CoCr alloy using induction casting technology and then finished. The tertiary structure was intraorally cemented onto the galvanoformed telescopes (Multilink Hybrid Abutment, Monobond) in order to obtain a tension-free restoration (Fig. 11).

Esthetic design

The structure thus obtained was covered in opaque light-curing lab composite (SR Nexco) in pink and white prior to finishing the prosthesis. The silicone key was again used as a guide: the Phonares II teeth were repositioned from the wax set-up to the framework. The occlusal parameters were again checked and then we proceeded to complete the restoration. To reconstruct the pink gingival portion, we used the IvoBase system. First, the denture was invested in two especially designed flask halves using type III and IV plaster. After removing the wax and isolating the plaster surfaces, we prepared an IvoBase capsule and placed it together with the flask into the polymerization chamber of the injector. The IvoBase injection and polymerization process is fully automated and takes about 60 minutes. Users can choose between two program options: Running the standard program takes about 40 minutes. If the other program is additionally activated, the pressing time increases, as a result of which the monomer concentration is reduced to less than one per cent after the pressing process. Thus the risk for allergies and irritations of the mucous membrane is virtually eliminated.

Upon completion of the injection program, the flask halves were opened, the denture divested from the stone core and processed with milling and polishing instruments. In an effort to create a tooth replacement that closely meets the expectations of the patient, we decided to customize the visible areas of the denture by applying additional material

Figs 12 and 13 Detailed view of the completed denture: customized prefabricated teeth and soft tissue parts

Fig. 14 The macro-texture and shade effect of the denture were individualized in a straightforward manner to achieve a result that is true to nature.

Fig. 15 Implant-retained overdenture inserted in the patient's mouth

(SR Nexco). To this end, the vestibular surfaces of the anterior teeth and the corresponding pink parts were sandblasted. SR Connect was applied and the teeth and prosthetic gingiva were characterized with SR Nexco and the shape adjusted according to the requirements of the patient. Final polishing was carried out with biaxial brushes and pads. This procedure yielded a result that was true to nature and ad- justed to the specific requirements of the patient (Figs 12 to 15).

Conclusion

Many patients respond with reluctance to the idea of being given removable dentures. If dentures are optimized by adding the stability of implants and the effectiveness of telescopes, dental professionals will be able to dispel the initial reservations of their patients and offer them a tooth replacement that provides the expected level of wear comfort. Completely edentulous patients have the same high esthetic expectations as patients requiring fixed restorations. However, some of these requirements are more difficult to satisfy in the edentulous patient, because we are forced to replace not only missing teeth but often also soft tissues. To achieve this, we need to find a way of creating harmony between the pink and white aspects of the denture. Today's patients tend to be well informed. They place ever higher expectations on the esthetic and functional aspects of tooth replacements. Against such a background, we need to be well trained and know which materials and technologies can ease our job and increase our efficiency. This will enable us to solve any clinical case, regardless of its difficulty.

This article was first published in Reflect 1, 2015, pages 16-19.

Product list

Product	Product name	Manufacturer
Denture teeth	SR Phonares II	Ivoclar Vivadent
Denture base material	IvoBase	Ivoclar Vivadent
Luting composite (self-curing)	Multilink Hybrid Abutment	Ivoclar Vivadent
Universal primer	Monobond	Ivoclar Vivadent
Composite		
– teeth	SR Nexco Paste	Ivoclar Vivadent
– gingiva	SR Nexco Paste Gingiva	Ivoclar Vivadent
Bonding agent (Composite)	SR Connect	Ivoclar Vivadent
Light-curing unit	Quick	Ivoclar Vivadent

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Natural-looking imitation of pink esthetics

Carsten Fischer
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Completing a denture base using the IvoBase System

Even in the case of complex prosthetic reconstructions, patients want their dentures to look natural in addition to having the basic functions (speaking, chewing, tasting) returned to their stomatognathic system. Dentures should by no means have an adverse effect on the patient's esthetic appearance. Esthetic soft tissue design reflects this philosophy.

The IvoBase denture base system offers an efficient method to create custom-made esthetic soft tissue reconstructions. The patients' expectations can be ideally met with a flair for esthetic design and a combination of IvoBase denture base material, SR Nexco (customization) and ideally designed denture teeth.

IvoBase System

The IvoBase System is based on a fully automated injection and polymerization process. All the components (flasks, capsules, injector, etc.) are coordinated with each other. Chemical shrinkage of the acrylic is compensated during the polymerization process due to thermal management in the flask. As a result, volumetric shrinkage is prevented by the continued supply of additional material during the polymerization process to provide a denture base that demonstrates a high accuracy of fit and an excellent surface finish. Chemically, the IvoBase denture base materials fall into the category of self-curing materials but offer the qualitative advantages of heat-curing materials. As the self-cure process of IvoBase commences at a starting temperature of 40°C, thermal shrinkage is reduced compared with that of conventional heat-curing materials. Monomer and polymer are supplied in predosed capsules to ensure an optimal mixing ratio and to eliminate direct skin contact with the monomer. The IvoBase System results in denture bases that demonstrate lifelike pink esthetics and closely resemble the light-optical properties of the natural gingiva. Characterizations can be easily applied to the denture bases to accommodate the specific expectations of the patient.

Case presentation

A partially edentulous upper jaw was to be restored with a palate-free denture retained with telescopic crowns. The inner (primary) zirconia copings for teeth no. 13, 14, 15 and 23, 24, 25 were sheathed with electroformed copings (secondary parts) attached to a tertiary structure made of base alloy. The electroformed copings were cemented to the base alloy structure in the oral cavity according to the Weigl method to ensure a tension-free fit. Tooth set-up was performed according to conventional prosthetic principles while the static and functional requirements as well as the patient's individual

Fig. 1 Esthetic try-in of the wax-up to validate final esthetics

Figs 2 and 3 Wax-up after successive contouring of the soft tissue parts in wax

Fig. 3

expectations were taken into account. Tooth position, smile line, lip volume, phonetics, centric relation and other criteria were checked in the course of an esthetic try-in (Fig. 1) before fabricating the final denture. Natural-looking artificial gingiva parts were already achieved in the wax-up and the soft tissue areas were individualized with subtle but effective touches (Figs 2 and 3).

Lab procedure

After both the dentist and patient had approved the wax-up, the denture was ready to be processed into acrylic. To perform this task, I used the IvoBase denture base system, which allowed me to transfer the wax-up to the final restoration without loss of detail. This injection-based system ensures a clean, precise, reliable and simple procedure.

Investing and boiling out

Both flask halves were identical. Prior to investing the model, I placed the flask lid, access former half and filter wax component in one of the flask halves. After applying a thin coating of petroleum jelly to the inner surfaces of the prepared flasks, I soaked the model with the mounted waxed-up denture with water and isolated it with stone-to-stone separating fluid. The model was now ready for being invested in plaster; a Class III dental stone is recommended for this purpose. I took care to place the model at the centre of the flask and to ensure a space between the anterior margin of the model and flask of approx. 10 mm. To create a flush surface between the edge of the model and the flask housing, I removed all surplus plaster whilst it was still soft. The stone surface should be flush with the access former to prevent the plaster from spalling during the subsequent working procedure.

After the stone had hardened, I replaced the access former half with the access former full and positioned the prefabricated injection wax component. As a palate-free denture base was fabricated in the present case, the sprues were pressed onto the maxillary tuberosity. I made sure that the sprue was contiguous in all areas of the denture base. Then, I attached what are known as aeriation channels at the anterior region to vent the flask cavity during the injection process. These components were also prefabricated and were easy to connect

Fig. 4 The flask is filled with dental stone using a vibration device.

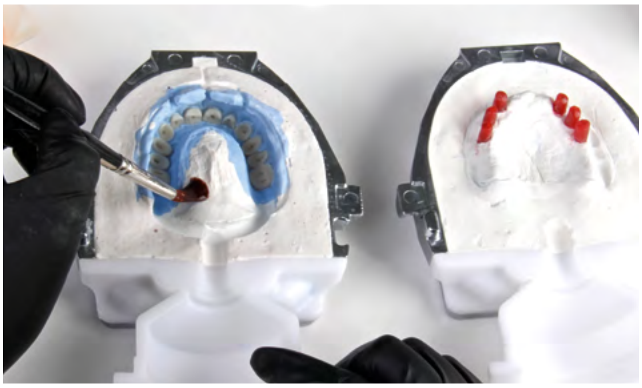

Fig. 5 The stone surfaces are isolated with SR Separating Fluid, the teeth are conditioned.

Fig. 6 The inhibited opaquer layer is removed and the framework repositioned on the framework.

Fig. 7 IvoBase is available in seven shades.

to the denture base. Important: the aeriation channels must not come into contact with the flask housing. Next, I coated the teeth and gingival areas with a medium-body addition-curing silicone (A silicone of a shore hardness of 65) and then applied some stippling to the silicone before it had set to create a retentive pattern and secure the silicone in the stone. No silicone was applied to the occlusal surfaces and access former. After isolating the stone surface, I positioned the upper flask half and locked the flask halves using the locking clasp. Then, I filled the flask with dental stone (Class III) with the help of a vibration device to avoid air bubbles (Fig. 4). Excess stone was skimmed off so that a flush surface resulted between the stone and flask lid. Once the stone had set, the flask was heated in a water bath at 90°C and then the two flask halves were separated. The wax was now soft and could be easily removed in large pieces. After the full access former had been taken out, the model and teeth were boiled out with clean boiling water to thoroughly remove all wax residue.

Transfer to acrylic

The basal surfaces of the cleaned teeth were roughened with jet medium and mechanical retentions applied with a small round bur. After that, I returned the teeth to the silicone key. Next, I applied a thin coating of Separating Fluid to the stone surfaces of the cooled flask halves (Fig. 5). Prior to joining the flask halves, I masked the base metal alloy framework with opaquer. For this purpose, I used a pink opaquer for the gingival areas and a tooth-coloured shade for the areas under the telescope teeth. These materials were applied as a covering layer. Once the framework had been thus prepared, it was placed on the model and secured with wax (Fig. 6). The aeriation filter, centring insert and funnel were inserted and the flask halves assembled.

The denture base materials are available in seven shades (Fig. 7). For the case presented here, I selected IvoBase High Impact in shade 34-V. I removed the monomer container from the predosed capsule, joined the fluid and powder and mixed the two components to a homogenous mixture. With a few easy manipulations I attached the centring insert and flask to the capsule and then placed them into the injector according to the manufacturer's instructions. Next, I selected the relevant injection program and then started the injection process. The process was fully automated and took approx. 65 minutes to complete. As the injection and polymerization process were exactly matched to the material, polymerization shrinkage of the acrylic was completely compensated. Once the program had been complete, I removed the flask and cooled with water. Divesting was performed under a dental press. The IvoBase System includes a divesting aid to facilitate this process. Having detached the flask halves, I carefully removed the denture from the stone core and separated the capsule

Fig. 8 Careful divesting after the fully automated polymerization process

using a separating disc (Fig. 8). All waxed-up areas were faithfully reproduced in the acrylic.

Completing the denture

Now, I directed my full attention to finishing the denture. The advantage of using this system became most apparent at this stage, as hardly any reworking was necessary. The finely modelled surface structures and textures of the wax pattern were replicated in the acrylic without loss of detail (Figs 9a – 9c). In a few quick steps the denture base was ready for final customization. With SR Nexco, the artificial gingiva can be given an individual touch and natural-looking characterizations to suit the patient's expectations. SR Nexco ideally complements the IvoBase denture base material (shade 34-V) (Fig. 10).

I applied a light-curing conditioner (SR Connect) to the acrylic surface to create an adhesive interface that would allow the application of individual shade characterizations (Fig. 11). After that, I focused on creating subtle details to reproduce a natural depth effect. I customized the vestibular areas and applied fine capillaries on the facial side using a variety of different shades (Figs 12 and 13). Key anatomical features should be borne in mind when characterizing soft tissue parts to achieve a lifelike reproduction. For instance, keratinized gingiva has a light pink colour because less blood normally flows through it. By contrast, the mucogingival areas receive a

Figs 9a to 9c Finishing requires only a few steps as the wax-up is processed into the acrylic without loss of accuracy.

Fig. 10 Light-curing SR Nexco composite can be optimally combined with the IvoBase System to characterize the denture base.

Figs 11 and 12 The bonding agent was applied with a brush to create an adhesive interface.

far larger supply of blood and are interspersed with fine blood vessels. These details were easy to reproduce with the SR Nexco range of materials. Aspects of three dimensionality including alveoli and festooning were already created in detail in the wax-up and transferred to the acrylic without loss of detail using the IvoBase System. The SR Nexco Paste gingiva materials and my technical skills enabled me to individualize the prosthetic gingiva by applying materials in different shades in a targeted fashion to attain a natural-looking final result (Fig. 14).

Prior to final light-curing, I covered the entire surface with an oxygen-tight glycerine-based gel (SR Gel) to prevent the formation of an inhibition layer (Fig. 15). After completing the final polymerization process, I polished the surface. The use of goat's hair brushes, a high-gloss buff and Universal Polishing Paste effectively resulted in a superbly smooth and glossy surface, without loss of surface texture or shade characteristics (Fig. 16).

Fig. 13 Characterization: subtle stippling and fine red blood vessels enhance the natural appearance of the prosthetic gingiva parts.

Fig. 14 The individual SR Nexco materials can be adapted using OptraSculpt Pad.

Fig. 15 Prior to final curing, glycerine gel is applied to prevent the formation of an inhibition layer.

Fig. 16 High-gloss polishing using a buff and universal polishing paste

Fig. 17 Successful interplay between light, shadow and shade. The surface texture modelled in wax has been processed into acrylic without loss of detail using the IvoBase System. The resulting light dynamic properties convey a natural appearance to the artificial gingiva.

Result

Pink esthetics that very closely resembles healthy soft tissue is the result of this approach. Fine details of texture – such as subtle stippling, slightly accentuated alveoli or free gingiva margins – give artificial gingiva a natural appearance. The IvoBase denture base material beautifully harmonizes with the SR Nexco composite and together, these two materials create natural light reflections and a dynamic interplay of colours. The compact and smooth surface is not only esthetically pleasing but also provides optimum conditions for denture hygiene (Fig. 17).

Conclusion

The IvoBase injection process provides a straightforward method to process waxed-up denture bases into high-quality PMMA. Waxed-up set-ups can be transferred 1:1. Polymerization shrinkage is mostly compensated, thus minimizing the effort required by the dental technician. The soft tissue parts can be customized to meet the individual expectations of the patient and to provide dentures with natural-looking pink esthetics (Figs 18 and 19).

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Figs 18 and 19 The tooth replacement harmoniously integrates into the patient's face and satisfies his esthetic expectations.

Product list

Product	Product name	Manufacturer
Denture base system	IvoBase	Ivoclar Vivadent
Composite		
– gingiva	SR Nexco Paste Gingiva	Ivoclar Vivadent
Bonding agent (composite)	SR Connect	Ivoclar Vivadent
Oxygen blocker	SR Gel	Ivoclar Vivadent
Separating fluid	SR Separating Fluid	Ivoclar Vivadent
Modelling instrument (composite, foam pad attachments)	OptraSculpt Pad	Ivoclar Vivadent

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A good option for the lifelike recreation of gingival tissue

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Esthetic composite layering of implant-supported restorations in an edentulous jaw

The flawless reconstruction of gingival tissue requires sound teamwork as well as excellent materials and exceptional skill. Layering with the light-curing laboratory composite SR Nexco takes this procedure to a new level.

Fig. 1 Initial portrait of the patient

Fig. 2 Extremely poor oral condition: The teeth could not be rescued. The jaw ridge in the upper jaw was considerably atrophied.

Careful planning is indispensable in the treatment of an edentulous jaw with implant-supported restorations. The axes and positions of the implants must correspond to the given biological, mechanical and esthetic conditions. In situations where severe bone recession has occurred, the work of the dental team will involve not only the reconstruction of dental but also of gingival tissue. The dentogingival complex must primarily fulfil two aspects: function (chewing and speaking) and esthetics (alignment of the teeth and gums and lip support).

Clinical case presentation

When the 37-year-old female patient presented to our practice, her teeth and the related bone structure were in very poor condition (Figs 1 and 2). Numerous teeth were missing in both the upper and lower jaw. Furthermore, the upper jaw showed considerable bone and gingival resorption. The patient wished to have fixed teeth again and regain an attractive appearance. Due to the extensive damage that had occurred, the complete restoration of both jaws with implants was indicated.

Surgical phase

As a result of sufficient bone structure in the lower jaw, this part of the mouth could be restored at once with four immediately loadable implants. During the reconstructive phase, the upper jaw had to be treated with a provisional removable denture due to the atrophied jaw ridge. The tooth extractions in the upper and lower jaw took place on one day. At the same time, the four lower jaw implants were inserted and loaded. An immediate denture was placed in the upper jaw. During the osseointegration period of the mandibular implants, the bones in the upper jaw were reconstructed. The maxillary sinus and the jaw ridge were augmented in one appointment. At the next appointment, ten implants were placed according to the treatment plan. Six months after this intervention, the implants were exposed. As a result of a well-planned soft tissue management strategy, firm keratinized tissue had formed in adequate form. The permanent restorations for the upper and lower jaw were fabricated two months later (Figs 3 and 4).

Prosthetic phase

The determination of the occlusal plane and the ideal incisal line allows the tooth arches to be integrated more easily in terms of esthetics and function.

Impression taking

Open tray impressions were taken with a special plaster (Snow White) and unsplinted impression posts. The considerable stiffness of the impression material completely immobilized the impression posts, which prevented any errors from occurring in the casting of the study models.

Articulation of the models

The articulator allows the kinematics of the jaw to be correctly simulated. The aim of this part of the treatment is of a functional nature. It is intended to ensure the optimal occlusal integration of the restorations and the proper jaw movements during chewing, speaking and swallowing. In this particular case, the upper jaw model was positioned with the help of a facebow. Four impression posts were screwed on the implants in order to provide strong support and enhanced reliability. Alternatively, this step can take place directly on the immediately loaded provisional restorations. For this purpose, however, the model has to be mounted in the articulator of the dental practice. In the present case, the masticatory model was positioned in the correct relation to the hinge axis-orbital plane. Subsequently, we adjusted the bite patterns in order to record the vertical dimension of occlusion. The centric relationship is regarded as the reference position for adjusting

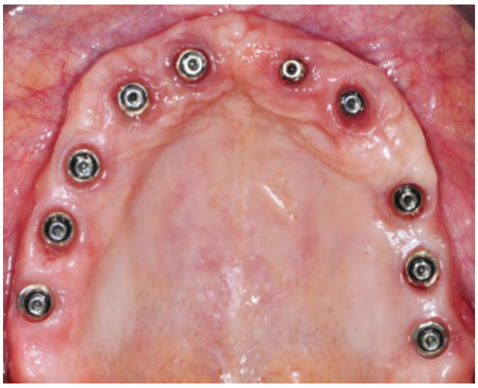
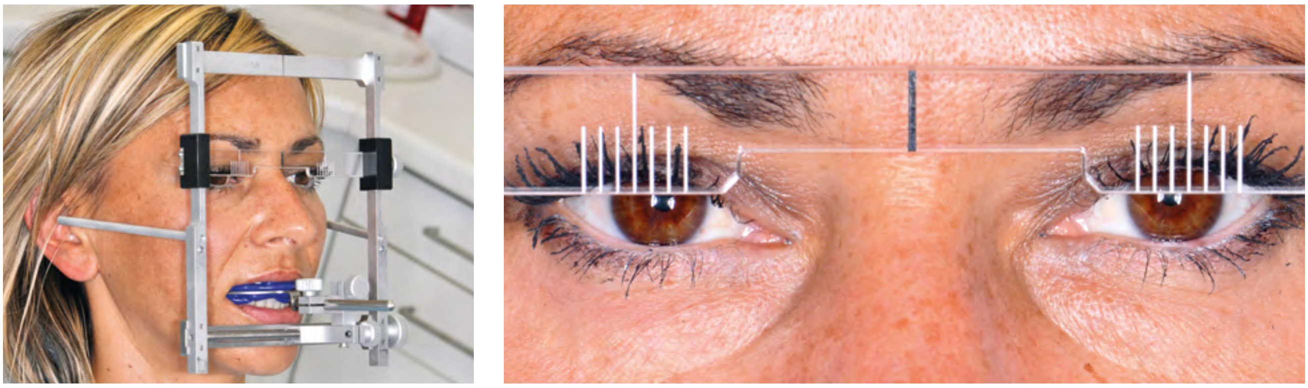


Fig. 3 After bone augmentation measures had taken place, ten implants were inserted. The picture shows the situation prior to the prosthetic phase.

Fig. 4 Four implants were inserted in the lower jaw. Bone augmentation measures were not necessary in this case.



Figs 5a and b Recording of the esthetic facial axes with the Ditramax system

the muscles to the centric and functional jaw relationship. The mandibular model was mounted in the articulator with the help of an antagonist jaw relationship record. If the centric and the vertical dimension of occlusion are correct, the immediately loaded provisional restorations can be used for this purpose. The restorations have to be immobilized when they are mounted in the articulator. The Artex system allows the articulator of the dental practice and that of the laboratory to be synchronized.

Recording of the esthetic facial axes

The Ditramax system was used to transfer the precise data related to the esthetic facial axes to the maxillary model (Figs 5a and b). Two axes were marked on the plaster base of the model (vertical and horizontal). The vertical axis represents the sagittal median plane. From the front, the horizontal axis is aligned parallel to the bipupillary line and from the side to Camper's plane. These markings, which should be very close to the working area, act as a guide for the dental technician in setting up the teeth. Therefore, the incisal line has a predictable parallel alignment to the bipupillary line. The incisal axis is aligned parallel with the sagittal/median plane. The Camper's plane markings indicate the alignment of the occlusal plane. All these elements provide a sound rationale for the tooth set-up according to esthetic and functional principles.

Tooth selection and set-up

We selected the tooth shade and the teeth on the basis of the SR Phonares II tooth mould chart. Holding the teeth up against the lips of the patient quickly reveals whether or not they are in harmony with the facial features. The set-up of the teeth according to the Ditramax markings (Fig. 6) allows the situation to be clinically validated. In this case, particular attention was

Fig. 6 The denture was set up with pre-fabricated teeth (SR Phonares II).

given to the esthetic integration of the dentogingival complex when the patient was smiling. The lip dynamics were shown with video clips. The functional criteria were also checked. The vertical dimension of occlusion had to be harmonious in order to achieve a balanced lower facial third and proper phonation.

Fabrication of the framework

We felt that a CAD/CAM-fabricated titanium framework (e.g. Procera from Nobel Biocare) would best fulfil this indication The double scan technique allowed the implant model to be superimposed on the tooth set-up to construct the framework. In the next step, the framework was machined and then tried on the model and in the patient's mouth (Fig. 7). The cast impression and the high-performance processing systems significantly contributed to ensuring the optimal passive (tension-free) fit of the framework, which is decisive for the long-term success of the restoration.

Preparation of the framework for veneering

The areas that needed to be built up with Gingiva materials were blasted with aluminium oxide (Al_2O_3) using 2 to 3 bar pressure. Subsequently, the SR Link bonding agent was applied, followed by a thin layer of the light-curing SR Nexco Gingiva Opaquer pink to prepare the metal framework for veneering. The opaquer was polymerized and then a second coating was applied and polymerized. The resulting inhibition layer was removed. The conventional flask technique with the heat-curing denture base material ProBase hot was used to produce the denture. After the polymerization process, the denture base was ground and space was made for building up the Gingiva composite. The surface was conditioned by blasting it with aluminium oxide (50 µm) at 2 bar (Fig. 8). Then, a bonding agent was applied, which was left to react for three minutes before it was light cured.

Veneering of the gingival areas

In order to achieve very lifelike results in the layering of the gingival tissue, saturated (intensive) materials were used first (SR Nexco Paste Intensive Gingiva) (Fig. 9). Next, translucent, light-curing Gingiva materials (SR Nexco Paste Gingiva, SR Nexco Paste Basic Gingiva BG 34) were used to impart the gingival areas with the desired depth (Fig. 10). The colours of the Gingiva composites range from pale pink to reddish and orange and purple. A certain learning curve is necessary to master the necessary mixing techniques and achieve a harmonious interplay of the intensive and the translucent materials. Practice is essential and it will pay off. With some technical skill, the gingival areas can be naturally reproduced in shape, texture and shade (Fig. 10).

All the individual layers were precured with a light-curing unit (Quick) in segments. A high-performance curing light was used for the final polymerization. Prior to this step, a coating of glycerine gel (SR Gel) was applied to the surfaces to prevent oxygen inhibition, which could lead to an unattractive and difficult-to-polish result. The surfaces of the teeth were characterized with a vertical and horizontal macrostructure. Particular attention was paid to mechanical polishing. Once the

Fig. 7 Try-in of the CAD/CAM-fabricated titanium framework in the upper jaw

Fig. 8 The ground down composite resin areas were conditioned for receiving the light-curing laboratory composite SR Nexco.

Fig. 9 Application of the colour saturated intensive Gingiva materials (SR Nexco Paste Intensive Gingiva)

Fig. 10 The application of various translucent materials imparted the prosthetic gingiva with the desired depth effects.

Fig. 11 Lifelike, vital, esthetic – the white and pink esthetics have been optimally imitated.

glycerine gel was removed, the restorations were finished with different polishing instruments of various grit sizes, pumice, leather buffing wheels and Universal Polishing Paste from Ivoclar Vivadent (Fig. 11). In the present case, mechanical polishing was preferred to glazing with light-curing composite in order to prevent premature ageing of the surface.

Attachment of the permanent dental restorations

The dentures were inserted manually with the help of multiunit abutments (Fig. 12). The screw channels were sealed with Teflon and light-curing composite resin. The position of maximum intercuspation was checked and the occlusal pathways were adjusted to the protrusive and laterotrusive movements. In addition, the restorations were checked in terms of the ability to clean them with interdental brushes, and the patient was given special instructions regarding her oral hygiene.

Discussion

For a long time, ceramics were considered to be the esthetic benchmark. With the introduction of state-of-the-art industrially fabricated acrylic teeth, which are specially designed for implant applications, the bar for esthetics has been raised in this category of materials. The teeth used in this case exhibit a true-to-nature morphology, which allows the restoration to be functionally integrated without any problems. Using the laboratory composite SR Nexco to recreate gingival tissue is a good restorative approach. In contrast to ceramic materials, the composite resin is easy to handle and delivers exceptionally esthetic results (Fig. 13). The light weight of the material is an added bonus. An all-ceramic restoration (zirconium oxide framework, layering ceramic, gingival mask) weighs almost twice as much as a titanium-composite resin denture. Another advantage of the type of restoration described here is its long service life.

Fig. 12 The restorations on the implants in the upper and lower jaw

Fig. 13 Close-up view: The macro- and microstructure of the teeth and the characteristic play of colour of the gingiva is clearly visible.

Fig. 14 The complex restoration gave the patient a new lease on life.

Conclusion

The success of an implant-retained denture depends on the systematic coordination of all the surgical and prosthetic requirements. A strict procedure needs to be followed from the treatment plan to the final outcome. Layering gingival portions with a laboratory composite represents a genuine improvement on previous materials and methods with regard to esthetics, handling and hygiene (Fig. 14).

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Product list

Product	Product name	Manufacturer
Plaster (impression, articulation)	Snow White	Kerr
Articulator	Artex	Amann Girrbach
Registration device (esthetic)	Ditramax pack	Ditramax
Denture teeth	SR Phonares II	Ivoclar Vivadent
Titanium framework	Procera	Nobel Biocare
Bonding agent (composite, metal)	SR Link	Ivoclar Vivadent
Heat-curing denture base material	ProBase Hot	Ivoclar Vivadent
Composite		
– gingiva	SR Nexco Paste Gingiva, SR Nexco Paste Intensive Gingiva	Ivoclar Vivadent
Light-curing unit		
– intermediate curing	Quick	Ivoclar Vivadent
Oxygen blocker	SR Gel	Ivoclar Vivadent
Polishing paste	Universal Polishing Paste	Ivoclar Vivadent
Abutments	Multi Unit Abutments	Nobel Biocare

A simple tool, effectively used

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SR Nexco Flask is a press flask that replaces the conventional composite layering method with an efficient overpress technique. The result is a streamlined workflow in the laboratory.

In this report, Dr Damir Jelušić and Vinko Iljadica take the reader through the stages of an indirect restoration to show when, and in which areas, it can make sense to replace the conventional composite layering technique with the purposeful use of the SR Nexco Flask, designed for the press technique in conjunction with light-curing lab composites. In the course of the restoration, it becomes evident that the overpress technique streamlines the work process in the lab and considerably increases the predictability of the final result.

In recent years, composite restorations have been pushed to the periphery of dental technology due to the focussed further development of esthetic ceramic materials and their continued advance in dentistry. The composite materials themselves contributed to the rise of ceramic due to their unfavourable physical properties: they demanded not only a taxing and time-consuming layering procedure (their stickiness alone made the application very difficult) but they also entailed a certain degree of uncertainty with regard to their depth of cure: you could just never be quite sure if they were cured along the entire depth. In addition, adapting the composite after the final polymerization often proved difficult. More shortcomings could undoubtedly be added. However, should this not be reason enough for change?

Advances resulted from adding newly developed technologies to dental materials

In an effort to find a solution to some of the above shortcomings, Ivoclar Vivadent introduced the light-curing lab composite SR Nexco. From the very moment you put your hands on this material, you can feel how user-friendly it is. The material simply does not stick. The application procedure can be additionally facilitated by using SR Modelling Liquid. Furthermore, the composite does not leave a film that may adversely affect the bond to subsequent layers. Characterizations can be applied with the SR Nexco Stains and tack-cured in 10 seconds. The composite also bonds effectively to rough surfaces and can therefore be used for add-ons later on. It features excellent polishing properties. Given the wide range of shades of the SR Nexco Paste Gingiva materials, we have good reason to allow composites such as SR Nexco back into our laboratory.

We live in a high-tech world where the dental market is awash with advanced CAD/CAM systems and dentistry is on the brink of becoming completely digital. Against such a back-ground, it is almost unimaginable that a simple tool such as the SR Nexco Flask can assist the work in the dental lab in such a meaningful way and streamline the workflow so well.

SR Nexco Flask is a classic flask for the press technique. The flask has been optimized by dental technicians. It is mainly made of aluminium and comes with a separate insert (block-out), transparent top half and three screws to lock the flask halves together.

The top flask half is made of transparent Plexiglas to facilitate the transmission of light and ensure a homogeneous polymerization. This straightforward flask system has been developed in addition to the conventional layering method to provide an efficient and fast press technique and, as a result, to streamline the work process in the laboratory, particularly in conjunction with long-span restorations.

Fig. 1 Wax-up of the lower jaw to match the complete denture in the upper jaw. Shape, size and function are optimally coordinated.


Figs 2 and 3 Implant-retained titanium framework for the All-on-4 restoration in the lower jaw, based on the full-contour set-up, which had been digitized by scanning and reduced in the software.

Fig. 4 A silicone key was created to ensure a precise transfer of the tooth positions and shapes. The key defines the space available for the composite.

Case report

This report describes the prosthetic treatment of a completely edentulous 60-year-old patient. Although the patient wore a periodontally supported lower bridge when we first saw him, the abutment teeth had become so loose that the bridge could no longer be saved (Fig. 1). The teeth were extracted and four implants were placed interforaminally. The plan was to restore the mandible with a direct screw-retained restoration on four implants according to the All-on-4 concept (Figs 2 to 4) and the maxilla with a complete, mucosa-supported denture. The mandibular implant-retained restoration would be fully veneered with composite, while the maxillary denture would only receive characterizations.

After the tooth set-up had been tried in on the patient, the maxillary denture was completed using the Ivobase system from Ivoclar Vivadent. This system provides a fully automated procedure for the manufacture of the denture base and ensures that the denture teeth are flawlessly and firmly integrated into the base. The maxillary prosthesis must be capable of withstanding the biomechanical forces of the mandible, which will be restored with a direct screw-retained composite bridge according to the All-on-4 concept. The mandibular teeth were set up in wax and matched to the denture in the upper jaw. In this way, a perfect fit in terms of shape and size can be achieved (Fig. 1).

The mandibular set-up was scanned. This data (tooth set-up) was then used to manufacture an anatomically reduced Nobel Procera framework (Figs 2 and 3). After this, a silicone key was

Figs 5 to 7 Prefabricated SR Phonares II teeth from Ivoclar Vivadent were used as models for the final restorations and waxed up on the titanium framework with the help of the silicone key.

Fig. 8 Before investing the waxed-up framework, an occlusal check was carried out in the articulator. This preempts the need for later adjustments and increases the efficiency.

Fig. 9 Once adjustments were no longer necessary, the framework was invested in the lower flask half using silicone putty with a Shore hardness of 85.

created to ensure an accurate transfer of the tooth set-up and tooth shapes to the final restoration. With the help of the silicone key, the space between the Procera titanium framework and the composite can be specified and this will also determine the thickness of the material (Fig. 4). The prefabricated SR Phonares II teeth are characterized by a pleasing form and texture. Why not take advantage of these qualities and use them for both the denture in the maxilla and the set-up in the mandible? After all, the tooth set-up of the composite bridge to be fabricated later on would be matched to the upper teeth. It was therefore necessary to transfer the exact contour and position of the SR Phonares II teeth in the mandible to the final restoration in composite. This is where the SR Nexco Flask comes in handy. With the help of the silicone key (matrix), it was child's play to transfer the waxed-up SR Phonares II teeth to the titanium framework. To simulate the final result, the silicone key was filled with wax and "fitted" on the Procera titanium framework (Figs 5 to 7).

It is important to check the occlusion in an articulator before investing the waxed-up framework in the flask (Fig. 8). When no more adjustments were required, the framework was invested in the lower flask half using silicone putty with a Shore hardness of 85 (Fig. 9). All the undercuts and screw channels must be blocked out with wax. It is crucial to use wax which is resistant to the heat that will arise during the subsequent light-curing process (Figs 10 and 11). The gingival mask and the plaster surfaces were isolated with SR Separating Fluid to prevent them from sticking to the clear silicone to be added later on (Figs 12 and 13). Once prepared, the object was invested (Fig. 14).


Figs 10 and 11 Undercuts and screw channels must be blocked out. If wax is used, it must be capable of withstanding the heat of the subsequent light-cure.


Figs 12 and 13 The plaster surfaces and gingival mask were isolated with SR Separating Fluid to ensure that no clear silicone would later on stick to these surfaces.

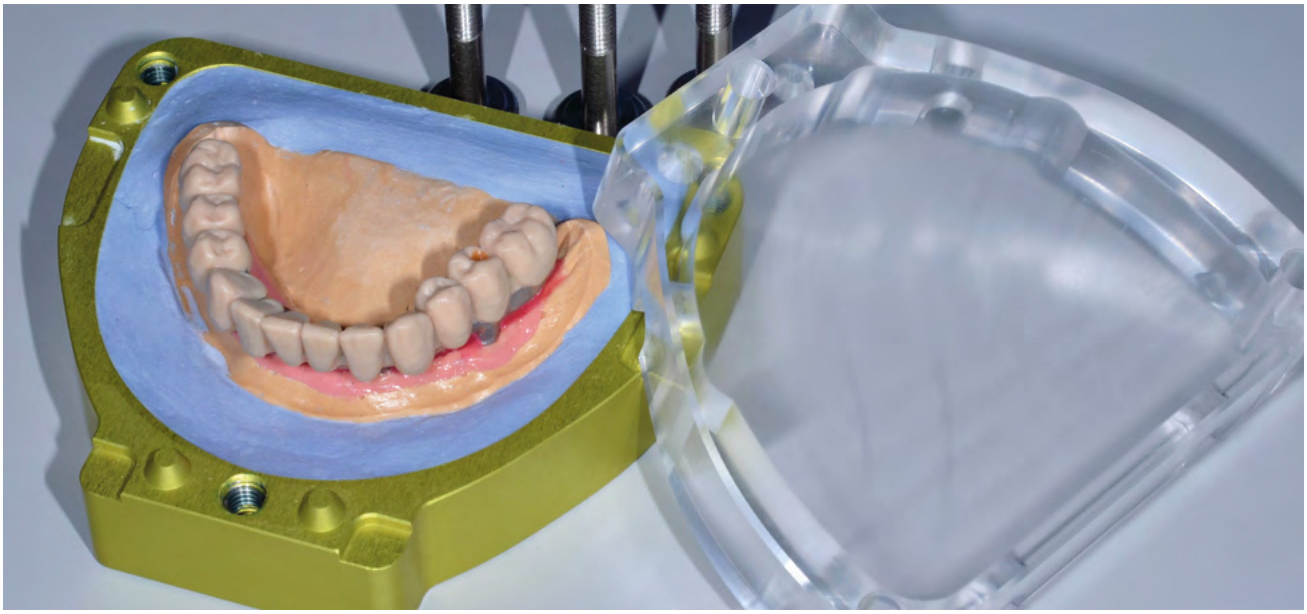
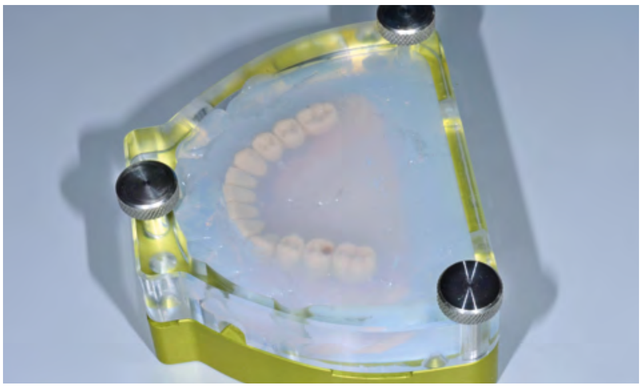


Fig. 14 Once the object was prepared and secured in the lower flask half, it was ready for investing and producing the opposing mould.

The flask was loaded with Transil F clear silicone to box the object in the flask. Given its clear shade, the silicone ensures an adequate light transmittance during the subsequent polymerization process and is therefore ideally suited for the fabrication of the silicone mould. Before the upper flask half was returned, a layer of clear silicone was applied to the teeth to prevent bubbles from forming in the critical marginal areas of the future restoration (Fig. 15). After this, the upper flask half was joined with the lower half and the entire flask was loaded with Transil F clear silicone (Figs 16 and 17). This step should be carried out promptly because the setting time of the silicone is relatively short. The tips of the Transil F cartridges exactly fit into the opening of the upper flask half to ensure that the remaining hollow in the upper flask half can be filled easily and quickly with silicone. It is important that the silicone does not polymerize until the flask is completely loaded and the fixing screws are firmly tightened.

After approximately 30 minutes, the silicone was set completely. The flask halves were separated, the framework was carefully taken out and the wax was removed. At the next step, the titanium framework was sandblasted with aluminium oxide (Fig. 18). Subsequently, SR Link metal-composite bonding agent was applied in a thin, even coating using a

Fig. 15 Transil F clear silicone from Ivoclar Vivadent is tailored for investing in the flask. The clear material ensures adequate light transmittance in the subsequent polymerization. A layer of clear silicone was first applied to the occlusal and cervical areas to prevent bubbles from forming.



Figs 16 and 17 Transil F clear silicone was then injected through the openings on the upper flask half to completely fill the hollow of the assembled SR Nexco Flask.

Fig. 18 After about 30 minutes, the flask halves were separated, the framework was carefully demoulded and liberated from wax. The titanium framework was now conditioned by sandblasting with aluminium oxide…

Figs 19 and 20 … and then SR Link metal-composite bonding agent was applied in a thin and even coating with a brush.

brush (Figs 19 and 20). This is required to facilitate a chemical bond to the opaque layer. After a contact time of approx. 60 seconds, excess liquid was carefully dispersed with compressed air and a layer of SR Nexco Opaquer was applied (Fig. 21). The opaquer was light-cured in a Lumamat 100 light unit (Fig. 22).

The SR Nexco composite materials can be applied directly and evenly without warming them up beforehand. However, the composites may be additionally warmed up to soften them slightly before use. This makes them easier to inject into the silicone mould.

To overpress the framework, the dentin material was applied first. For this purpose, SR Nexco Paste Dentin material was carefully applied into the silicone mould. Bubbles and inclusions should be avoided (Fig. 23). After having been loaded, the silicone mould was then returned to the flask base and the screws were firmly tightened. In this way, the SR Nexco Paste Dentin material is pressed onto the framework as the first layer. The dentin layer was subsequently light-cured in the Lumamat 100 (Fig. 24). After the light-curing process, the flask halves were separated and the dentin pressing was removed. The result was a stable full-contour tooth shape made of dentin material (Fig. 25). In this case, the pressing resulted in a full-contour copy of the set-up (of the SR Phonares II teeth) in SR Nexco dentin material.

The incisal area was then reduced and mamelons were created (Fig. 26). This stage is ideal to apply a variety of characterizations using the SR Nexco Stains materials. However, the case

Fig. 21 After a contact time of about 60 seconds, the bonding agent was carefully dispersed with compressed air to allow for the application of a layer of SR Nexco Opaquer.

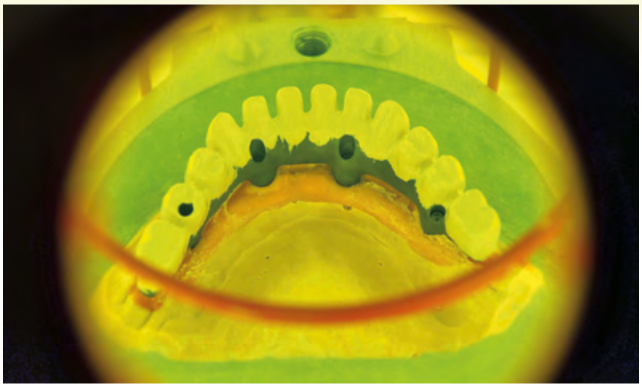


Fig. 22 The opaquer was polymerized in a Lumamat 100 unit.

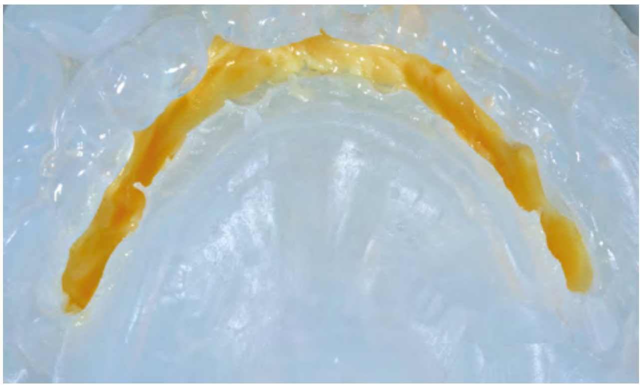


Fig. 23 To make the SR Nexco composites less viscous and facilitate the injection into the silicone mould, they may additionally be warmed up before use. To overpress the framework, dentin material was first applied into the silicone mould.

Fig. 24 After locking the flask halves together, the framework with the pressed dentin was again light-cured in the Lumamat. After polymerization, …

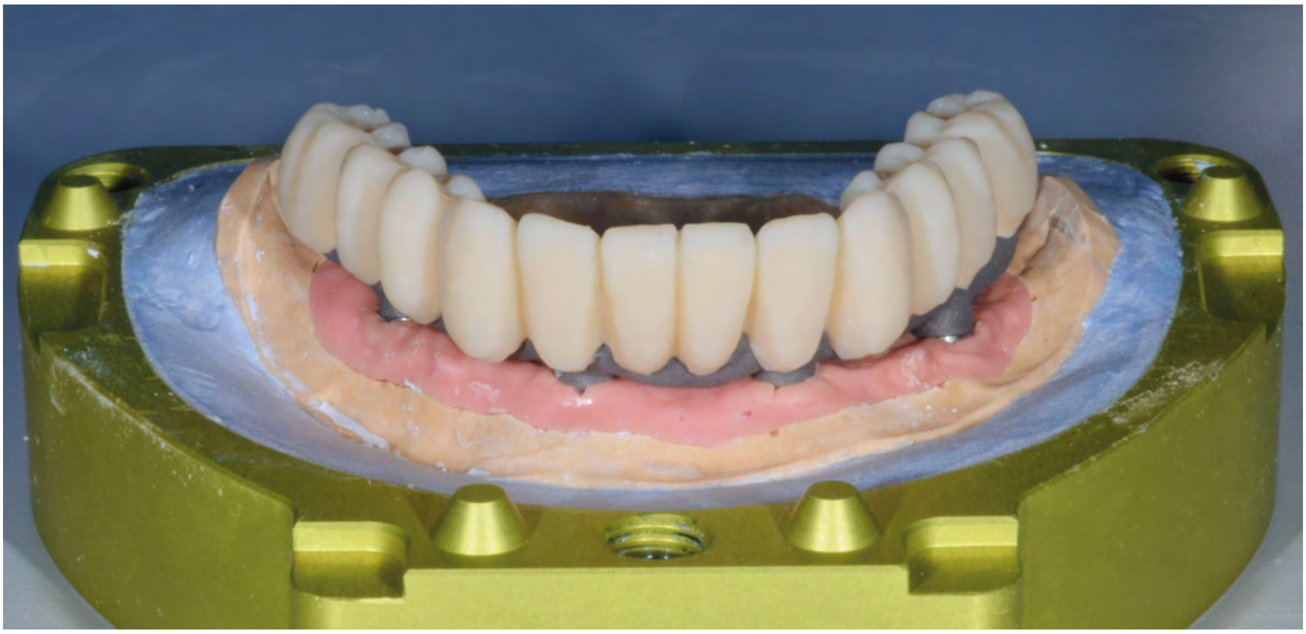
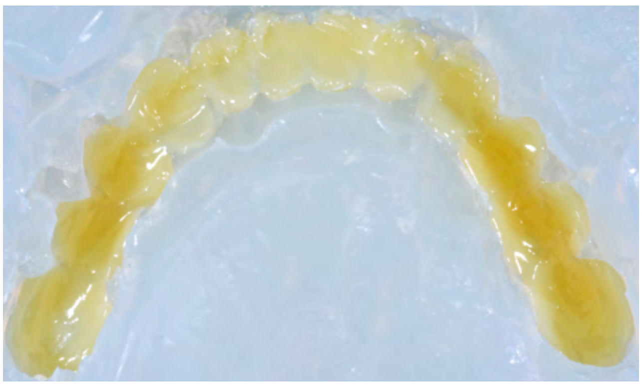


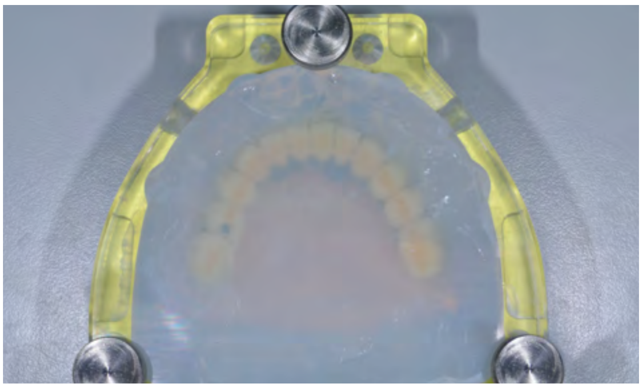
Fig. 25 … the flask halves were separated and the dentin pressing was removed. Here, the dentin pressing is shown after having been demoulded and returned. It is a full-contour copy of the set-up in SR Nexco Dentin.

Fig. 26 The dentin was then reduced in selected areas – here at the incisals. Mamelons were also created.

Fig. 27 To increase the translucency in the incisal area, SR Nexco Paste Opal Effect OE1 was applied.

Fig. 28 A small amount of SR Nexco Stains white and orange was applied to the occlusal area of the posterior teeth to enhance the depth effect.





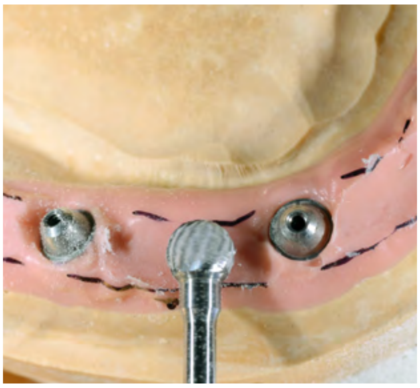
Figs 29 and 30 The implant-retained mandibular denture was now ready for the application of the SR Nexco Paste Incisal materials and was then returned to the flask.

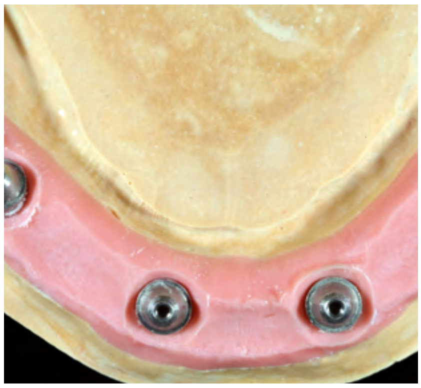
Figs 31 and 32 The final overpressed, polymerized and finished framework was removed from the flask, together with the model, and an occlusal check was carried out in the articulator.

presented here did not require any additional customizations, as the aim was to match the shade to the SR Phonares II teeth in the upper jaw. Yet, a small amount of SR Nexco Paste Opal Effect OE1 was applied in the region of the mamelons to heighten the translucency (Fig. 27). Additionally, the occlusal area was enhanced with small amounts of SR Nexco Stains white and orange to create a depth effect (Fig. 28). The mandibular restoration was now ready for the application of SR Nexo Paste Incisal material before it was returned to the flask. The incisal material was pressed using the same procedure as for the dentin pressing (Figs 29 and 30). Once the incisal material was light-cured, again in the Lumamat 100, the press procedure was complete. The final overpressed framework (Fig. 31) was removed from the flask. The occlusal check showed an astoundingly precise fit. No additional adjustments of the occlusal contacts were required (Fig. 32). This really says something about the precision and efficiency of this technique.

The next step was to build up the gingival portions with the SR Nexco Paste Gingiva composites. However, before the layering could be begun, the master model had to be prepared. This meant that selected gingival areas were reduced to allow for a convex design of the contact areas between the bridge framework and the oral mucous membrane later on. This will make dental hygiene considerably easier for the patient (Figs 33 to 35).

To design the gingival areas, the part of the framework which had not been overpressed was first coated with a layer of pink



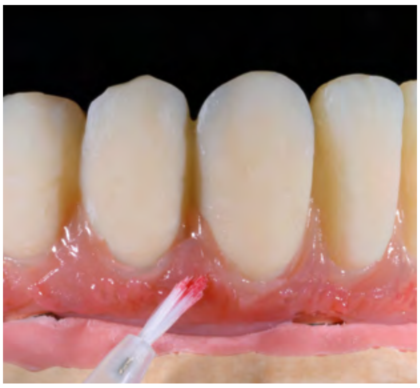


Figs 33 to 35 Once the white esthetics were completed, the design of the gingival portions with the SR Nexco Gingiva materials began. Selected gingival areas were given a convex shape to make it easier to clean the partly removable prosthesis later on.

Fig. 36 Before reproducing the gingival parts, a layer of pink SR Nexco Gingiva Opaquer was applied.

Fig. 37 The opaque framework portions were coated with a covering layer of SR Nexco Paste Basic Gingiva in shade BG 34.

Fig. 38 A mixture of SR Nexco Paste Gingiva G4 and "chili" SR Nexco Paste was applied to the well perfused areas of the gingiva on top of the foundation of SR Nexco Paste Basic Gingiva.



Figs 39 to 41 The area below the papillae was characterized with SR Nexco Stains in shade "chili". The gingival margins along the teeth were imitated with light pink SR Nexco Paste Gingiva G3.

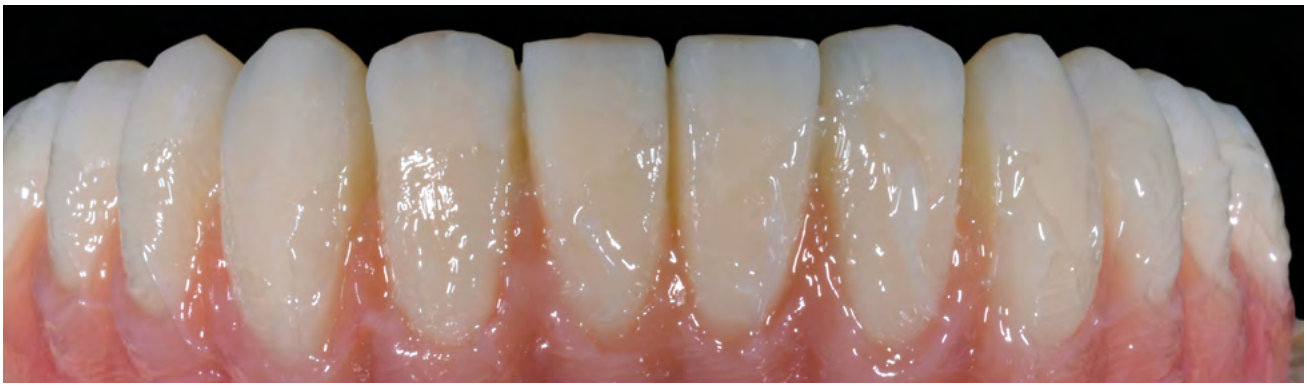


Fig. 42 The entire restoration was light-cured once more. SR Gel was applied to the layered gingival areas to prevent the formation of an oxygen inhibition layer.

Figs 43 and 44 Restorations made of SR Nexco Composite can be easily finished and polished to a high gloss with burs, brushes and felt wheels.

SR Nexco Gingiva Opaquer (Fig. 36). Once the opaque layer was polymerized, it was completely coated with SR Nexco Paste Basic Gingiva in shade BG 34 (Fig. 37). This created a gingiva-coloured foundation onto which more intensive shades could be applied to characterize the gingiva. Mixing SR Nexco Paste Gingiva G4 and "chili" SR Nexco Stains resulted in an ideal reddish hue to reproduce the well perfused gingival areas (Fig. 38). The "chili" shade is also useful for "drawing" blood vessels on the gingiva-coloured foundation to make the gingiva look even more natural. In this case, the gingival surfaces were intensely characterized using this method and then coated with SR Nexco Paste Gingiva G4. The areas of attached gingiva were perfected using light pink SR Nexco Paste Gingiva G3 (Figs 39 to 41). This step completed the design of the gingival contours. Subsequently, the restoration was light-cured again, and for the last time in this case. To prevent the formation of an oxygen inhibition layer, the teeth and gingival areas were covered with SR Gel prior to polymerization (Fig. 42).

Once polymerized, the SR Nexco composites can be easily finished and polished to a high gloss using burs, brushes and felt wheels (Figs 43 and 44). To achieve an optimum shade match with the upper jaw, the gingival portions of the maxillary prosthesis were characterized accordingly (Fig. 45).

Fig. 45 The gingival areas of the upper denture were characterized to match them to the lower denture. In this way, a harmonious result was attained and the requirements of the set-up were met.

Conclusion

Although most technicians prefer ceramic options, composites definitely provide preferable qualities for certain indications. Easy processability and low susceptibility to wear present essential aspects in this context. The SR Nexco Flask is an extremely useful tool in the dental lab to convert the planned design into the final restoration faithfully. With the help of the SR Nexco Flask, the white esthetics of even long-span composite bridgework can be completed in only three curing steps (Fig. 46).

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Fig. 46 Once inserted in the patient's mouth, the dentures – mucosa-supported in the upper jaw and implant-supported in the lower jaw – not only restored the function of the space between the upper and lower jaw but also returned an age-appropriate appearance to the face of the 60-year-old patient, as can be seen on the before and after pictures.

Product list

Product	Product name	Manufacturer
CAD/CAM system	NobelProcera	Nobel Biocare
Bonding agent, composite/metal	SR Link	Ivoclar Vivadent
Implant superstructure, titanium	NobelProcera Implant Bridge	Nobel Biocare
Cold-curing denture base material	ProBase Cold	Ivoclar Vivadent
Composite		
– teeth	SR Nexco Paste	Ivoclar Vivadent
– gingiva	SR Nexco Paste Gingiva	Ivoclar Vivadent
Flask	SR Nexco Flask	Ivoclar Vivadent
Light-curing unit	Lumamat 100	Ivoclar Vivadent
Modelling liquid	SR Modelling Liquid	Ivoclar Vivadent
Denture base polymerization unit	Ivobase system	Ivoclar Vivadent
Denture teeth, prefabricated	SR Phonares II	Ivoclar Vivadent
Oxygen blocker	SR Gel	Ivoclar Vivadent
Silicone, flowable, clear	Transil F	Ivoclar Vivadent
Silicone, putty	Zetalabor Platinum 85	Zhermack

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Step by step:

Artificial gingiva made of SR Nexco on a metal-ceramic bridge

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Didier Crescenzo
(Golfe de Saint Tropez, France)

The following article describes how to use the light-curing laboratory composite SR Nexco to build up the gingival part of a metal-ceramic bridge.

Preoperative situation

Dr Frédéric Chiche inserted two implants to replace tooth 33 and 43. The treatment possibilities were previously established with the help of temporaries.

Fig. 1

Preoperative situation: inadequate restoration. The abutments of 43, 31, 32 and 33 were missing. Moreover, considerable tissue and bone loss was evident. Root resorption in tooth 33 and a crack in tooth 32 had caused the alveolar ridge to collapse in the region of 31, 32 and 33. Consequently, the new restoration would require artificial gingival portions made of SR Nexco.

Metal-ceramic bridge

Fig. 2

Framework try-in. The framework was designed in such a way that artificial root and gum tissue could subsequently be added.

Fig. 3

Selection of the shade in the corresponding position

Try-in and selection of the gingiva colours

Fig. 4

Fig. 5

Fig. 6

Completion of the implant-supported bridge framework made of semi-precious metal after the intraoral try-in. This approach ensures the proper fit of the framework before ceramic layering.

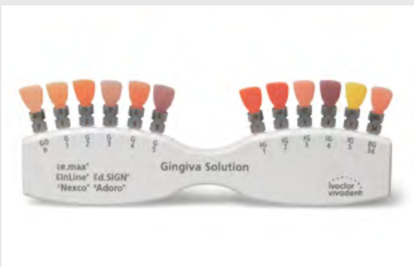

Fig. 7

Gingiva Solution shade guide

Fig. 8

Mould for pressing the individual SR Nexco colour samples featuring different levels of chroma. They supplement the existing shade samples from Ivoclar Vivadent and therefore heighten the accuracy of the shade selection process.

Fig. 9

Personalized SR Nexco shade guide produced with the help of the My Shade Guide tools.

Fig. 10

Fig. 11

Fig. 12

Figures 10, 11 and 12 show the try-in of the framework and the selection of the intensive SR Nexco Paste Gingiva materials. The different shade samples fabricated in the laboratory provided a useful aid in devising the layering scheme. In the present case, SR Nexco Paste Gingiva G3 and G4 as well as the intensive SR Nexco Paste Intensive Gingiva IG2 and IG3 were selected.

Fig. 13

The volume of the restoration was built up and then the surface was created. Its texture and geometry including the vertical and horizontal transitions were carefully crafted. In view of the space requirements and the tooth alignment, three incisal teeth and two canines were chosen to achieve a balanced result.

Artificial gingival areas

Fig. 14

After the unglazed ceramic had been fired, the shape and shade of the bridge was checked in the mouth. Subsequently, the bridge was glazed and mechanically polished. Then the ceramic surface was prepared for the application of the gingiva-coloured light-curing laboratory composite SR Nexco.

Fig. 15

The surfaces onto which SR Nexco would be applied were blasted with maximum 1.5 to 2 bar pressure. The surfaces that needed to be protected from accidental application of the composite resin were coated with a fine layer of wax.

The hydrofluoric acid gel (Etching Gel) supplied in the IPS Ceramic Kit from Ivoclar Vivadent was applied to the corresponding areas for 60 seconds in preparation for the application of SR Nexco. After this reaction time, the remaining gel was rinsed off with plenty of water. Finally, the entire bridge was steam cleaned.

The surfaces in question were coated with a thin layer of the universal primer Monobond Plus using a brush. The primer was allowed to react for one minute. Next, the light-curing bonding agent Heliobond was applied and cured with a curing light.

Fig. 16

SR Nexco Paste composite resin in syringes

Fig. 17

Universal Polishing Paste, polishing brush and cotton buffing wheel

Fig. 18

In preparation for layering the gingival composite resin, the plaster model was isolated with SR Model Separator. Then the light-curing laboratory composite SR Nexco Paste was applied. A composite warmer can be used to increase the flow of the materials. However, these composite resins can be applied evenly and homogenously without any warming. SR Nexco Pastes are generally characterized by excellent viscosity and handling.

First, a layer of intensive, dark pink SR Nexco Paste Intensive Gingiva IG3 and IG2 was applied. The convex areas were created with light pink SR Nexco Paste Gingiva G3 and G4, since these materials are more translucent.

Fig. 19

A few indentations between the layers were created by lightly tapping the restoration with the tip of a brush.

Fig. 20

Fig. 21

Enhancement of the concave and convex contours: After the layering process was completed, the oxygen inhibiting SR Gel was applied to prevent the formation of an inhibition layer on the SR Nexco surfaces during final polymerization.

Then the restoration was polymerized in a light-curing unit according to the instructions of the manufacturer (for more information about light curing, please consult the SR Nexco Instructions for Use).

The SR Nexco surfaces were first polished with Universal Polishing Paste using long and soft brushes. They were subsequently polished to a high gloss with cotton buffing wheels, without using any polishing paste.

Fig. 22

Layering scheme for the different SR Nexco composite materials. It is important to use the high-chroma products first. Then the colours with medium chroma are applied in the concave areas. Lighter materials are placed on the curvatures. Translucent materials are used to completely build up the gingiva and to create the transitions to the natural soft tissue.

Fig. 23

It is of utmost importance to prevent any voids under the bridge framework, so that the dentist can properly shape the soft tissue, which should eventually be flat enough for the patient to take all the necessary cleaning measures without any problems.

Fig. 24

Completed bridge after small adjustments were made under teeth 41 and 42.

Fig. 25

Clinical situation

Fig. 26

The patient's smile looks natural and pleasing despite the asymmetry of the dentition and the missing incisor.

Product list

Product	Product name	Manufacturer
Composite		
– gingival tissue	SR Nexco Paste Gingiva	Ivoclar Vivadent
Shade guide (Gingiva)		
– standardized	Gingiva Solution	Ivoclar Vivadent
– personalized	My Shade Guide	Smile Line
Hydrofluoric acid gel	Etching Gel	Ivoclar Vivadent
Universal primer	Monobond Plus	Ivoclar Vivadent
Bonding agent (composite-ceramic)	Heliobond	Ivoclar Vivadent
Separating liquid	SR Model Separator	Ivoclar Vivadent
Oxygen inhibiting gel	SR Gel	Ivoclar Vivadent
Polishing paste	Universal Polishing Paste	Ivoclar Vivadent

Summary

The described technique allows restorations to be conveniently adjusted at a later stage. Pontic areas can be augmented at any time should the gingival segments have to be changed in the future. This is a considerable advantage of composite resin restorations. If changes become necessary in a ceramic bridge after several years of use, the restoration would have to be re-fired.

We would like to thank Dr Frédéric Chiche for his outstanding work and his collaboration in the implantological and prosthetic steps. We are also indebted to Dr Gil Tirlet for the clinical pictures and his invaluable and reliable assistance.

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SR Nexco®

The light-curing lab composite

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- **Multiple applications** for framework-based and framework-free restorations
- **Efficient veneering** of frameworks with SR Nexco Flask

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