REFLECT

dental people for dental people 01/10

Esthetics redefined
Implant-borne dental prostheses with SR Phonares® teeth

Comfort through innovation
Removable dental prostheses on implants

The reconstruction of pink and white esthetics
The pink hybrid technique used in combination with the IPS e.max® system

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Editorial

Dear Reader

Up until quite recently, the dental industry remained almost unaffected by global economic conditions. Considerable losses were experienced in this sector for the first time in the fourth quarter of 2009. Even though the economic situation seems to be improving in many countries around the world, we must continue to be vigilant. In economically difficult times, it is important to focus on making product and process improvements that are comprehensible to customers and will further heighten their efficiency and performance.

This edition of Reflect contains case reports of recognized dental professionals who are working with cutting-edge and extremely result-oriented products and techniques. The readiness of authors to share their experiences with us, and of course with you, continues to motivate us to supply outstanding products that will enable you to fulfil the demands of quality conscious and esthetically discerning patients and therefore help to restore their well-being.

In our range of Ivoclar Vivadent all-ceramics, the unique lithium disilicate glass-ceramic stands out with its highly esthetic properties and exceptional physical characteristics. As a result, this product is seriously challenging the position of zirconium oxide as a material for fabricating single crown restorations, irrespective of the processing technique used to produce the dental work – press or CAD/CAM technique. In this edition of Reflect, we introduce you to the many different possibilities offered by the IPS e.max® system.

In the field of implant prosthodontics, implant-supported removable dentures are growing in popularity. The unique implant denture teeth SR Phonares® represent a new development in this segment. These teeth are particularly suitable for use in removable dentures, because of their striking esthetics and optimized wear properties – due to the innovative material composition. The corresponding article reveals more about this interesting topic.

Finally, this edition also features fascinating and successful case reports involving direct restorative materials: for example, the new IPS Empress® Direct, which produces results that are difficult to distinguish from layered ceramic restorations. The outcomes achieved with one of our proven universal composites are just as impressive.

I wish you much reading pleasure and hope that you find this edition of Reflect just as interesting and inspiring as I do.

Yours

Josef Richter
Chief Sales Officer

The cover picture shows the different layers of SR Phonares NHC teeth (photo: Nicole Schweizer).

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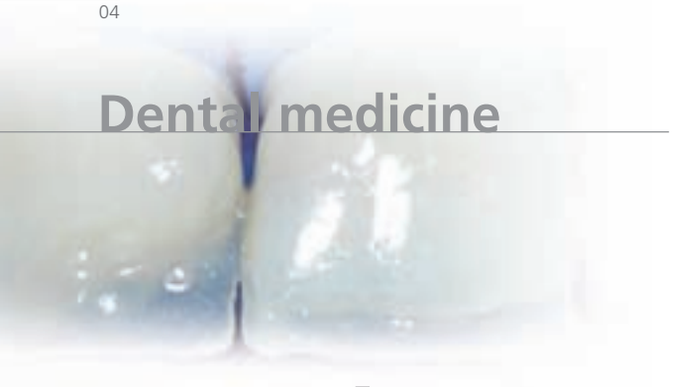


Esthetic reproduction of anterior teeth

Restoration of anterior teeth with IPS Empress® Direct composite resin

Dr Julio Reynafarje and Dr Rony Hidalgo, both from Lima/Peru

Dental composite resins continue to undergo further development with the objective of successfully reproducing all the visual and physical aspects of the tooth structure. Materials such as IPS Empress Direct are evidence of the fact that this goal has been achieved for all practical purposes. The restorative's favourable handling properties and its wide processing window make it easier for practitioners to fabricate esthetically pleasing restorations. As a result, the material has become an indispensible tool in esthetically-oriented dental practices.

Our patient presented with concerns about the appearance of his upper incisors. At that time, his 13-month orthodontic treatment had just come to an end. The orthodontic appliances were removed and his teeth received prophylactic treatment. Subsequently, his front teeth were whitened (Fig 1). While the patient waited during the whitening procedure, impressions were taken of both dental arches and study models were fabricated. As a guideline for our treatment, we fabricated a diagnostic wax-up of the anterior teeth. In the process, we considerably cut back the palatal side of the teeth that needed to be restored. After having checked the occlusion, we used a high viscosity silicone material to make a precision impression of the palatal surface of the wax-up of the upper front teeth. We used this impression as a matrix in the reconstruction of the teeth. It was important to reduce the gingival margin of the silicone impression to prevent any overlaps once the teeth have been completely isolated and the matrix, which assists in the placement of the first increment, has been introduced. In order to achieve optimum adhesion, we waited two weeks after the whitening procedure before we began with the reconstruction of the incisors using the composite restorative. The clinical approach on which we had decided required us to remove a composite restoration on the mesio-incisal edge of tooth 11, because it did not correspond to the patient's esthetic expectations and the new whitened tooth colour. Furthermore, we bevelled the peripheral enamel of the area that needed to be restored.

In order to achieve a durable bond, we etched the vestibular and palatal areas of tooth 11 and 21 with acid (Total Etch®) for 20 seconds and we rinsed the teeth for the same amount of time. Next, we dried the surfaces with oil-free air and applied the bonding agent (ExciTE® VivaPen) (Fig 2). Subsequently, the solvent contained in the bonding agent had to be evaporated with an indirect stream of air. For this purpose, the air stream of the 3-way dental air-water syringe was directed against a dental mirror, which was held at an angle to the pre-

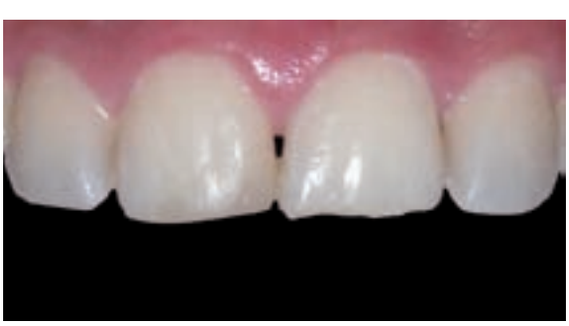


Fig 1 Preoperative situation

Fig 2 Application of the bonding system (ExciTE VivaPen)

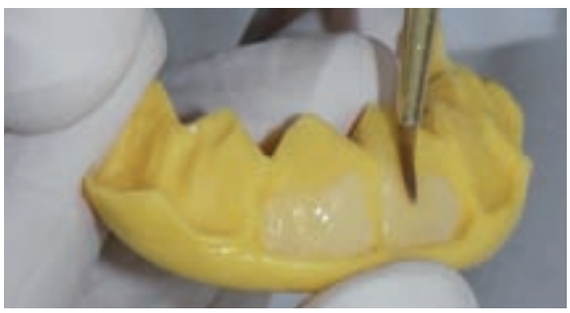


Fig 3 Placement of the translucent layer in the silicone matrix

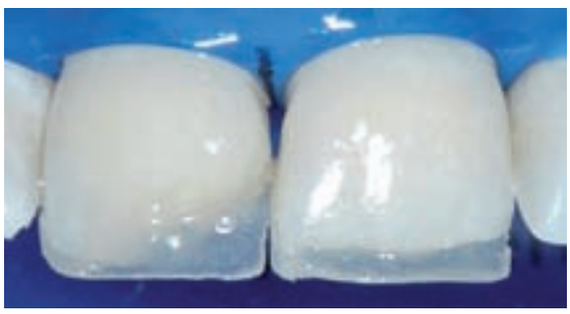
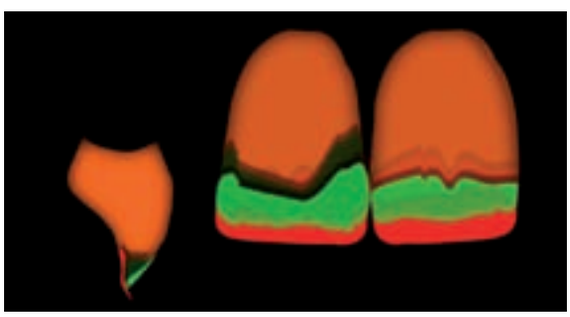


Fig 4 Light-cured translucent layer sealed with Tetric EvoFlow A2



Figs 5a and b Middle dentin layer of IPS Empress Direct A1 Dentin extending to the incisal area

pared surface. This prevented the bonding agent from becoming contaminated by any micro-droplets of water. On average this step takes 20 seconds. Nevertheless, the rule of thumb requires that evaporation be conducted until the prepared surface has a shiny and smooth appearance. At this stage, the bonding agent is ready for 10 second-light-curing using the "low" mode of the bluephase® G2 polymerization device.

We began restoring the teeth by building up the palatal side with composite resin. We placed the supporting increment in the silicone matrix. For this purpose, we used the translucent IPS Empress Direct material called Trans 30. To avoid the formation of bubbles on the palatal surface, we applied the restorative material with a brush (Fig 3).

The matrix was placed in the mouth and the composite was lightly pressed to the palatal surface of both the teeth. Next, the material was light-cured for 20 seconds using the "soft-start" mode. Immediately following this step, the joints and the adjacent tooth surfaces were sealed with a thin layer of Tetric EvoFlow® (shade A2). This was done to prevent the formation of bubbles in these areas (Fig 4).

We used opaque materials to eliminate the line between the composite resin and remaining tooth structure. In this case, we used A2 Dentin from the IPS Empress Direct range for the deep increment. We chose IPS Empress Direct A1 Dentin for the superficial increment, which extended to the incisal area. These increments imitate the appearance of natural dentin, because they correspond to the structure of natural teeth. We marked the incisal edge with a probe, in order to copy the anatomy of the mamelons and obtain translucent incisal edges (Figs 5a and b).

As soon as the dentin layers had been placed, we started work on recreating the translucency of the incisal edges. For this purpose, we used Trans Opal Effect materials from the IPS Empress Direct range. This material was used to fill the area between the dentin and the incisal edge. A brush was used to control the application of the material. Each individual layer was completely light-cured for 20 seconds using the "soft-start" mode.

Before the deep increments were completed and the enamel layers were applied, the teeth were characterized. These effects were light-cured using the "soft-start" mode for 20 seconds (Fig 6).

While we were determining the shade of the restorations, we realized that the anterior teeth showed a colour shift that extended from the middle third of the teeth to the incisal edge. In order to achieve a very life-like appearance of the restoration, therefore, we decided to desaturate the superficial shade A2 to A1 (Figs 7 to 8b). After the composite layers had been contoured, they were completely cured using the "soft-start" mode for 20 seconds.

Subsequently, all the excess composite resin had to be removed. For this type of work, we usually use a fine-grit diamond or a cross-cut carbide bur. At the same time, these instruments allow us to finish the anatomy of the teeth that we are restoring. Subsequently, the restorations were polished with the Astropol® system under continuous water cooling. Rubber polishers have an

Fig 6 Application of IPS Empress Direct Opal Effect on the incisal edge and proximal margins. In addition, application of Tetric Color white.

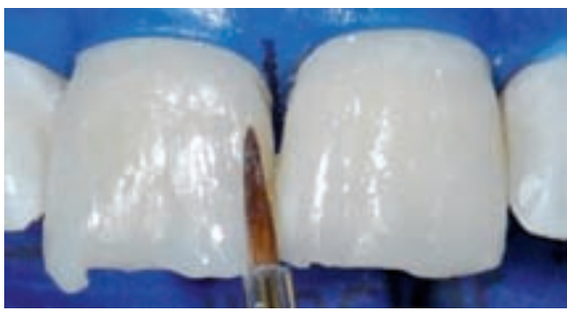
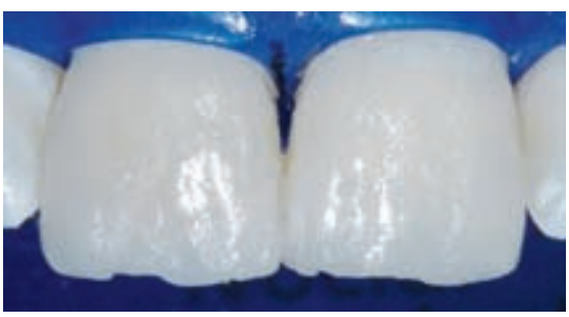
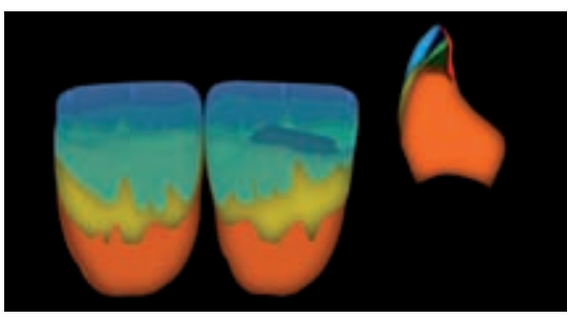


Fig 7 The middle enamel layer of IPS Empress Direct A2 Enamel is distributed with a brush.





Figs 8a and b Incisal enamel layer of IPS Empress Direct A1 Enamel; next to it, a graphic synthesis of this second vestibular enamel increment (light blue)

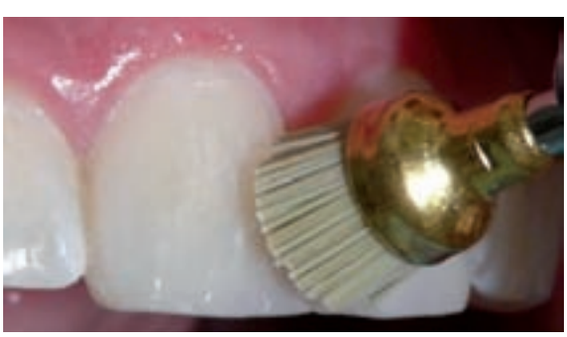


Fig 9 Polishing with Astropol. Subsequently, polishing of the proximal areas with Astrobrush.

Fig 10 Esthetic reconstruction of the front teeth. The restorations have been seamlessly integrated.

advantage over polishing discs in that they do not remove the texture of the restoration, which is achieved by individually contouring the enamel materials and distributing them with a brush. This approach maintains a natural appearance and produces the lustre expected of esthetic restorations (Fig 9).

Conclusion

Materials such as IPS Empress Direct allow the colour dimensions and translucency levels of natural tooth structure to be faithfully reproduced in dental restorations. IPS Empress Direct is easy to handle and offers a wide processing window. In addition, its flow properties allow it to be applied with brushes. Therefore, clinicians can expect to produce textures and lustres that are comparable to those of natural dentition (Fig 10). ❑

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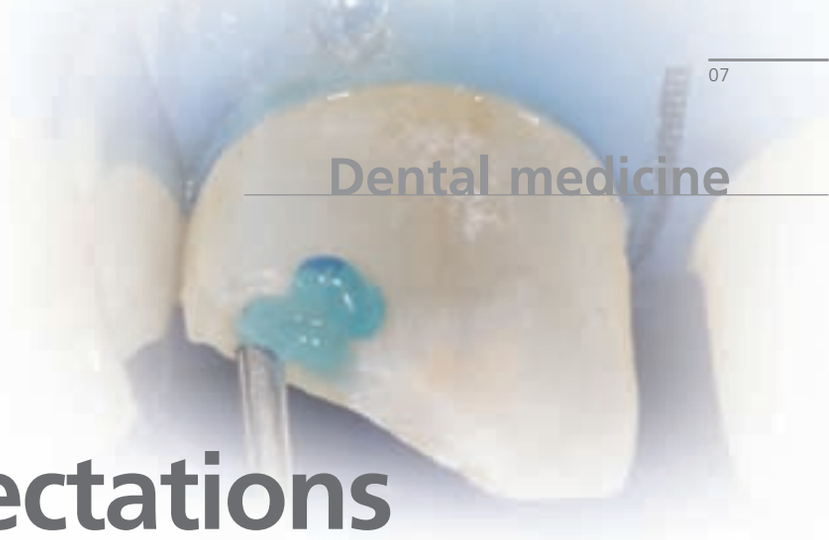


Patient expectations and restorative principles

Composite resin restoration of a maxillary anterior Class IV fracture in the adolescent patient

Arthur J Mowery Jr, DMD, Florida/USA*

Dental restorations in the anterior maxilla are often viewed with additional scrutiny because of the visibility of this region during the patient's daily function. Whereas the patient himself or herself cannot necessarily observe the shade of a resin-based restoration in the posterior quadrant or detect its marginal integrity, anterior restorations can be easily observed and any discrepancy in tooth morphology, proportion, or colour can be concerning. Consequently, the clinician's understanding of the patient's esthetic expectations and ability to reconcile them with accepted restorative principles is paramount when treating the anterior maxilla.

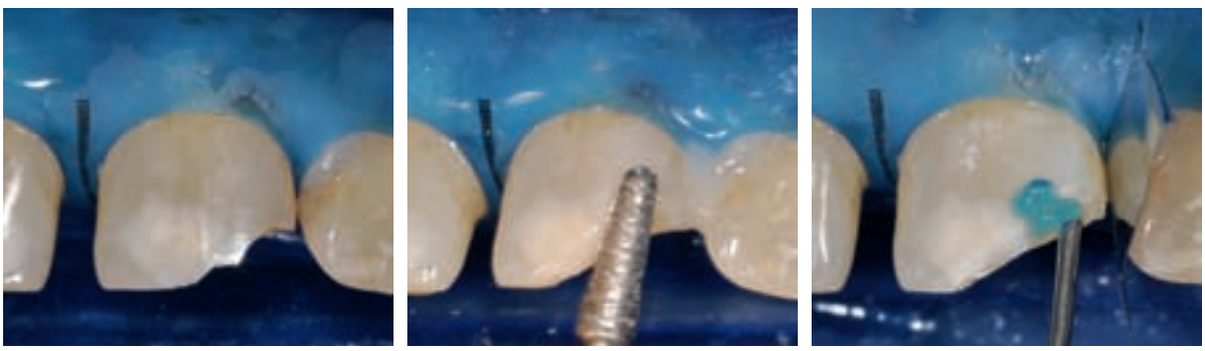
Composite resin materials enable the clinician to have chairside control over the form, texture, and colour of the patient's restoration. This is particularly valuable in the esthetic management of a single tooth in the anterior maxilla, where matching the characterizations of the adjacent dentition can be challenging through indirect treatment. Direct resin restorations are also important in the treatment of adolescent patients and in those where preservation of sound tooth structure through a minimally invasive approach will permit subsequent restoration in the future. Fortunately, contemporary adhesive materials are available in a variety of shades, handling characteristics, and strength values to meet the varying needs of the practitioner. This presentation will demonstrate a direct resin protocol for a maxillary anterior Class IV fracture presented by a 22-year-old male patient following trauma (Fig 1).

Fig 1 Preoperative view of a Class IV fracture of the maxillary left central incisor upon patient presentation

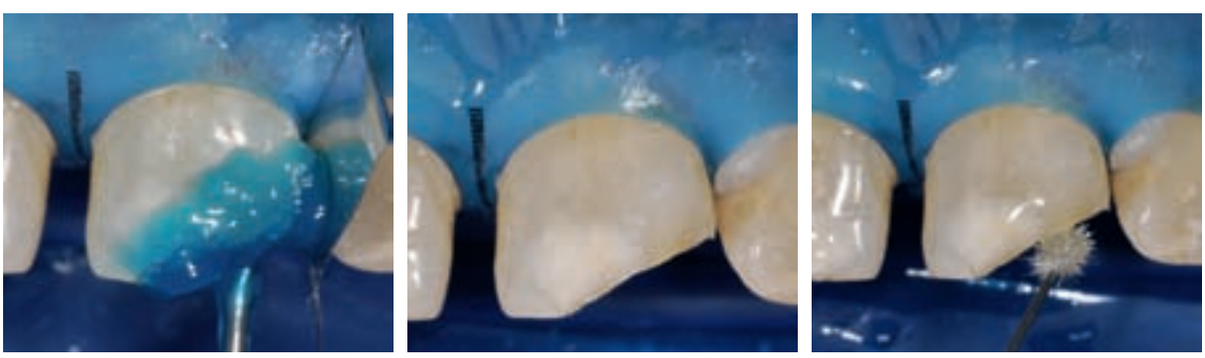
Initial examination and patient presentation

Clinical examination revealed the presence of a Class IV fracture of the distal incisal edge of the maxillary left central incisor. Radiographic evaluation showed exposed dentin but no pulpal involvement and no sensitivity. The available restorative options were discussed with the patient, who ultimately selected a treatment plan that consisted of a direct composite restoration of tooth 21, which would be completed without the administration of any anaesthesia. Signed consent was obtained, and treatment commenced.

Isolation was performed with an anatomically shaped rubber dam (OptraDam®), which would be essential in controlling moisture at the treatment site and keeping the tooth surfaces free from contaminants during the total-etch procedure. It would also allow the clinician to achieve a clean surface during the characterization of the final composite. The isolated area was then cleaned and preparation began. The rough edges of the fracture were rounded, and a facial bevel was placed using medium-grit diamond burs. This preparation design would ensure the resin would blend with the natural tooth structures and create a tooth surface conducive to adhesive bonding (Figs 2a to c).



Figs 2a to c Following placement of a rubber dam to ensure complete isolation of the treatment site and keep the tooth surfaces free from contaminants, preparation was started.



Figs 3a to c The enamel surfaces were etched (Total Etch), rinsed and dried. Subsequently, the single-component adhesive ExciTE was applied.

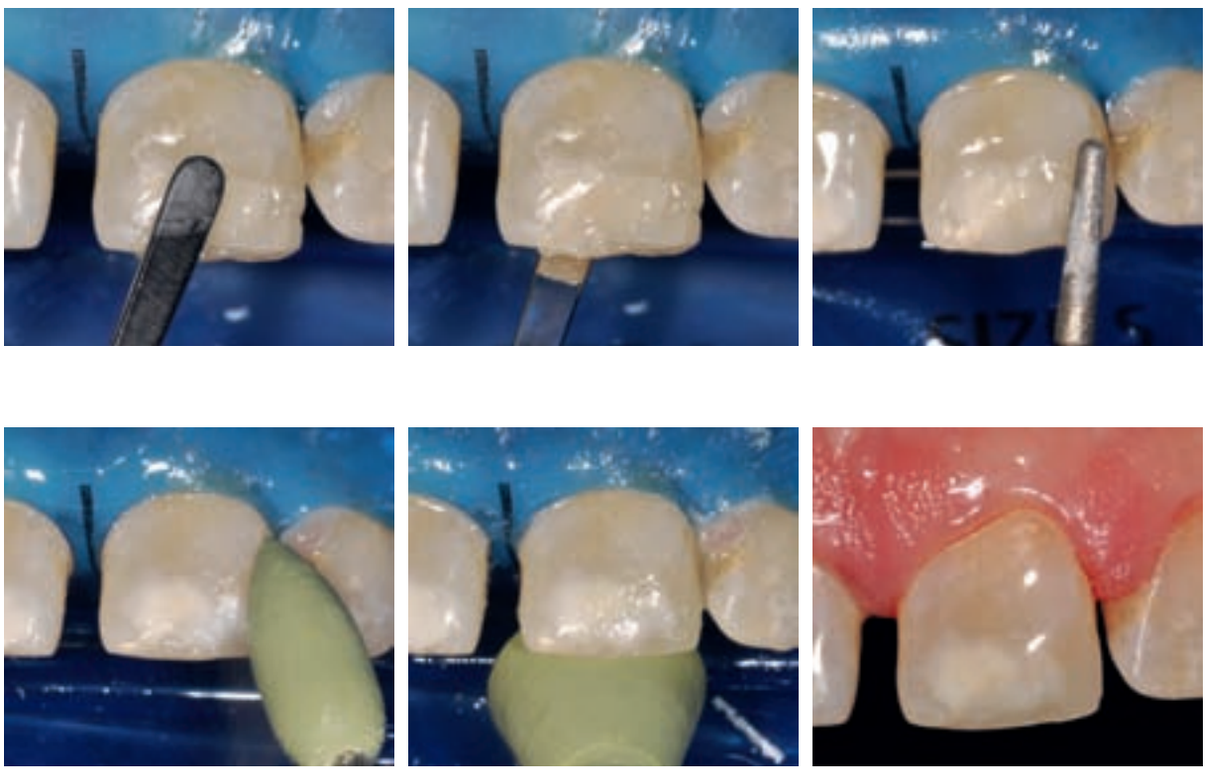
Figs 4a to c The resin was contoured with an instrument especially designed for handling composite materials (OptraSculpt).

The enamel surfaces of the tooth were etched for 20 seconds with 37% phosphoric acid (Total Etch) and then rinsed thoroughly. The surfaces were then air dried but not desiccated. Subsequently, a single-component bonding agent (ExciTE®) was applied, brushed into the tooth surface for 10 seconds. Then the coat of adhesive was air thinned and light-cured for 10 seconds on each aspect using the low-power mode (bluephase®) (Figs 3a to c).

A non-stick composite instrument (ie OptraSculpt®) was used to contour the composite resin to ideal shape.

A layering technique was utilized to achieve the proper value and hue of the final restoration. The lingual portion was placed first utilizing a body-shaded resin (ie Tetric EvoCeram®), a portion of Bleach XL was then placed to mimic the hypocalcifications of the natural teeth. An irregular surface was created with the composite instrument prior to placement of the final layer of resin using Enamel material (shade A2) (Figs 4a to c).

A translucent composite material (Tetric EvoCeram, shade T) was used for the final layer of the build-up; it



Figs 5a to f To provide the restoration with a natural incisal translucency, T material (Tetric EvoCeram) was applied. Excess material was removed and the restoration was finished.

was selected for its ability to provide the restoration with a natural incisal translucency. Excess composite resin was removed with a fine-grit diamond, and the restoration was finished with rubber polishing points and cups. A finishing brush (Astrobrush®) was used with a light touch on the facial surface to complete the natural lustre of the restoration. Occlusion was verified with articulating paper (Figs 5a to f).

The treatment was completed in a cost-effective, single visit. This direct approach enabled the clinician to control proper shading intraorally, which would have been challenging for even a talented dental technician relying upon clinical photographs and secondary information from the operator.

Acknowledgement

The author would like to thank Dr Will Martin for providing the pictures. ❑

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Comfort through innovation

Removable dental prostheses on implants

Prof Dr Christian E Besimo, Brunnen/Switzerland

The focus of prosthetic rehabilitation with implant-retained removable dental prostheses is increasingly centred on the ageing and elderly population. Consequently, general medical, psychosocial and economic factors have to be considered when determining the indication and assessing the pros and cons of different reconstructive treatment options [1]. The clinical studies available indicate that a substantial improvement in the psychosocial and functional status of the patients can be achieved with plain ball anchors on implants, comparable to the improvement attained with bar constructions [2,3]. Current cost-benefit ratios appear to speak in favour of removable reconstructions rather than fixed bridges in the edentulous jaw [4,5]. However, removable superstructures sometimes cause problems in the peri-implant soft tissue. These problems can be almost entirely eliminated by a bridge-shaped design of the dental prosthesis [6,7]. The present report describes the application of pre-fabricated cylindrical anchors, which clearly facilitate the procedure in the practice and laboratory compared with techniques involving double-crown systems and bar attachments [1,8].

Innovative superstructure design with pre-fabricated cylindrical anchors

The removable part of the dental prosthesis is shaped in the form of a bridge in the peri-implant region. Mucous membrane-supported saddle areas are only created in those regions where the body of the prosthesis replaces not only teeth but also missing soft and bone tissues (Figs 1a to c). This type of prosthetic design takes unfavourable soft tissue conditions into account. Peri-implant mucous membrane irritations, which are frequently observed in closed-surface prosthetic bases, can be avoided with this method. The open-surface design of the prosthetic basis clearly reduces the prosthetic-induced susceptibility to peri-implant plaque accretion and inflammation. Small pre-fabricated cylindrical anchors provide an easy means of correcting unfavourable axial implant positions, which are often unavoidable even if subtle planning is applied, as jaw atrophy has progressed to an advanced stage [1,8]. Experimental in-vitro investigations have shown that the implant loading of cylindrical anchors is comparable to that of ball and bar attachments [1,9].

If sufficient bone structure is present in the posterior segments of the jaw, superstructures with cylindrical anchors can be designed as purely implant-supported bridges by

Figs 1a to c Bridge-shaped design of prosthetic body in the peri-implant region with saddle areas in the posterior segments and rigid prosthetic anchorage with Mini-Gerber retention cylinders

Figs 2a and b Purely implant-borne removable bridge construction involving four cylindrical anchors

Fig 3 The number of abutments is increased with single-tooth implants and pre-fabricated cylindrical attachments to preserve the dental prosthesis following the loss of a double-crown anchor.

Figs 4a to c Single-part retention basis of the Straumann implant system (a) for mounting pre-fabricated cylindrical anchors (b). The area above the horizontal marking line can be ground to parallelize the position of the attachments and to enable a shoulder-shape enclosure of the abutment by the removable bridge framework (c).

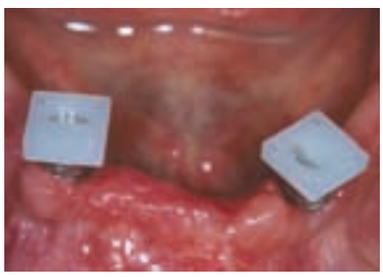
inserting two implants each on the mesial and distal side of the mental foramen (Figs 2a and b). If only a few teeth are left or the remaining teeth are distributed unfavourably, these attachments are also suitable for increasing the number of implant-retained abutments. Hence, they can be used to optimize the prosthetic situation in ways that should not be underestimated (Fig 3). The cylindrical anchors may also be incorporated into an existing prosthesis. This method results in a clearly more stable position of the prosthesis compared to the stability achieved with ball anchors [1,10].

Newly gained self-confidence and joy of living

A 56-year-old female patient neglected her teeth for several years because she suffered from extreme fear of dental treatment. As a consequence, she developed cosmetic problems and halitosis, which caused her to completely withdraw from her social activities. The dental findings showed that none of her remaining teeth were in a good enough condition to be preserved. After the patient had been prepared psychologically for the treatment, the necessary surgical intervention and oral rehabilitation with complete maxillary and mandibular dentures were performed. These measures required the patient to be hospitalized in the clinic to allow her to become accustomed to the changed oral situation in her own time and to return to her social settings with renewed self-confidence. In the course of the following regular dental recalls, she said that she would like the lower denture to stay more firmly in her mouth. We increased the retention of the denture in a reliable and straightforward manner simply by anchoring it to the jaw with two implant-borne cylindrical attachments (Figs 1a to c). The patient's life was again filled with confidence and joy of living!

Implant attachment and abutment

Cylindrical anchors comprise a cylindrical male part and a sleeve-type matrix housing and represent pre-fabricated double crowns. The male section of the attachment is homogeneously laser-welded to the implant abutment. The female part is bonded into the removable component of the prosthesis. The anchoring components can be easily mounted, activated and replaced. In the present case, a Mini-Gerber cylindrical retention-grip anchor (Cendres & Métaux SA, Biel, Switzerland) was used. A special abutment is required to mount cylindrical anchors. This single-part retention base (Straumann AG, Basel, Switzerland) is made of a high-gold noble alloy or titanium like the male part of the cylindrical anchor and is tightened on the implant at a torque of 35 Ncm using a special ratchet and torque control device (Figs 4a to c). The smooth cylindrical portion of the retention base can be modified by grinding the areas that are above the marking line. This method allows the user to correct inconvenient abutment positions and to parallelize the cylindrical anchors if several implants are present.



Figs 5a and b The retention base is mounted at a torque of 35 Ncm with a torque control device to take a final impression of the jaw (a). The impression caps click into their final position on the retention bases by means of a snap mechanism (b).

Fig 6 Framework for a bridge that is supported entirely by implants

Removable prosthetic component

Individual trays and high-precision elastomers are utilized to take an impression of the edentulous jaw and implants. The unworked retention bases are tightened on the implants at 35 Ncm and the impression caps are placed (Figs 5a and b). The caps should click into place on the external polygonal surface of the retention base with a definite snap and can be rendered smaller by trimming. To fabricate the working model, the retention bases are removed from the oral cavity, finger tightened onto the manipulation implant and re-positioned on the impression. The transfer aids, which are not removed from the impression, ensure that the retention bases can be clearly positioned. A wax-up of the final tooth set-up is produced and tried in on the patient. This wax-up forms the basis for the final contouring of the retention bases, mounting of the male part of the attachment and the fabrication of the removable component of the prosthesis. The retention bases are provided with a milled circular shoulder in the direction of the insertion path of the prosthesis. This circular support increases the space available for the soft tissue-friendly contouring of the removable prosthetic component and is completely enclosed by the removable metal framework to relieve the strain on the cylindrical anchor. The removable reinforcing framework features a bridge-shaped design in the peri-implant area. In the areas of the saddles, the framework is supplemented with retentions that can be relined. The entire prosthetic body can be designed in the shape of a bridge in conjunction with purely implant-borne superstructures on four abutments (Fig 6). Direct bonding of the female section of the attachment in the patient's oral cavity helps to achieve a tension-free fit of the secondary frame, which is fabricated of titanium or a cobalt base alloy. The accuracy of fit of the saddle areas can be optimized in the course of the final try-in of the prosthesis with the help of the altered cast technique, if necessary. The bridge body can either be veneered with a veneering composite (eg Chromasit®, Ivoclar Vivadent) or completed with ground composite denture teeth (eg SR Postaris® DCL, Ivoclar Vivadent).

Uncomplicated postoperative care

The use of rigid single attachments improves the prosthetic design and stability of the removable prosthetic part, which is not the case with closed-surface bases or articulated anchoring systems. The use of single anchors considerably facilitates oral hygiene for the patient and professional aftercare for the dental team. In addition, plaque control, including the use of plaque disclosing agents (Plaque Test, Ivoclar Vivadent), and mechanical professional cleaning with pastes (eg Proxyt®, Ivoclar Vivadent) can be more easily performed on attachment parts which are firmly tightened to the implants than on bar attachments because the former are more easily accessible. In addition, proven protective varnishes such as Cervitec® Plus (Ivoclar Vivadent) can be easily and effectively applied between the implant and abutment, onto the primary anchors or into the secondary anchors of the removable prosthetic component to prevent peri-implant inflammation [11,12]. On the part of the patient, the removable prosthetic component can be effectively used as a drug carrier to deliver anti-inflammatory preparations such as Cervitec Gel to the peri-implant margin in a targeted fashion. ❑

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A list of references is available from the editorial team on request.

Smiling again

Restoration of teeth using lithium disilicate glass-ceramics in a patient with Dentinogenesis Imperfecta

Prof Dr Daniel Edelhoff, Munich, Oliver Brix, DT, Wiesbaden, and Josef Schweiger, DT, Munich, all from Germany

Modern fabrication techniques and cutting-edge restorative materials allow dental professionals to pursue treatment strategies that involve a protracted temporary restoration phase for the recreation of functional and esthetic aspects. The complex restoration of severely discoloured tooth structure in a young patient is shown on the basis of a case study. Due to the use of long-term temporaries fabricated with CAD/CAM procedures using a high-performance polymer, the treatment team was able to study the restoration design during the growth phase of the patient. As a result, this approach ensured high predictability of the final restoration made of lithium disilicate glass-ceramic (LS_2).

Preoperative situation

The 16-year-old patient presented with Dentinogenesis Imperfecta Type II (Fig 1). In restoring the dentition of this patient, the treatment team had to meet a number of challenges: for example, the young age of the patient (growth phase), the patient's demand for a prompt solution, the appropriate recreation of the tooth morphology and the complete adjustment of the vertical height, as well as the permanent cementation of the restoration to the damaged tooth structure.

Treatment plan and clinical procedure

Due to the deformation of the dentin, bonding to the dental enamel posed a considerable problem in many areas (Figs 2a and b). Therefore, minimally invasive, purely adhesive cementation of the restorations had to be eliminated as a restorative approach. For the esthetic and functional restoration of this young patient's dentition, the following treatment goals were defined: appropriate recreation of tooth morphology with anterior-canine-protected articulation and adjustment of the vertical dimension.

For the analysis and planning of this case, the dental lab was supplied with extraoral (portraits) and intraoral photographs, alginate impressions of the two jaws, a record of the centric relation as well as an arbitrary face-bow record. After a technical and clinical analysis, the patient and his family together with the clinical team decided on the following treatment plan. Full crowns made of lithium disilicate glass-ceramics (LS_2) would be used to permanently restore the teeth. The anterior restorations would be fabricated with the layering tech-

Fig 1 Preoperative situation: The severe damage of the dentition affects the esthetic appearance of the teeth and their function.

Figs 2a and b Preoperative situation: The first molars of both jaws in particular show a high degree of destruction as a consequence of enamel chipping.

Fig 3 For the evaluation of the restoration design, temporaries were fabricated from a high-performance polymer material using CAD/CAM technology.

Fig 4 The long-term temporaries were removed and the maxillomandibular relationship was recorded with a Bis-GMA-based temporary restorative material (C&B Provilink). This record was subsequently used as a reference in the second quadrant.

Figs 5a and b Restorations made of IPS e.max Press after adhesive cementation with Syntac/Variolink II

Fig 6 Postoperative situation after the placement of the permanent restorations. The different tooth lengths of the anterior teeth correspond to the young age of the patient.

nique (IPS e.max® Press MO 0/IPS e.max® Ceram) and the posterior restorations with the staining technique (IPS e.max Press LT A2). As considerable esthetic and functional changes were to be combined with the adjustment of the vertical dimension, the clinical team decided on the following clinical procedure:

1. Fabrication of a wax-up to assist in the creation of tooth morphology that is both esthetic and functional
2. Intraoral evaluation of the esthetics of the wax-up with the help of a diagnostic matrix
3. Transfer of the increase in the vertical dimension that was determined with the wax-up to a modified Michigan splint for an eight-week functional evaluation period
4. Tooth preparation guided by the diagnostic matrix, precision impression-taking and recording of the maxillomandibular relationship with a Michigan splint
5. Fabrication of precision long-term temporaries by first scanning the wax-up and then using CAD/CAM techniques and a high-performance polymer material (Fig 3)
6. Trial of the long-term temporaries for at least 12 months with the possibility of making modifications
7. After the successful provisional phase, restoration of the teeth in the upper jaw: taking of maxillomandibular relationship records and impressions and fabrication of the glass-ceramic crowns in the dental laboratory (Fig 4)
8. Try-in and adhesive cementation (Variolink® II) of the permanent crowns made of IPS e.max Press for the upper jaw
9. Same procedure for the fabrication of the IPS e.max Press crowns in the lower jaw (Figs 5a and b)

The extended provisional phase allowed the dental team to adequately test the adjusted vertical dimension and therefore ensure a high level of predictability for the final restorations. The findings of this pre-treatment phase were successfully incorporated into the glass-ceramic restoration. The patient was delighted with the result in terms of both esthetics and function (Fig 6). ❑

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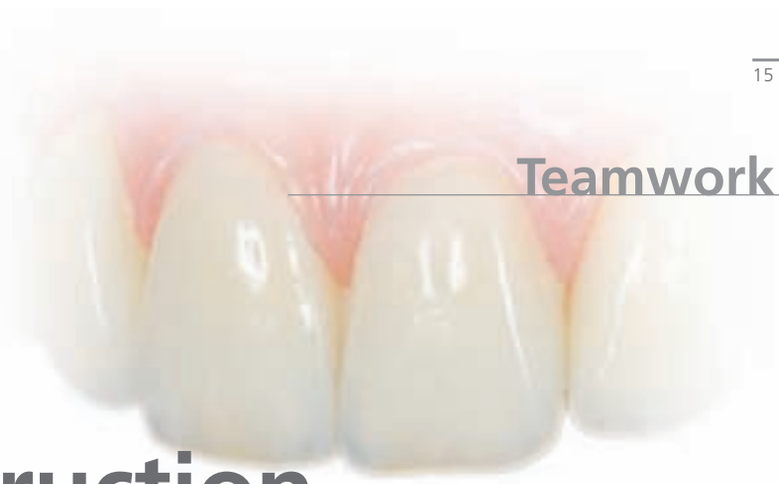


The reconstruction of pink and white esthetics

The pink hybrid technique used in combination with the IPS e.max® system

Christian Coachman, CDT, DDS (acting in the capacity of dental technician in the present case), and Marcelo Calamita, DDS, MSD, PhD, both São Paulo/Brazil

Surgical procedures to re-establish the three-dimensional architecture of hard and soft tissue ridge deformities have been developed and performed successfully throughout the past 15 years. In some cases, however, the results are still unpredictable and unsatisfactory in terms of esthetics and function, even if state-of-the-art regenerative procedures such as bone graft, soft tissue graft and orthodontic relocation are employed (Figs 1 and 2).

Creating a prosthetic gingiva can represent an esthetic and functional alternative for the predictable reconstruction of ridge deformities in fixed partial implant restorations [2,8,9-17], particularly in patients who do not want to undergo any surgical procedure. By opting for such a procedure from the very beginning, dental professionals are in a position to choose a design and/or use adjunctive measures that produce better results than if this procedure were to be used as the last resource or as a form of repair [2,10-13,15,18-21].

Teamwork and an interdisciplinary treatment plan are paramount for the long-term success of this kind of restoration. The dental technician should have the skills to analyse the three-dimensional shape of the tooth, to determine the correct position of the implant and to understand the principles of gingival esthetics and also the need for soft tissue management. This knowledge can then be used in the reconstruction of the gingiva in order to ensure harmony, balance, and continuity of form between the patient's natural gingiva and the prosthetic gingiva [13,16,19-24]. Usually, dentists and technicians are well versed when it comes to reconstructing the white component of a smile, the teeth. However, restoring challenging cases in the anterior area involves a more comprehensive approach and requires a deeper understanding of the pink component of the smile, the gingiva. The gingival architecture represents the frame for the teeth. If it is not restored correctly, either surgically or prosthetically, it will impair the final three-dimensional esthetic outcome. Just as the astute technician learns how to pay attention to the minute details of the tooth anatomy, shade variations and textures, he or she should do the same with regard to the various types or designs of the gingiva. Gingival anatomy, shade and texture should be analysed and learned to be restored in the best possible way. If the patient has a high lip line, this problem will be even more evident.

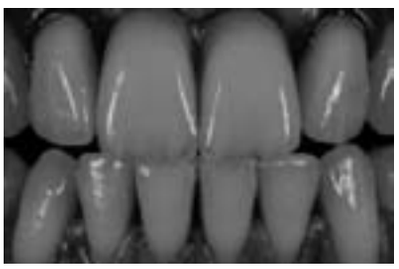
Case presentation

A 37-year-old male patient presented with a history of tooth loss in regions 11 and 21. Of the implants placed in these regions, the implant in region 11 had failed (Fig 2). The patient was very dissatisfied with the esthetics and phonetics of his anterior teeth, did not feel com-

Fig 1 Preoperative situation

Fig 2 Loss of the implant in region 11. Placement of a new implant.

Fig 3 Completed ceramic restoration: Single-tooth crowns (IPS e.max Press) and implant-retained restoration with ZrO_2 framework



Figs 4 to 6 Try-in. Digital modification of the photos in order to better visualize brightness, chroma, characterizations and surface structure.

fortable about smiling and had a low self-esteem. When he was informed about the different treatment options such as orthodontic relocation combined with hard and/or soft tissue grafts, he chose the easiest and fastest option: the restoration of the dentogingival complex by means of the pink hybrid technique. In region 11, a new implant was placed (NobelReplace™, Nobel Biocare, USA). After four months, a substructure made of yttrium-tetragonal zirconia polycrystals (Y-TZP) was placed over the implants. Zirconia exhibits high biocompatibility and improved fracture toughness [25-27] and is compatible with the veneering ceramic IPS e.max® Ceram (Ivoclar Vivadent, Liechtenstein). In regions 12 and 22, copings made of IPS e.max® Press lithium disilicate glass-ceramic, shade A1, were placed. The corresponding veneering ceramic – IPS e.max Ceram – is very versatile. It can be fired to both substrates, glass and oxide ceramics (Fig 3).

Dentogingival diagnostic wax-up guided treatment

The dentogingival diagnostic wax-up allows the restoration to be created on the basis of white and pink esthetic principles. The wax-up is the ultimate guide for all the surgical, restorative and laboratory procedures conducted.

At this stage, the team will perform an analysis of the three-dimensional volume of the lost tissue and the position of gingival interfaces, based on the Quadrants Concept [18] in order to minimize the visibility of this junction, restore the asymmetry of the gingival architecture, and replace the papilla [13,14,16,17,22,28].

The need for soft tissue conditioning should be evaluated when the wax-up is created. Depending on the extension of the area to be conditioned, the corresponding steps will be carried out during the surgical and provisional phase and refined when seating the final bridge [18,29]. The ridge should be flat to generate an esthetic and cleansable interface between the prosthetic and natural gingiva [15,30]. The lingual aspect should provide comfort during mastication, ensure optimum phonetics, avoid food entrapment and promote air sealing.

Ceramic

A strict digital photography protocol is paramount for the successful shade communication. Digital manipulation of the photos can help the visualization of the value, chroma and internal characterizations (Figs 4 to 6). For this purpose, pre-op photos can be used, which then help in the selection of the ceramic powders. Furthermore, during the try-in of the crowns, they are used to check if the shade needs to be adjusted.

When utilizing the IPS e.max system, the practitioner should understand all the options the system has to offer in order to take advantage of the unique features that this system provides.

Pink material selection

The materials currently available for the reproduction of artificial gingiva are ceramics, acrylics and composite. Each one has its own advantages, disadvantages and specific indications.

For fixed partial restorations, ceramics were usually the material of choice to reproduce not only the white esthetics but also the pink esthetics [11-17]. As ceramics are a very delicate and challenging material to handle, particularly as far as shrinkage during firing, the number of firing cycles, colour matching and moisture control is concerned, the final appearance of pink porcelain bridges was usually unsatisfactory. The esthetics were further compromised by the easily noticeable interface between the prosthetic and natural gingiva.

In an attempt to overcome these limitations, a hybrid technique was developed in order to make the prosthetic gingival restoration more esthetic and predictable [18,30] (Figs 7 to 9). The hybrid technique basically involves a screw-retained partial implant bridge providing the white esthetics and a gingival base made of ceramics, which is covered with a composite overlay to create the

Fig 7 Implant restoration prior to …

Fig 8 … and after the intraoral reconstruction of the gingival portion using composite

Fig 9 Extraoral finishing of the gingival portion. The design of the restoration should ensure both ideal hygiene capabilities and an esthetic appearance.

Figs 10 and 11 IPS e.max restoration completed with the pink hybrid technique

final pink contours (using eg anaxGUM Pink Composite, Anaxdent, Germany). The composite is placed directly in the mouth and finished chairside.

The utilization of the hybrid technique presents some remarkable advantages:

- ❑ Preservation of the optical and physical properties of the ceramic veneering material by decreasing the number of ceramic bakes.
- ❑ More predictability and control of the factors that determine the pink esthetics, such as shape, colour and texture.
- ❑ Possibility of repair, re-contouring and uncomplicated maintenance, even after years of use, without having to re-fire the ceramic.

Seating and hygiene orientation

During the seating process, transitory blanching of the gingiva may occur. The intensity will vary depending on the extension of the tissue conditioning required, the design of the pontics and the biotype of the patient's gingiva and should be checked with dental floss. The excess of pressure should be reduced by re-shaping the soft tissue with diamond burs, electrosurgery or diode laser, or by re-contouring the prosthetic gingiva with specific burs or wheels. The main goal is to create a comfortable, healthy and cleansable interface while maintaining a high esthetic level.

The hygiene and maintenance procedures should be carefully discussed with the patient as they are paramount for the long-term success of the restoration. Follow-up appointments should be scheduled in advance. The first appointment should be scheduled within three months after insertion. Subsequently, patients can be placed on six months to one year recall cycles, depending on their risk assessment.

Conclusion

In spite of all the recent developments in periodontal and peri-implant surgical regenerative procedures, comprehensively and esthetically re-establishing the hard and soft tissue contours still represents a challenge.

The prosthetic restoration of the pink esthetics offers a reliable and consistent alternative to resolving cases with uncertain surgical outcome or cases in which patients do not want to undergo regenerative surgical procedures. The understanding of the indications and procedures involved in this technique requires a paradigm shift for the whole interdisciplinary team to maximize the biological, functional and esthetic results and to surpass the patients' expectations (Figs 10 and 11). ❑

Literature: A list of references is available from the editorial team on request.

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One step closer to nature

Imitating natural optical properties using lithium disilicate restorations

Bradley L Jones, AAACD, Boise/ID/USA

The dental laboratory industry has searched for a material that is structurally sound and highly esthetic. That material is now available in lithium disilicate glass ceramic (IPS e.max® Press), which is a material like no other in dentistry. The IPS e.max Press lithium disilicate is the first structural (ie long-lasting) material that is esthetic, even without layering, when its High Translucency ingots are used.
Its high strength comes from the lithium disilicate crystals. The IPS e.max lithium disilicate is composed of quartz, lithium dioxide, phosphoric oxide, alumina, potassium oxide, and other components. Overall, this composition yields a glass ceramic which shows low thermal expansion when it is processed.

Polyvalent ions dissolved in the glass provide the desired colour to the lithium disilicate material. These colour-releasing ions are homogeneously distributed in the single-phase material, resulting in the elimination of colour pigment imperfections in the microstructure.

With its four levels of opacity and translucency (ie High Opacity [HO], Medium Opacity [MO], Low Translucency [LT], and High Translucency [HT]), IPS e.max Press enables laboratory ceramists to satisfy different esthetic demands and deliver a beautiful and strong restoration. Overall, these materials demonstrate specific advantages, such as higher edge strength vs traditional glass ceramic materials (can be finished thinner without chipping); low viscosity of heated ingot enables pressing to very thin dimension (ie enabling minimal prep or no-prep veneers); and chameleon effect due to higher translucency. In some cases, minimal tooth preparation is needed (eg thin veneers), and IPS e.max lithium disilicate enables restorations to be pressed as thin as 0.3 mm, while still ensuring strength of 400 MPa.

***Figs 1 and 2** Preoperative 1:2 view showing discoloured temporary repairs to the central incisors*

This article guides readers through the process of accurately maintaining the incisal edge position, length, shape and contour of provisional restorations when fabricating final IPS e.max Press anterior restorations. Additionally, if one were to take the enamel (0.5 mm) off a natural tooth, the internal dentin effects would be visible. The technique described here also provides a step-by-step guide to precisely mimic these internal effects. By enameling over these effects quickly and accurately, the restoration can be returned to full contour while including natural optical effects and segmenting both high- and low-value enamels.

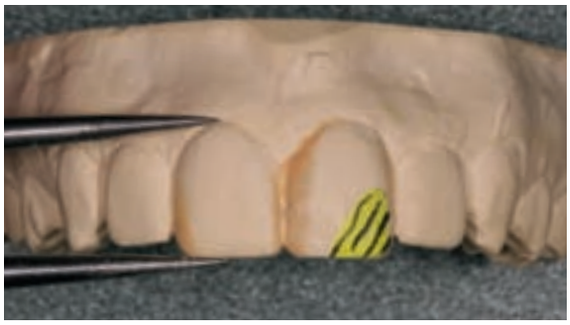

Fig 3 An approved model of the provisional restorations was perfected by adding wax and reducing stone.

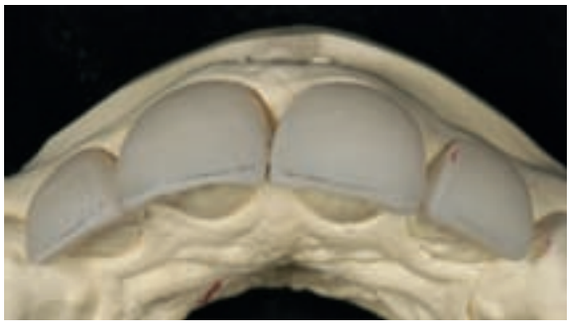

Fig 4 The facial incisal area was bevelled back 0.5 mm using a contour stone.

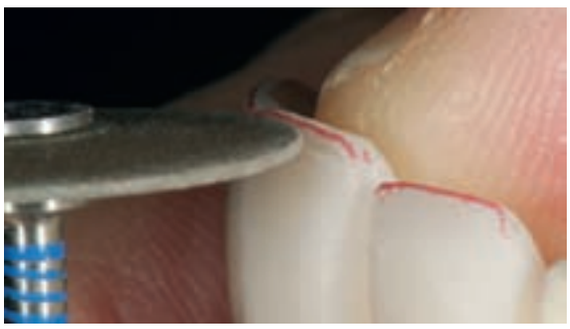

Fig 5 An undercut was made inside the silhouette of the incisal half to ensure the establishment of a halo effect.

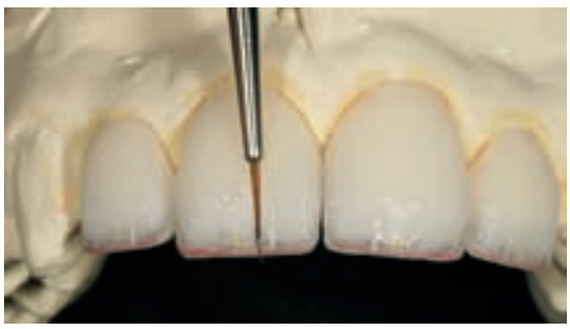

Fig 6 After smoothing out the incisal facial area, grey, vanilla and salmon stains were applied to create internal effects, then fired.

Fig 7 IPS e.max OE4 was placed to shape the internal lobe structures. They were feathered out after being formed.

Fig 8 To reproduce a natural halo effect, IPS e.max MM Light was added.

Case presentation

A 19-year-old male patient presented with the desire to improve the overall appearance of his smile (Figs 1 and 2). As a youth, he chipped both central incisors (teeth 11 and 12) and needed several temporary repairs that were performed by a dentist over the years.

The patient underwent a thorough examination. To ensure proper shade matching and design of the restorations, a complete laboratory esthetic prescription, detailed shade mapping, alteration of the type of light source used to take the shade, the amount and colour of the incisal translucency, and surface texture were obtained and recorded.

An approved model of the provisional restorations was perfected by adding wax and reducing stone (Fig 3). With a pair of dividers, the exact lengths were verified using a model of the provisional restorations.

After the facial incisal edge was outlined using a red pencil, a 0.3 mm lead pencil line was placed 0.5 mm lingually. A contour stone (Komet 9001, Komet USA, Rock Hill, SC) was used to bevel the facial incisal edge back 0.5 mm (Fig 4). The value was drawn in, and a centred diamond disc (Komet K6974) was used to carefully cut in the value area, making certain that a halo effect was established (Fig 5).

Using a contour stone (Komet 9001), the incisal facial area was smoothed out to create a canvas for the internal effects. To create the internal effects, grey, vanilla and salmon IPS e.max Essence stains were applied and fired (Fig 6).

IPS e.max Opal Effect 4 (OE4) was placed to softly shape the internal lobe structures. Once the internal lobes had been formed, they were feathered out (Fig 7). IPS e.max Mamelon (MM) Light was added to reproduce a natural halo effect (Fig 8). After a thorough and careful evaluation, the external effects were fired.

A red pencil was used to identify the line angles, as well as places for a segment of high-value powder. IPS e.max Opal Effect 3 (OE3) was applied to the line angles in thin

Fig 9 IPS e.max OE3 was applied in thin segments to the line angles and strategic places.

Fig 10 The IPS e.max TI1 Transpa Incisal was built in flush with the previously fired OE3 height of contour and high-value segments to full contour.

Fig 11 A coarse rubber wheel was used to re-establish the deflective zones and redefine the line angles.

Fig 12 Completed restoration on the model

Figs 13 and 14 Postoperative 1:2 view of the patient's new smile

segments, as well as to strategic places, to achieve a natural optical effect and re-establish the heights of the contour (Fig 9).

The segments of IPS e.max OE3 were built to 0.5 mm, which was the exact thickness of the initial facial cutback, making it faster and easier to return to the original full contour. IPS e.max OE3 was fired to ensure that the high-value segments mimicked the enamel optics found in the natural teeth, after which the IPS e.max Transpa Incisal 1 (TI1) was built flush with the previously fired OE3 height of the contour and high-value segments to full contour (Fig 10).

The restorations were bisque baked. Then, after using a diamond bur (Komet 842R) to smooth the facial surface, a coarse rubber wheel (Komet 9472C) was used to re-establish the deflective zones and redefine the line angles (Fig 11). The facial lobes were recreated with a diamond bur (Komet 842R) after the desired amount of perikymata was added with a diamond bur (Komet 850 016). The restorations were then glazed and polished.

Conclusion

Today's patients have become increasingly more internet savvy, demanding higher esthetics and longer-lasting restorations. In this author's opinion, IPS e.max Press offers the ceramist – for the first time in the history of this industry – a restorative material that is both beautiful and incredibly strong. It surpasses our patients' expectations, as demonstrated in the case illustrated here (Figs 12 to 14).

Acknowledgement

The author acknowledges Dr James Gorczyca from Boise, Idaho, for his exceptional excellence in dentistry. ❑

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Esthetics redefined

Implant-borne dental prostheses with SR Phonares® teeth

Andreas Kunz, MDT, Berlin/Germany

Modern dentistry requires not only new technologies and treatment methods but also modern products that are geared towards the needs of today's market. Products that have been utilized to meet the same demands for many years have to be assessed according to new criteria. Pre-fabricated denture teeth, for example, are used for new fields of application, eg in implantology.
Pre-fabricated composite teeth are basically divided into two categories: PMMA-based pre-fabricated denture teeth have been available for many years and mainly cover the market for removable dental prosthetics. With the arrival of Condyloform® II NFC from Candulor (Wangen, Switzerland) and SR Phonares NHC from Ivoclar Vivadent (Schaan, Liechtenstein), the second generation of composite-based teeth has been launched.

If a close look at the requirements of dental implant prosthetics is taken, the differences to conventional tooth replacements are clearly evident. The chewing forces measured in implant-borne dental prostheses are eight to ten times higher than those recorded in tooth-supported restorations. Consequently, denture teeth are exposed to considerably higher abrasive wear when used in implant-borne reconstructions (Fig 1). Another difference is found in relation to complete denture prosthetics. While the aim is to achieve a balanced occlusion in complete dentures, conventional canine guidance is recommended in conjunction with implant-supported prostheses.

Material of the future?

With SR Phonares NHC, Ivoclar Vivadent focused on developing a tooth line that meets the requirements of modern dentistry. This tooth line has been specifically designed for use in implant prosthetics. It consists of a nano-hybrid composite (NHC) and involves the use of advanced iso-filler technology. The inorganic nanofillers which are part of this technology provide the material with a homogeneous material quality. Scientific studies show that the filler composition affects the wear behaviour of materials. Homogeneous materials which contain microfillers demonstrate lower abrasive wear values than materials containing macrofillers. In addition, the SR Phonares teeth are manufactured with a newly developed method of production; instead of pressing, an injection process is used. Consequently, the teeth are free of flash lines and can be rotated in all directions during the tooth set-up. As a result, any individualized esthetic set-up option can be accomplished.

Properties

The wear values have been improved over those of conventional PMMA teeth, as was confirmed in a study by Dr Martin Rosentritt (University of Regensburg, Germany, 08/2009, Fig 2). Consequently, the SR Phonares NHC teeth are suitable for use in implant prosthetics. In addition, the innovative range of anterior tooth moulds meets the specific characteristics of the individual patient. With the help of a selection tool (FormSelector), the tooth size is first selected from sizes S, M and L. Next, the basic type is determined: soft (round) or bold (angular). Finally, the degree of wear is

Fig 1 Removable implant-borne bar-latch prosthesis with conventional PMMA denture teeth after a service life of two years. High chewing forces and poor wear properties resulted in the rapid damage of the occlusal surfaces.

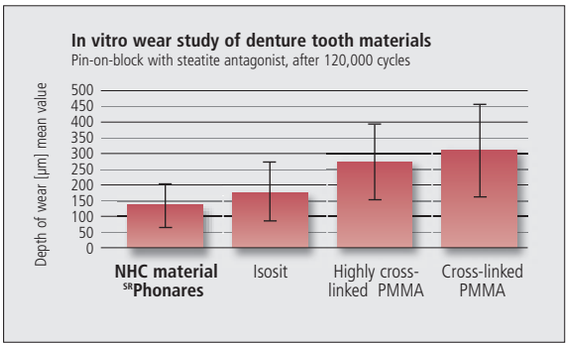

Fig 2 Source: Dr dipl Ing (FH) Martin Rosentritt, 08/2009, University of Regensburg, Germany

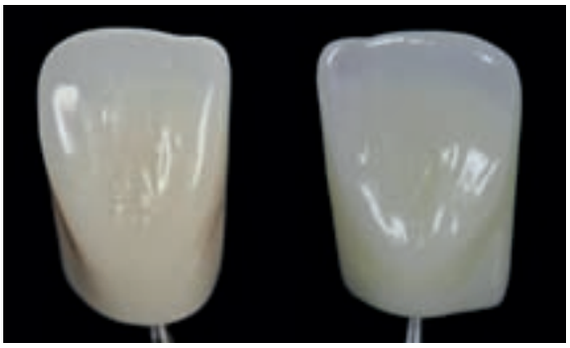

Fig 3 Lifelike moulds and clearly structured surfaces characterize the SR Phonares NHC teeth. The gingival proportions can be shaped to match the natural contours.

Fig 4 Tooth moulds are selected according to the patient-specific characteristics. Shape type chosen here: M – soft – universal.

Fig 5 Situation after initial temporary stage. A removable implant-borne bar-retained prosthesis was planned for the lower jaw.

chosen: no wear (youthful), low wear (universal) or severe wear (mature). The teeth feature a silky mat surface and lifelike surface structure, which may be modified with rotating instruments if necessary. In my opinion, special attention was given to developing a tooth line that helps optimize the gingival architecture. Interdental closure can easily be accomplished, even if the teeth are rotated. In addition, the cervical design allows for a harmonious contouring of the gingival papillae. The oval cervical shape creates a natural emergence profile (Fig 3).

Application in practice

The tooth moulds have been designed with the patient in mind and this really shows in practice. We first determine the shape type directly on the patient by means of an analysis of the esthetic appearance, taking all esthetic characteristics into account. On the basis of this analysis, a matching tooth mould is selected from the range of SR Phonares teeth. In the above example, the tooth mould of the maxillary tooth set-up (wax-up) harmoniously blends into the surroundings of the lips (Fig 4).

The patient case presents an edentulous patient who was treated with an upper denture on six implants and a lower denture on four implants (Fig 5). A fixed-detachable, veneered metal-ceramic prosthetic reconstruction was designed for the upper jaw. The lower jaw was reconstructed with a bar-retained prosthesis. The distal extensions of the bar enable the rotational axis to be shifted towards the posterior side, which increases the stability of the prosthesis. A wax-up of the anterior and posterior teeth was created and tried in on the patient. After the esthetic dimensions had been established, a gold alloy primary bar and an electroplated secondary structure were fabricated with the help of silicone keys. A tertiary framework was cast of base metal alloy and bonded to the electroplated structure to reinforce it (Fig 6). From our long-term experience in implant prosthetics, we have seen the importance of placing cast retention pins under each individual denture tooth. To mount the teeth, they are wetted with monomer and polymerized onto the framework using tooth-coloured resin. The tooth necks and cervical areas of the SR Phonares nano-hybrid composite teeth consist of a PMMA resin, which ensures a reliable bond to the denture base. Next, the metal basis is coated with a pink opaquer (Fig 7). The pink esthetics was created according to the specific characteristics of the patient. The restoration of the upper jaw will not be discussed here.

Before the prostheses were incorporated, anterior guidance was established. The composite denture teeth of the lower jaw should work in harmony with the ceramic veneers in the upper jaw. The light-optical characteristics of the NHC material should be similar to those of the ceramic (Figs 8 to 11). The topic of discussion will be the long-term wear behaviour of these different materials.

Fig 6 The substructure consists of a primary bar with an electroplated secondary structure, which is bonded to a base metal strengthening frame.

Fig 7 The teeth are mounted to the framework using tooth-coloured resin before the reconstruction is completed with pink material.

Fig 8 Completed implant-borne lower prosthesis

Fig 9 The shape and surface of the new SR Phonares NHC teeth harmonize well with the contours of artificial tissues.

Fig 10 The new NHC denture teeth in their oral surroundings

Fig 11 Combined implant esthetics – removable composite prosthesis in the mandible and fixed ceramic veneered reconstruction in the maxilla

Conclusion

If these teeth fulfil their promise, they will be suited for several fields of application, particularly in implant prosthetics. The technical characteristics offer a great deal of potential. The nano-hybrid composite was optimized during several years of development. As a result, the teeth are distinguished by increased resistance to wear, low affinity for plaque accretion and high resistance to discoloration. Esthetically speaking, they allow a pragmatic, lifelike reconstruction of the oral situation in many patient cases. The anterior teeth in particular feature an accomplished shape and surface structure due to their haptic design. Dental prosthetists will be pleased with the possibilities to design the gingival contours. Individualized add-on materials are certainly a further possibility to be discussed in future. The long-term results on the wear behaviour in particular will show if SR Phonares NHC deserves the accolade "implant tooth of the future". ❑

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