REFLECT

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Modern approaches to esthetic anterior restorations

Direct composite restorations using IPS Empress Direct

Without cutback and layering

Fabricating veneers with IPS e.max Press Impulse

Smiling with self-confidence – while wearing a temporary

Highly esthetic long-term temporary made of Telio Lab

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passion vision innovation

Dear Reader

The pursuit of innovation is dedicated to questioning and/or improving established principles. Accordingly, Ivoclar Vivadent continues to set new trends in restorative dentistry and prosthodontics in 2012. In order to highlight the company's innovative spirit, we have redesigned the Reflect magazine to provide readers with a clearer view of the topics and articles. Moreover, the revamped and updated look is more suited to the clinical and practical requirements of our readers.

The current issue of Reflect contains a user report which describes the attractiveness of the highly esthetic IPS Empress Direct material for filling teeth. This composite offers impressive and highly efficient treatment solutions.

Meanwhile, the success story of IPS e.max lithium disilicate continues: The fact that exceptional results have been achieved with this ceramic over many years is just one of the reasons why users have asked for additional products in this range. Due to our innovation efforts, we have been able to meet their demands and introduce new versions, such as IPS e.max Impulse Opal and IPS e.max Press L ingots, which are designed to enhance the natural appearance of prosthodontic work.

Our passion for developing innovative solutions, which facilitate the work of dental professionals on a daily basis, connects and inspires many users of our products and systems. We hope that the pictures and articles in this issue will motivate you to achieve new heights. Please do not hesitate to contact the editorial team of Reflect if you would like to share your experiences with us and with many other international colleagues.

Yours

Josef Richter
Chief Sales Officer
Ivoclar Vivadent AG

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An ideal combination

Restoring an upper left premolar
Dr Toshihisa Terada and Dr Hidetaka Sasaki, Tokyo/Japan

Lithium disilicate glass-ceramic material allows esthetic tooth restorations with superior natural lustre to be fabricated, which result in a high level of patient satisfaction.

Lithium disilicate glass-ceramic (LS_2) has been shown to enhance the esthetic appearance and longevity of prosthodontic work. This material forms the basis of the IPS e.max® System, which has been consistently adapted to the changing market conditions and user needs since it was first launched. When used in combination with the CEREC® AC System (Sirona), it allows esthetic restorations with a high accuracy of fit to be fabricated in only one appointment. We have been using the IPS e.max System since it was released to the Japanese market. In the meantime, we can look back on approximately 500 IPS e.max restorations placed. All the treatments involving IPS e.max have had favourable outcomes – at the moment, the wear time is still below four years. IPS e.max has become an important clinical option within the spectrum of the restorative treatments we offer. The exceptional esthetic appearance and lifelike surface gloss achievable due to the excellent translucency of the material ensure a true-to-nature shade effect and high patient satisfaction. With IPS e.max, either the cut-back technique can be used or the full-contour restorations can be characterized directly. This makes it easy for dentists to meet the varying demands of patients.

The first IPS e.max CAD blocks to be introduced to the market were the MO (Medium Opacity) and the LT (Low Translucency) blocks. They were followed by further blocks in quick succession, such as the HT (High Translucency) blocks, the Impulse series and the B 40 series for the CAD-on technique. A while ago, the product line was extended to include the RC Straumann® Anatomic IPS e.max® Abutment (Straumann) – the result of the cooperation between Straumann and Ivoclar Vivadent. This prefabricated zirconium oxide abutment is compatible with the Straumann® Bone Level Implant. It enables dentists to fabricate the implant superstructure directly in their practice. With the addition of this abutment to the range, Straumann, CEREC and Ivoclar Vivadent users can now choose from a comprehensive range of coordinated materials in computer-aided implant dentistry, ranging from abutments to materials for the fabrication of temporary restorations and implant superstructures. The system offers remarkable advantages with regard to durability and reproducibility. Another promising aspect of this product is that the abutment is made of zirconium oxide, a material that is both biocompatible and esthetically appealing.

Clinical case report

A 33-year-old male patient presented to our practice with tooth 24 missing. After having discussed the different treatment options extensively with the patient, we decided to close the gap with a highly esthetic restoration: an implant-supported all-ceramic crown. In the area of the missing tooth, a Straumann Bone Level Implant (RC, diameter 4.1 mm, 10 mm SLActive®) was placed. This step was followed by a guided bone regeneration procedure. A load-free healing period of four months was allowed to achieve successful osseointegration and to establish the optimal

Figs 1a and b View of the implant in the gap left by the loss of tooth 24 four months after its insertion. Note the optimal soft tissue architecture.

Figs 2a and b Accurate fit of the zirconium abutment

Fig. 3 With a choice of two colours, two different designs and two different gingival heights, the Straumann Anatomic IPS e.max Abutment offers exceptional flexibility in its application.

Fig. 4 The digital impression was taken with the CEREC Bluecam.

form and architecture of the soft tissue. The implant was uncovered with a tissue punch and the sealing screw replaced by a bottle-shaped gingiva former (4 mm in height) (Figs 1a and b). After the gingiva had healed completely, an RC Straumann Anatomic IPS e.max Abutment was screwed into the implant (Figs 2a and b). As in previous cases we were again impressed by the abutment's outstanding accuracy of fit, which is achieved thanks to the stringent quality control procedures that the abutments undergo during and after the production process.

Zirconium oxide is ideally suitable as a material for implant abutments in the anterior region, where high esthetics and longevity are paramount.

A few years ago, it took dental technicians several days, sometimes even weeks, to finish the abutment for an implant case. The availability of standardized zirconium oxide abutments substantially cuts down on the total treatment time. The abutment described in this article is available in two different gingival heights (2 mm and 3.5 mm), two shades (MO0 and MO1) and two different designs (straight 0° and angled 15°) and thus offers high flexibility in its application (Fig. 3).

Following the insertion of the abutment, a digital impression was taken using the CEREC Bluecam. Auxiliary aids such as OptraGate® and IPS® Contrast Spray Chairside (shade blue lemon) provided additional support (Fig. 4). The Bluecam (max. focal length 2.5 cm) allowed the cervical "preparation" limit of the abutment, which is located deeper than that of any natural tooth stump, to be captured precisely. Subsequently, a buccal scan was used to record the opposing

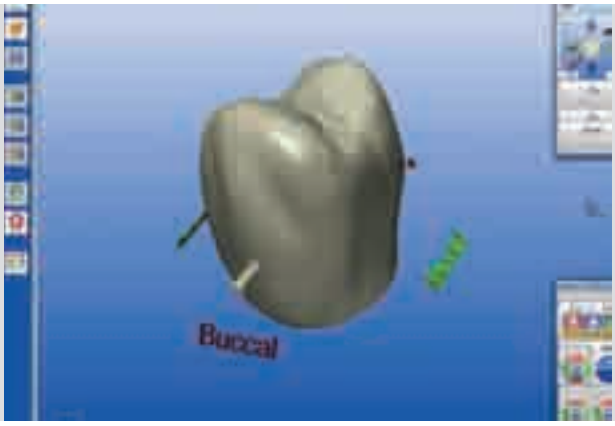

Fig. 5 Virtual design of the crown. The picture illustrates the "modeling" of the temporary restoration on the computer screen using the CEREC Biogeneric software.

Fig. 6 The temporary crown was milled from Telio CAD acrylate polymer blocks using a chairside CAD/CAM machine.

teeth and the bite relation. The occlusal surface of the temporary restoration to be fabricated was designed with the CEREC Biogeneric software (Fig. 5).

For the fabrication of the temporary crown, Telio® CAD was used (Fig. 6). The Telio CAD range comprises acrylic polymer blocks which can be processed at the chairside with CAD/CAM systems. In the present case, the temporary was milled based on the scanned data without having to make any adjustments. It was immediately seated in the mouth of the patient. The maximum wear time of Telio CAD temporary restorations is twelve months. Blocks in six different shades (BL3, A1, A2, A3, A3.5 and B1) and two sizes (B40L and B55) are available. As Telio CAD is easy to polish and thus allows appealing esthetic results to be achieved, it is ideally suitable for implant temporization (Fig. 7). Yet another advantage of Telio CAD blocks is that they can be machined directly in the dental practice, both with CEREC AC and CEREC MC-XL. The temporary restoration we fabricated was cemented into place on the same day. The shape and occlusal contact design of the temporary were transferred to the permanent restoration. For the fabrication of the permanent restoration, IPS e.max CAD (LT A3.5) was selected (Fig. 8).

The data of a digitally designed restoration can be used to fabricate several restorations using different materials. The data are saved and can even be slightly adjusted if required. Following machining, the final restoration in this case was characterized using IPS e.max CAD Crystall./Shade and Stains and crystallized in the Programat® CS furnace (Figs 9a and b). Crystallization firing in the Programat CS lasts approx. 20 minutes and results in the complete crystallization of IPS e.max CAD restorations. In the process, the lithium disilicate crystals fully develop and impart the material with its final shade and strength of 360 MPa. As the restorations can already be characterized in the blue state, the procedure is particularly time-saving and leads to highly esthetic, natural-looking results.

After having verified the fit, marginal seal, proximal contacts and the occlusion of the IPS e.max CAD crown, a silane (Monobond® Plus) was applied for one minute. The silane was also applied to the surface of the abutment. Monobond Plus contains three different types of methacrylates: silane methacrylate, phosphoric acid methacrylate and disulphide methacrylate. They make Monobond Plus an outstanding single-component bonding agent suitable for use in conjunction with a wide array of restorative materials, including

Fig. 7 In the case at hand, the temporary crown did not require any adjustments and could be seated immediately in the mouth of the patient.

Fig. 8 The shape and the occusal contact design of the temporary were transferred to the permanent crown prior to machining it using IPS e.max CAD (LT A3.5).

Figs 9a and b The final restoration was characterized with IPS e.max CAD Crystall./Shade and Stains and crystallized in the Programat CS furnace.

Fig. 10 The crown was permanently incorporated using the adhesive luting composite Multilink Implant.

Fig. 11 The completed restoration in situ. The missing tooth 24 was replaced by a highly esthetic, very natural looking all-ceramic implant restoration.

glass-ceramics, zirconium oxide ceramics, aluminium oxide ceramics, noble metal alloys, base metal alloys and composite resin. The establishment of a strong bond between the restoration and the luting material enhances the clinical safety and reliability of dental restorative procedures. An adhesive cementation protocol was followed to permanently cement the restoration into place (Fig. 10). The adhesive luting composite used was Multilink® Implant. Compared to conventional luting composites, clean-up of excess is much easier with this product. Therefore, it is particularly suitable for use in implant dentistry, since the complete removal of excess is pivotal for the success of implant restorations.

Conclusion

Figure 11 shows the completed restoration after having been permanently cemented. The launch of the RC Straumann Anatomic IPS e.max Abutment has changed a very complex procedure: Implant restorations can now be fabricated based on a series of systematic treatment steps, achieving convincing results. Using IPS e.max in combination with CEREC AC offers multiple advantages, such as improved esthetics, long-term stability and shorter treatment times.

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Modern approaches to esthetic anterior restorations

Direct composite restorations using IPS Empress® Direct
Dr Gauthier Weisrock, Marseille/France

Combining a high-performance material with a clearly defined protocol extends the boundaries of feasibility in direct restorative procedures.

Modern and high-performance composite materials and an approach that has been standardized by now have led to ever more direct composite restorations being fabricated in the anterior region. Even extreme cases may now be treated at the chairside, while the results are predictable and the loss of tooth structure minimal.

Initial situation

A 24-year-old female patient came to our practice with an esthetic request. She disliked the appearance of her tooth 11, which showed severe discolouration after endodontic treatment. The clinical examination revealed that the tooth root had been extirpated after an accident and that a fractured piece of the tooth had been reattached with composite material (Figs 1 and 2). Upon radiological examination, it was noted that the root canal treatment had been correctly performed but a post was not used.

Given that approx. half of the original tooth structure was lost, we opted for a direct composite restoration, provided that a tooth whitening procedure could be successfully completed. On the spectrum of possible treatments, this approach is located between "conventional" composite restoration and ceramic veneer and therefore seemed to be clinically appropriate. The patient, whose primary concerns were a natural tooth shade and minimal loss of tooth structure, agreed with the planned procedure. We decided to use IPS Empress Direct to fabricate the restorations. In addition to dentin and enamel materials, this product also offers an opalescent material version.

Fig. 1 Severely discoloured tooth 11

Fig. 2 The shape of tooth 11 seemed appropriate compared with tooth 21. The substance loss amounted to somewhat less than half the tooth.

Fig. 3 After the bleaching procedure, the shade of tooth 11 was optimal.

Preliminary treatment

First of all, internal bleaching was conducted on the tooth. The further course of treatment would depend on the success of this procedure. Access to the endodontic chamber was created through the old restoration and the gutta-percha increment was removed up to 3 mm below the cementodentinal junction. At the bottom of the cavity, a plug with a thickness of 2 mm made of glass ionomer cement was inserted to prevent the bleaching agent from accessing the sensitive areas. We used a mixture of sodium perborate and distilled water for the bleaching procedure. The access to the cavity was then sealed with a temporary material. Because the desired tooth shade had not been achieved, the entire procedure was repeated after one week. After another week, however, the result was optimal (Fig. 3). To neutralize the bleaching agent, it is indispensable to apply calcium hydroxide into the cavity and to leave it in place for at least one week. An adhesive may only be applied fifteen days after conclusion of the bleaching procedure, in order to ensure an optimum adhesion and stable shade.

Esthetic diagnosis and shade determination

After tooth shape analysis we concluded that the proportions were harmonious in comparison with tooth 21. The tooth shade was determined in daylight and prior to any intervention to avoid a misinterpretation of the shade due to dry adjacent teeth. For the determination of the enamel and dentin materials, the IPS Empress Direct shade guide was used. We determined the dentin shade on the basis of the cervical third and the enamel material on the basis of the incisal third of the adjacent tooth. Particular attention was paid to the anatomical structure of the adjacent tooth and the various opalescent reflections which were visible on the incisal surface, as it was our aim to imitate these features. A layering diagram detailing all the materials that were to be used was prepared. In this case, only four shades were used: A3/A2 Dentin, A2 Enamel and Trans Opal.

Subsequently, we created a palatal silicone key on tooth 11 with the appropriate shape and occlusion. Once in place intraorally, this key served to create the palatal wall of the restoration in one step. The key included the teeth adjacent to the tooth that needed to be restored and also covered the incisal area.

Preparation and application of the adhesive

The existing restoration was removed with rotary and ultrasound instruments, using care to prevent any damage to the adjacent teeth. During preparation of the tooth, the mechanical properties of the material that is used and the esthetic integration need to be taken into account. In the case of the IPS Empress Direct nanohybrid composite, which was used here, the ideal preparation design involves a vestibular chamfer and a straight, right-angle proximal and palatal margin (Fig. 4).

Before proceeding with the adhesive cementation, it is necessary to protect the operatory field from saliva or blood in the oral cavity. We isolated the anterior teeth including the canines with a rubber dam. This expanded treatment area allowed us to assess the incisal line and the size and shape of the adjacent teeth. We checked whether or not the silicone key could be exactly positioned. If required, interfering areas can be adjusted using a scalpel until a precise fit is achieved. The enamel areas were etched for 30 seconds and the dentin for 15 seconds and then thoroughly rinsed and dried.

Subsequently, the adhesive was applied, while the adjacent teeth were protected with a metal matrix. We used the ExciTE® F total-etch adhesive for this step. Given the non-retentive preparation design and the fact that most of the restoration would be created on enamel, this type of adhesive was preferred over self-etch products. To promote the penetration of adhesive into the dentin tubules, the adhesive was gently massaged into the cavity walls. After the adhesive is dried, the cavity must exhibit a "glossy" appearance. If this is not the case, the procedure needs to be repeated. The adhesive was then light-cured for 10 seconds with a bluephase® style curing light.

Fig. 4 Prepared tooth 11 with vestibular chamfer and straight, right-angle palatal margin

Fig. 5 Creating the palatal wall with enamel material (A2 enamel)

Fig. 6 Designing the proximal area and the transition lines

Fig. 7 Built-up palatal area and proximal areas, or: transforming a complex preparation into a simple one

Fig. 8 Application of dentin material A3

Building up the palatal and proximal walls

In a first step, the palatal enamel was built up. To this end, a thin layer of enamel material (shade A2) was applied into the palatal key and smoothed out with a brush. The material layer was thinner than 0.5 mm. Then the key loaded with composite material was placed in the mouth and the fit was checked again. If necessary, the material may be modified before it is polymerized for 10 seconds. The palatal wall that was created in the process showed the exact desired shade and did not touch the adjacent teeth (Fig. 5).

By applying a thin layer of enamel material (A2) to the proximal walls, the complex cavity was turned into a simple one. To create the thin layer, we secured a transparent matrix in place with a wooden wedge. This allowed us to create the transition lines (the convex area that separates the proximal from the vestibular area). The restorative outcome is influenced by the successful design of these transitional areas, because it is not possible to design them with rotary instruments. We then applied composite material from the distal side of tooth 11, while tightening the matrix from the opposite side and polymerizing the material in this position (Fig. 6). In this way, enough composite material could be added until the desired transition area was achieved. The mesial side was built up in the same manner (Fig. 7).

Building up the dentin core

By using dentin materials, a restoration is created which shows a decreasing saturation from the cervical to the incisal and from the palatal to the vestibular area. To achieve this, a three-dimensional layering technique is applied, using materials with different levels of saturation. First, material with a saturation that was one degree higher than the desired final tooth shade was applied. Therefore, dentin material in the shade A3 was used in the area of the cervical margin. The layer was applied to the palatal wall using a flat spatula suitable for composite resins (Fig. 8). Subsequently, a layer with dentin material with a lower saturation was applied (A2). For this layer, a pointed silicone instrument was used to design a slightly wavy margin covering half of the chamfer up to 1 mm below the incisal edge (Fig. 9). If this technique is applied, the translucency of the enamel material becomes visible in the area of the incisal edge and the transition from tooth structure to composite material is masked. Each individual layer was polymerized with bluephase style for 10 seconds.

Designing the enamel portion

The opalescence effect was enhanced by applying a thin layer of Trans Opal material in the area of the incisal edge. As the visible effect of this material is very intense, only a small amount should be used. An enamel layer (shade A2) was applied in several steps on the vestibular area, contoured with brushes and cured for 10 seconds. This enamel material covers the entire restoration (Fig. 10).

Finishing and polishing

The patient's teeth exhibited a very pronounced macro- and microtexture (vertical pits and horizontal streaks, respec-

Fig. 9 Application of dentin material A2. The previous layer was entirely covered with this material.

Fig. 10 Application of a covering layer of enamel material in shade A2

Figs 11 and 12 The restored tooth 11 exhibits a harmonious appearance, achieved with a minimal loss of tooth structure.

tively). Imitating these features to achieve a lifelike light reflection on the restorative surfaces was a challenging task. This process step is similarly important as determining the appropriate shade.

The human eye is more likely to perceive shape imperfections than slight shade differences.

We imitated the surface texture with fine-grain diamond-coated burs, using flame- and lens-shaped instruments (first with the red and then with the yellow colour code). The burs were used on the red handpiece without water irrigation. Another important step was the finishing of the transition lines and the interproximal areas. It is advisable to use abrasive strips for this purpose, because rotary instruments may produce flat areas which exhibit inappropriate reflections. OptraPol® Next Generation polishers with water irrigation were used for polishing. We always take great care to polish restorations perfectly whilst avoiding any damage to the surface texture we designed. The polishing step is greatly facilitated as a result of the convenient polishability of this composite material (Figs 11 and 12).

Conclusion

Due to materials, such as IPS Empress Direct, which are consistently improving and a clearly defined approach, we may use direct restorations for ever more indications, thus constantly extending the boundaries of feasibility. The advantage of direct restorative procedures is that they are time-saving and conservative. Nevertheless, it may happen that directly restored teeth develop discolourations again in spite of the perfect esthetic outcome, in which case renewed treatment is inevitable.

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Video clip available

Without cutback and layering

Fabricating veneers with IPS e.max® Press Impulse

G. Franklin Shull, DMD, Lexington, South Carolina, and Matt Roberts, AAACD, Idaho Falls, Idaho/USA

Natural-looking restorations can be fabricated easily and efficiently with pressable lithium disilicate ceramic.

The fabrication of veneers requires an adaptable material to accommodate the need for appropriate reduction that will enable the necessary change in tooth colour, mask the discoloured dentition and provide adequate strength. IPS e.max lithium disilicate glass-ceramic (LS_2), particularly the IPS e.max Impulse Opal ingot that can be pressed to full contour, can provide clinicians with a strong, esthetic material for anterior veneer cases without cutback and layering. When treating patients with a high risk of incisal chipping, lithium disilicate is the material of choice due to its enhanced strength. Lithium disilicate affords the ease and versatility that allows dentists to provide patients with minimal preparations while simultaneously addressing esthetic issues. In terms of esthetics, clinicians and their laboratory ceramists can deliver restorations that demonstrate the soft progression of chroma gradient and non-dynamic incisal effects that are frequently seen in natural teeth.

The IPS e.max all-ceramic product line represents a universal system that includes pressable fabrication techniques for satisfying an assortment of case demands. Ideal for cases requiring inlays, onlays, partial crowns, telescope crowns, anterior and posterior crowns, veneers and thin veneers, IPS e.max Press provides the fit and function of traditional pressable ceramics, with outstanding strength [1-4]. With its controlled size, shape and density, the unique structural characteristics of IPS e.max ensure greater strength and durability than conventional ceramics [1-6]. Manufactured with needle-like crystals in a glassy matrix and possessing a flexural strength of 400 MPa, IPS e.max Press lithium disilicate ensures predictable and long-lasting restorations and is suitable for complex cases [7-9].

Fig. 1 A preoperative full face view helps harmonize dental esthetics with facial esthetics.

Fig. 2 The preoperative photograph indicates the relation of the teeth to the lip line.

Fig. 3 Shade tabs (Chromascop) were previewed.

Case presentation

A 32-year-old woman presented with feldspathic veneers in teeth 12 to 22 that had been placed approximately 15 years ago. Although satisfied with the overall length and shape, the patient had concerns regarding discolorations at the margins and the overall colour of the restorations (Figs 1 and 2). Once the patient had agreed to the recommended treatment plan of replacing the veneers, night guard vital bleaching was used to improve the patient's natural teeth to an 030 Chromascop shade (Fig. 3). Maxillary and mandibular study models, facebow, bite registration, stick bite and a complete set of photographs and radiographs were obtained.

Material selection

Pressable lithium disilicate (IPS e.max Press) was the material of choice. Ideal for esthetically challenging cases, lithium disilicate demonstrates life-like translucency due to a relatively lower refractive index and superior optical properties compared to traditional all-ceramic materials [7-10]. A variety of translucencies and opacities, including high translucency (HT), low translucency (LT), medium opacity (MO) and high opacity (HO) are available. Different brightness effects can be reproduced with the availability of three brightness values and two opalescent shades (Value, Opal). As IPS e.max Press requires a minimum thickness of only 0.3 mm, minimally invasive preparation procedures can be performed that are gentle to the tooth structure [12]. Moreover, press technology guarantees a high accuracy of fit.

Clinical preparation protocol

The patient was anaesthesized and the old porcelain was removed. The existing preparations were moderately aggressive and had exposed dentin in multiple areas. Changes to the preparations included breaking the contacts and placing interproximal margins slightly subgingivally to allow proper emergence of the restorations. In order not to leave the final shade of the restoration to chance, determining the shade of the preparation using the IPS® Natural Die shade guide was essential.

> The shade of the preparation has a substantial influence on the final shade of the restoration.

Next, an impression was taken. Preparation photographs with shade tabs were obtained (Fig. 4). BIS-acryl provisionals were fabricated from a pre-preparation model, making only slight modifications to improve esthetics.

The provisionals were evaluated four days later (Fig. 5), at which time the patient was happy with the colour and esthetics. Occlusal stops remained in the enamel, therefore only the incisal edge position needed to be evaluated for esthetics, speech and function. Once confirmed, a series of photographs and a stone model of the provisionals, as a starting point for shape and form, were taken and forwarded to the laboratory to duplicate the incisal edge position.

Fig. 4 The preparation shade was determined using the IPS Natural Die shade guide.

Fig. 5 Photographs of the provisionals were taken.

Fig. 6 A sectioned working model was created. Data from the provisional stone model was transferred to the working model.

Fig. 7 An enhanced wax-up indicates contour refinements and detailed surface texture.

Laboratory protocol

A master model was created and a SilTech® matrix of the provisional models was placed over the master model (Fig. 6). Data from the provisionals, complete with incisal edge and form, was transferred to the master model using wax injection (Fig. 7). The contour of the wax injection was then refined and final shaping of embrasure form and incisal position was undertaken on the master model to create the planned esthetic result.

Surface morphology was established mimicking the natural anatomy of anterior teeth. A combination of carving and additive waxing was employed to create shape and form that fit the patient's needs. In this case her provisional restorations seemed a bit wide, so the mesial and distal embrasure form was opened up to minimize the perceived visible width of the individual teeth, thus improving the apparent length-to-width ratio. Her smile line was also a little flat, so centrals were lengthened slightly to give positive curvature to the smile. Due to the hardness of the ceramic, it is more efficient to perform surface texture and detailed waxing – two crucial steps, especially when using a monolithic lithium disilicate material – than to grind the restorations.

The restorations were sprued and invested in the traditional manner for pressed ceramics, and a fast burn-out technique was administered. The press procedure was conducted in a Programat® EP 5000 furnace. After they had been pressed using the IPS e.max Press Impulse Opal 1 ingot, the restorations were divested and the sprues ground down using a lithium disilicate and zirconia grinder (Fig. 8). Next, a carbide bur was utilized to create surface morphology between the teeth, delineating the tooth as individual in relation to the adjacent tooth. Positioning the contact and controlling the light into the embrasure form is critical to achieve superior esthetics. A medium grit, lithium disilicate grinder was used to clean up the lingual area close to the margins, making it possible to get right up against the margin without chipping. At this time the restorations were ready for staining. One of the advantages of the Opal ingot is that staining is sufficient to achieve a life-like appearance of the restoration. The surface was dampened with a small amount of stain liquid. It is important that stain liquid be applied underneath and between the restoration and the composite die. This step determines the amount of stump shade show-through that will be present in the mouth and gives the technician a chance to apply shading in a way that harmonizes with the underlying colour.

The combination of underlying colour and restorative thickness plays an important role in ingot selection and subsequently in attaining the natural colour of the dentition. For instance, 1.2 mm of Opal 1 will have quite a different effect than 0.4 mm facial thickness. Viewed side by side, the thicker appear brighter than the thinner restorations. Coordinating the preparation depth appropriate for the patient's underlying tooth colour and ingot selection by the technician to achieve the desired final shade is critical to the success of bonded all-ceramic cases, especially with more translucent ceramic materials. At this point, stain was applied from gingival to incisal to achieve a colour gradient effect. Stain was blended to achieve natural colour gradation and applied to all restorations in this manner. Although the Opal ingot is already translucent, a small amount of Incisal blue was added for enhancement. After the stains were fired, a glaze layer was applied. Finally, a small amount of white stain was added to the glaze to attain a white halo effect.

Fig. 8 Finished restorations on the stone model

Fig. 9 View of restorations before seating

Fig. 10 Retracted view of the seated restorations

Fig. 11 Postoperative close-up of the final restorations

Figs 12 und 13 Close-ups of the final restorations

Although requiring a fairly thick restoration, simply by choosing the appropriate ingot, an Opal 1 in this case, the optical qualities of the natural tooth enamel were well matched, eliminating the need for cutback and layering (Fig. 9).

Final seating

After the patient was anaesthesized, the provisionals were removed by sectioning with a very thin carbide bur at high speed, but with very light pressure. The preparations were cleaned with 2% chlorhexidine gluconate and each unit was tried-in separately for marginal fit. Next, all four veneers were tried-in together with a small amount of Variolink® Veneer try-in paste to confirm contacts and esthetics. The porcelain was cleaned, then prepared with silane (Monobond® Plus).

The teeth were cleaned and treated with a total etch, single bottle adhesive system (ExiTE® F DSC) prior to seating with a light-cure-only veneer resin cement (Variolink Veneer). Occlusion was refined and the margins polished (Figs 10 to 13).

Conclusion

Lithium disilicate restorations (IPS e.max Press) enable dentists to offer patients a conservative alternative while transforming the appearance of their smiles [4,11]. With lithium disilicate, achieving translucent incisal effects, such as detailed dentin lobe structure and dynamic translucency, often requires cutback and layering. However, the availability of Opal lithium disilicate ingots enable stained and glazed restorations to be fabricated that blend in seamlessly with the remaining dentition. In the presented case, the patient was happy with the need for only minimal tooth reduction and more than pleased with the function and esthetics of the IPS e.max Press restorations using the Impulse Opal 1 ingot.

A literature list is available from the editors on request.

View user video

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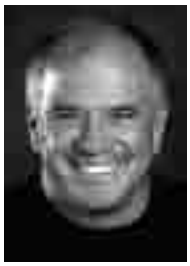

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The pros and cons

A smile make-over – without any tooth preparation

Dr Eduardo Mahn, Las Condes, Santiago/Chile, and Volker Brosch, MDT, Essen/Germany

How can a major improvement of the shade and shape of teeth be achieved? Is there only one appropriate treatment procedure, or are there alternatives?

For quite some time, we have been hearing about minimally invasive techniques for the esthetic rehabilitation of the oral cavity. Whether a patient wishes to have stains removed, teeth bleached or the tooth shape and general appearance improved, the range of treatment options is almost unlimited. Procedures include tooth bleaching, enamel micro-abrasion, direct composite restorations and the whole spectrum of laminate veneer restorations, ranging from full veneers involving more aggressive preparation and the different types of thin or micro-veneers to non-prep veneers and edge-ups. In cases where a major improvement of the shade and shape is desirable, indirect veneers are clearly the clinician's first choice.

Because of their superior esthetic and mechanical properties, indirect veneers are ideal when extensive esthetic adjustments are required. Before the material is chosen, the clinician needs to understand the two main challenges of esthetic oral rehabilitation: selecting the proper shade and opacity of the material and determining the amount of tooth structure that needs to be removed in order to achieve the desired result. For example, in cases where teeth are moderately to severely misaligned and orthodontic treatment is not possible, aggressive preparation will be needed. The same applies to teeth with heavy staining caused by fluorosis or tetracycline.

Fig. 1 Preoperative situation: Multiple distemas are present. The patient's wish was to have them closed.

Indication: non-prep veneers

Multiple diastemas may be present when teeth are too small for the maxilla and mandible or after the patient has undergone orthodontic treatment to achieve an adequate Class I canine relation. This is an ideal situation for the minimally invasive treatment with thin, non-prep veneers, especially if no major discolorations are present and if the teeth are square and flat. Contrary to common belief, non-prep veneers can represent a clinical challenge in many respects.

Digital mock-up

A diagnostic wax-up is of paramount importance in order to evaluate the feasibility of the treatment. Once the wax-up has been created, it needs to be transferred to the mouth to demonstrate the possible esthetic outcome to the patient. A mock-up based on an impression of the wax-up is normally the method of choice. If the traditional protocol is followed, the clinician will have the chance to make small adjustments to the mock-up and discuss them with the patient after the teeth have been prepared and the temporary restorations placed. These adjustments are then communicated to the dental technician before the final restoration is fabricated.

In the case of non-prep veneers, a direct mock-up can be challenging to fabricate and the final outcome difficult to visualize due to the minimal thickness of the final restorations and the differences between the resin (used for the mock-up) and the ceramic (used for the final veneers). Presentation and imaging programs (which are easily available and affordable for everyone) are a novel option for simulating the final outcome. They allow digital mock-ups to be created on the computer screen. This method is extremely easy, accurate and reliable and saves cost and time. While a classical mock-up requires a chair time of 15-20 minutes, the digital mock-up can be done in less than one minute by the dental assistant or the clinician, if appropriate clinical and technical pictures are available. By superimposing a picture of the wax-up onto the preoperative picture, a digital image of the final result is obtained. The only requirement is to match dimensions, inclination and perspective.

Material selection

Closing multiple diastemas with non-prep veneers can be quite a challenging task. In most cases, the veneers will be extremely thin on the labial aspect and at the same time very thick mesially and distally. While high translucency is required to "capture" some colour from the underlying tooth structure and thus ensure a natural appearance, the material also requires reasonable opacity in order to mask the darkness of the oral cavity shining through in the area of the diastemas.

Feldspathic power/liquid ceramics are well-known for their fantastic esthetic properties, but also for their weaknesses. They will fulfil the requirements of a standard case, but if wide diastemas (1.5 mm and wider) are involved, the occurring occlusal forces can be problematical. In the past few years, the esthetic properties of IPS e.max® lithium disilicate glass-ceramic (LS_2) have been significantly improved due to the introduction of different gradations of translucency. Today, LS_2 ceramics can be processed using either CAD/CAM or press techniques. The materials are available in up to five different levels of translucency and show flexural strengths ranging from 360 to 400 MPa. For the case at hand, the highly translucent lithium disilicate glass-ceramic IPS e.max Press HT was chosen.

Clinical case report

A 37-year-old female patient presented to our office. She was dissatisfied with her appearance. She did not like the multiple diastemas showing when she smiled (Fig. 1) and was hoping to find someone who could offer her durable and predictable treatment not involving any tooth preparation and at a reasonable price. She had undergone orthodontic treatment before. In another clinic, teeth 11 to 21 had been restored distally with composite fillings.

Figs 2a and b The wax-up on the model with the gingival mask in place gives an idea of how the situation can be improved.

In our practice, the old composite fillings were removed. In non-prep veneer cases, it is essential for the dental technician to have exact knowledge of the sulcus depth. Therefore, two retractions cords were placed: triple 0 (Ultrapak, Ultradent), which remained in place during impression taking, and 0, which retracted her gingiva and was removed before the impression was finalized. A wax-up was fabricated (Figs 2a and b), digitized and superimposed onto the clinical picture to create a digital mock-up, which was then discussed with the patient (Fig. 3).

In the laboratory, thin veneers were pressed on the basis of the wax-ups using IPS e.max Press. They were stained and glazed (Fig. 4). Their thickness was about that of a human nail. In the mandible, we faced a different challenge.

Fig. 3 A digital picture of the wax-up was superimposed onto the picture of the preoperative situation. In this way, a digital mock-up was created.

Fig. 4 Full-contour veneers were pressed using highly translucent IPS e.max Press lithium disilicate material (layer thickness 200 to 300 µm).

Fig. 5 In the mandible, the diastemas were closed with lithium disilicate edge-ups.

Fig. 6 Dry try-in of the veneers to determine the shade of the luting composite

Fig. 7 Adhesive luting of the veneers using solvent-free Heliobond enamel adhesive …

Diastemas between the laterals and canines were present on both sides. The patient did not expect a dramatic change in the shade of her teeth. Her main concern was acceptable costs and the avoidance of any kind of tooth preparation. Therefore, we decided to restore her teeth with partial veneers (edge-ups). Traditional non-prep veneers would have increased the thickness of the lateral incisors and canines so that they would not have been compatible with the central incisors. This would have created the need for 2 or 3 additional veneers (Fig. 5).

In the case at hand, the luting composite provided assistance. The value concept of Variolink® Veneer enables the clinician to make slight adjustments to the shade of the restoration. The "High Value" shades allow the shade to be lightened gradually, while with the "Low Value" shades, the overlying all-ceramic material can be made darker in stages. For permanent cementation, a solvent-free bonding agent (Heliobond for enamel bonding) and a light-curing luting composite (Variolink Veneer Value +1) were used (Figs 6 to 9).

The selection of the final shade of the restoration is among the most difficult decisions that the clinician has to take together with the patient.

Fig. 8 … in combination with Variolink Veneer, a purely light-curing luting composite

Fig. 9 The function of the veneers was checked immediately after seating. The gingiva was still slightly traumatized at this point.

Figs 10 and 11 View one week after the placement of the veneers. The mandibular teeth were subjected to a one-time bleaching process.

Fig. 12
After four weeks, the gingiva had healed completely.

Fig. 13
Final result after two months

Conclusion

The photographs taken one week after incorporation of the veneers showed their seamless integration into the oral environment (Figs 10 and 11). Two of the aspects that are always mentioned as disadvantages of non-prep veneers are their bulky appearance and the resulting cervical transition between the veneer and the tooth structure, which can lead to periodontal problems in the long term. As shown in Figure 12, both issues can be controlled if the thickness of the ceramic layer is minimal and proper finishing and polishing is done. Figure 13 shows the final result after two months.

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Smiling with self-confidence – while wearing a temporary

Highly esthetic long-term temporary made of Telio® Lab

Velimir Žujić, Rijeka/Croatia

Thanks to esthetic and functional temporary restorations, patients may partake in social activities, maintain a regular daily routine and eat healthy.

Particularly in the case of complex treatments, dental professionals sometimes tend to fail to recognize the importance of the temporary restoration, even though it assumes an important function in the treatment process. Apart from protecting the prepared teeth from infections and chemical and thermal influences, this also includes stabilizing the prepared teeth within the dental arch, securing the jaw relation as well as restoring, maintaining or correcting the function, phonetics, esthetics and shape. From a patient's point of view, the esthetic appearance of the temporary restoration is an important requirement, as they want to participate in social activities and smile with self-confidence also while wearing an intermediate restoration. Thanks to modern materials, this requirement can be met today.

Patient case

Beautiful teeth and a bright, natural smile help to boost self-confidence in most people. In the case described in this article, a female patient was unhappy with her oral situation and thus consulted her dentist. She was about to take on a new professional challenge for which she would be required to interact with people. Therefore, she requested that her teeth should be esthetically restored. Some of the teeth showed carious lesions and the existing crowns and amalgam fillings were defective. In addition, the cervical areas in the anterior region were severely discoloured (Fig. 1). Teeth 16 and 12 could not be preserved and were extracted. We opted for replacing tooth 12 with an implant. The amalgam fillings

Fig. 1
Initial situation: Some teeth showed carious lesions and discolouration. The existing crowns and amalgam fillings were defective.

in teeth 25, 26 and 27 were removed and teeth 17, 13 and 24 were endodontically treated. Furthermore, it was necessary to correct the vertical dimension of occlusion and to adjust teeth 14, 13 and 11 to match the gingival contours.

The severely compromised initial situation would require an extensive restorative treatment, which entailed a long preparation and treatment phase. In order to bridge the period until the seating of the permanent restorations, the dentist and the patient decided to have a long-term temporary fabricated. To ensure that she could start the new job with joy and without reservations, the patient wished that the provisional restoration should be of a high quality in esthetic terms. Another major advantage of this treatment concept is the fact that the temporary restoration enables us to preview the planned permanent restoration. The temporary thus serves the dental professional as an instrument for possible functional and esthetic corrections.

PMMA temporaries – a proven classic

In order to meet the esthetic requirements of the patient, we chose the Telio Lab material. This PMMA-based cold-curing polymer is used to fabricate highly esthetic temporary crowns and bridges. Usually, the restorations are fabricated in the pouring technique and esthetically customized using light-curing composites and stains.

In the present case, the maxillary anterior teeth of the right quadrant were lengthened on the study model by means of a functional wax-up (Fig. 2) and subsequently adjusted to match the tooth shape of the left quadrant. Starting with the palatal aspect and then proceeding to the frontal side, the wax-up was then recorded with a two-part matrix fabricated with silicone putty (Fig. 3). This matrix was then transferred to the articulated model with detachable segments (Fig. 4). I placed markings on the frontal block, so that it would be easier to reposition the matrix exactly. Prior to pouring the temporary material, I blocked out the areas between the segments and undercuts with wax. As stated in the instructions, the model was then water-soaked for five minutes. After isolation of the model with SR Separating Fluid (Fig. 5), the composite powder was poured into a mixing cup and mixed so as to avoid bubbles.

After mixing, the cup must be covered and the resin material allowed a dough time of approx. 2 minutes. The material achieves an optimum consistency during this time.

Fig. 2 Wax-up: The teeth in the first quadrant were lengthened on the study model.

Fig. 3 The wax-up was recorded with silicone putty.

Fig. 4 The silicone matrix was transferred to the articulated model with detachable segments.

Fig. 5
The gaps between the segments and undercuts were blocked out with wax and the model was isolated with SR Separating Fluid.

While in a low-viscosity state, the resin material was carefully applied to the isolated model and subsequently poured into the silicone matrix as evenly as possible (Fig. 6). In order to avoid an increase in vertical dimension, a minimal excess is necessary. When the silicone matrix filled with composite material is placed onto the model, excess material is squeezed out. The polymerization time is 15 minutes in a water bath at 50 °C / 122 °F and with approx. 3 bar / 44 psi pressure.

In the present case, I chose shade A2. In addition to a perfect basic shade, the material showed a homogeneous surface already after removal of the silicone key (Fig. 7). This surface makes the Telio material unique and imparts outstanding polishing properties to the material. Cut-back was performed with cross-cut burs (H138E or H136EF, Komet) to create the required space to design mamelons and the incisal edge (Fig. 8). It is important to regularly check their shape and length while designing them by means of the silicone matrix.

After the cut-back, I blasted the surface with aluminium oxide at a pressure of 2 bar / 29 psi, cleaned it with steam and, after drying, I wetted it with monomer liquid (Telio Cold Liquid). To ensure a sound bond with the light-curing characterization materials, I conditioned the surface with SR Composiv. Subsequently, I customized the temporary with Telio LC Incisal material. For this process, I successively built up and characterized the previously reduced areas – in this case, I used Telio Stains blue and white, among others (Figs 9 and 10). Also during this process, I kept checking the shape of the teeth with the silicone matrix (Fig. 11). Prior to final polymerization, SR Gel was applied, in order to prevent the formation of an inhibition layer on the restoration surface. The final polymerization took place in a Lumamat furnace for 11 minutes.

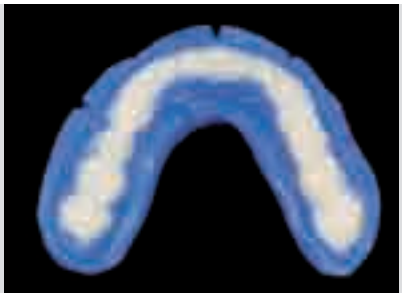

Fig. 6 The resin was poured into the silicone matrix evenly.

Fig. 7 The homogeneous surface became evident already upon removal of the silicone matrix.

Fig. 8 Cut-back was performed with a cross-cut bur.

Fig. 9 Telio Stains blue was used for the individual characterization of the incisal area.

Fig. 10 A small amount of Telio Stains white was applied between the mamelons.

Fig. 11 The tooth shape was checked with the silicone matrix also during layering.

Sound planning, superior result

Subsequently, I applied the usual occlusal and proximal adjustments. Using cross-cut, fine-grit burs, I designed a lifelike surface texture. The completed and polished temporary exhibited a compact and smooth surface (Fig. 12).

On the intraoral images, you can see the harmonious dimensions of the temporary. Due to the application of small details (such as an incipient enamel crack on tooth 11, internally applied blue stains and simple white mamelons), the temporary restoration was given a lifelike, esthetic effect. In addition, the good material properties support the regeneration of the gingiva and are thus conducive to achieving good pink esthetics (Fig. 13).

The patient was overjoyed. She could now start her new job without any worries and meet her new colleagues and customers with self-confidence. The temporary restoration did not cause any esthetic compromises (Fig. 14). Such temporary restorations give patients a feeling of confidence, are comfortable to wear and in addition protect the prepared teeth. At the same time, these restorations are an excellent tool dental professionals can use when fabricating the permanent restoration.

Fig. 12 The completed, polished restoration exhibited a compact and smooth surface.

Fig. 13 Immediately after cementation, the temporary restoration showed a harmonious integration into the oral situation.

Fig. 14 It's hard to believe that this is a PMMA temporary restoration. The patient was pleased with the result and could look forward to her new job with boosted self-confidence.

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