

ANTERIOR ESTHETIC ENHANCEMENTS WITH IPS EMPRESS® VENEERS:

*The Beauty and Versatility
of an All-Ceramic
Restorative System*

by NELSON Y. HOWARD, D.D.S.



Dr. Nelson Y. Howard graduated from the UCLA School of Dentistry in 1986 and completed a one year general practice residency at the V.A. Medical Center in West Los Angeles, California in 1987. He has a private practice limited to cosmetic and restorative dentistry at his Center for Advanced Cosmetic Dentistry in San Marcos, California. Dr. Howard is the President-Elect of the Southwest Chapter of the AACD and is the immediate Past President of the San Dieguito Dental Health Academy. He founded the West Coast Society for Cosmetic Dentistry in 1998 and the North County Dentists Disability Service in 1996. He lectures and has published numerous articles on various topics within the area of cosmetic dentistry.

The esthetic revolution in dentistry has never been more apparent than it is right now. Today, in many situations, the "bonded" partial coverage restoration has replaced the traditional full coverage cemented restoration of yesterday. In an age where less reduction is more beneficial to a patient, the realm of conservative dental treatment modalities has markedly increased over years past. To further "complicate" matters is the considerable role that esthetics now plays in the vast majority of restorative procedures. In particular, with anterior indirect restorations, there are numerous all-ceramic restorative systems currently in use which enable dentists to dramatically enhance and

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improve the esthetics desired by the more "cosmetically conscious" patient of today. Intertwined in this mutual esthetic goal between doctor and patient is the ability of the ceramist to create restorative improvements that will bring about positive changes in a person's life reflected through the beauty of the dental artistry they create. The all-ceramic restorative system selected for each particular case is critical; in most instances, numerous factors need to be considered before selecting a material which will meet all the criteria necessary to optimize success and minimize esthetic failure. Some of these factors include:



Figure 1: Initial smile showing esthetically defective porcelain veneer on the maxillary right central incisor.

- Color of surrounding dentition that will reflect onto and through the tooth/teeth being restored;
- External (surface) and internal color of the tooth/teeth being restored;
- The physical strength of the restorative material;
- Dynamics of function against the final restoration;
- The shade and optical properties of the luting cement being used for the final restoration³;
- The biocompatibility of the restorative material;
- The periodontal health of the tooth/teeth being restored,
- The gingival architecture of the adjacent teeth; in particular as it relates to smile design and analysis.

With anterior esthetics, the restorative options include full coverage crowns and veneers. In many instances, the more conservative veneer option can be used in a variety of applications to achieve highly desirable esthetic results. With veneer technology rapidly improving, knowledge of the many ways veneers can be utilized to change the dimensions of a tooth is essential if clinical success is to be optimized and failure is to be minimized.

This article illustrates the use of one all-ceramic restorative system, IPS Empress® (Ivoclar Williams, Amherst, NY), in the veneer application for anterior esthetic enhancement of two patients.

MATERIAL CHARACTERISTICS

The IPS Empress porcelain system has been in clinical service for over ten years and was selected for these two cases because of its outstanding esthet-

ics, high tensile strength, fracture resistance, and excellent marginal adaptation, when compared to most other all-ceramic systems.^{2,3,4} IPS Empress offers ceramic ingot material for every hue of the shade guide (Chromascop™, Ivoclar/Williams, Amherst, NY) used with either the layering or staining technique.⁵ The mechanical properties and strength of IPS Empress are improved by leucite crystal reinforcement which help to prevent or reduce the propagation of microcracks throughout the glass matrix, in addition to providing a flexural strength of the pressed ceramic of about 125 MPA.^{5,6} This system utilizes the “lost wax” principle in combination with ceramic ingots that are preheated and pressed into the investment material under vacuum at a temperature of 1100°C and a pressure of 5.0 bar.⁷ During a programmable holding period, the ceramic accurately reproduces the fine details of the investment cavity, even thin margins. This “pressing” process produces

an optimal fit with a marginal adaptation of approximately 20 micror. Along with wear resistance of the ceramic material similar to that of natural enamel, its kindness to opposing tooth structure and natural life-like esthetics makes IPS Empress an ideal material for all-porcelain restorations.

An added advantage to the IPS Empress system is the use of shaded dies upon which the restorations are built up. There are nine different shaded ceramic materials (“Stumpf” shade guide, Ivoclar Williams, Amherst, NY) which the clinician can choose from based on the actual shade of the prepared tooth. These selected shades, or “stump” colors, enable the ceramist to fabricate the restoration with an awareness of the actual color and shade of the tooth preparation. The esthetic considerations of the restoration can then be accounted for and modified accordingly by knowing how the underlying tooth structure color will reflect through the all-ceramic restoration.



Figure 2: Final IPS Empress Veneer preparation showing facial “masking/block-out” of discolored coronal tooth structure with composite and recontoured facial gingiva.

RESTORATION/ FABRICATION DESIGNS

With the IPS Empress system, two restoration/fabrication designs are utilized. The first involves the "Staining Technique" whereby the final restoration is waxed up to completion, invested, burned-out, and then pressed with one shaded ceramic ingot. Upon divesting, the pressed restoration is fitted to the master die and the occlusion adjusted. The restoration is then "stained" to achieve the final shading.

The second design utilizes the "Layering Technique." With this technique, the restoration is again waxed to completion, invested, burned-out, then pressed with a shaded ceramic ingot that matches the natural dentin color of the tooth preparation. Upon divesting and fitting to the master die, the restoration is "cut-back" to replicate the internal dentin anatomy of the desired final restoration. This dentin substructure constitutes the "core" of the restoration. Enamel and incisal

porcelains are then built up around this dentin "core" to create the final restoration. Final staining creates the finishing touches to this restoration design.

The "Layering Technique" is the much preferred restoration design, especially when anterior and posterior full-coverage and veneer restorations are used. The use of the "cut-back" step to the initial pressed restoration, combined with the addition of the numerous shaded enamel and incisal porcelains, gives this "layered" restoration improved light transmission qualities with a greater resemblance to the characteristics of natural teeth.

CASE PRESENTATIONS

CASE ONE

A 49 year-old female presented with an existing porcelain veneer on her maxillary right central incisor which she said had recently been placed. She was not very happy with the appearance of the veneer and was especially dis-

pleased with the visible fracture of the veneer so soon after it had been placed (Figure 1). She felt the tooth was "ugly and stuck out too much" compared to her adjacent central incisor. Upon further clinical, periodontal, and radiographic examination, the following findings were noted:

- A. No pulp chamber and canal was present, and the patient did not recall any past history of trauma to this tooth.
- B. Excessively bulky marginal gingiva was present solely around the maxillary right central incisor.
- C. Numerous internal and external colors were present on all maxillary anterior teeth, in particular the right central incisor. This was probably attributed to the lack of pulpal tissue, and thus, internal color changes which followed with the eventual atrophy of the pulpal tissue.

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Figure 3: Final IPS Empress Veneer on maxillary right central incisor. Note outstanding characterized esthetics, ideal form and shape, and excellent periodontal health.

Based on all the clinical findings and after discussion with the patient, the decision was made to replace the existing veneer with an IPS Empress Veneer utilizing the "layering technique." An IPS Empress veneer was preferred on the maxillary right central incisor because of its more anterior position, high gingival margin, and the desire to have maximum light transmission through the material illuminating the tooth, giving a more natural color to the surrounding gingival tissue. Translucency allows this type of veneer to mimic natural tooth structure because the light passes through the ceramic material and is reflected

off the underlying tooth structure and composite luting material.⁹

PREPARATION GUIDELINES

With IPS Empress restorations, a crucial element is the design of the preparation. Veneers should be uniformly reduced at least .6 mm at the cervical one-third, with .8 mm to 1.0 mm at the incisal.¹⁰ Adequate thickness is necessary not only for proper pressing, but also for adequate strength.⁸ The interproximal preparation should be extended from the gingival margin into the proximal space and follow the contour of the gingival papilla and the adjacent tooth, extending incisally, thereby creating an "elbow-like" extension. This is especially important when the veneer is used to significantly alter the shade of the tooth. This extension will conceal the proximal margin from view.¹¹ Coverage of the incisal edge is required in most cases in order to achieve a natural-appearing translucent edge that offers improved

longevity and strength. Preparation of the teeth without ceramic overlapping of the incisal edge can be achieved only in those maxillary restorations without parafunction, without the need for tooth lengthening, or with a thick incisal edge.⁵ If the tooth is to be lengthened, the preparation should provide approximately 1.5 mm of

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porcelain between the incisal edge of the preparation and the final incisal edge of the veneer. The lingual margin should join the proximal margins creating a 360 degree continuous chamfer margin. The lingual margin should be placed approximately 1 mm to 1.5 mm gingivally of the incisal edge of the

preparation. Sharp internal line angles, edges, and undercuts should be avoided with all types of porcelain restorations. A shoulder preparation with a butt joint margin or a deep chamfer margin are essential and should whenever possible be placed supragingivally and follow the contours of the gingival margin. As a final step, a fine metal finishing strip is gently passed through the proximal surfaces to lighten the proximal contacts. This aids the ceramist in separating the dies and facilitates veneer cementation.¹¹

PREPARATION PROCEDURE

After anesthesia was obtained via infiltration, the existing porcelain veneer was removed with a diamond bur and the tooth was prepared according to the preparation guidelines previously discussed. Due to the excessive amount of gingival margin tissue, electrosurgical recontouring was performed to even out the gingival anatomy and architecture to the adjacent incisors. The tooth was provisionally temporized using a flowable composite as a "coping" upon which a microfill composite was applied and sculpted to match the shape of the contralateral incisor. The tissue was allowed to heal for two weeks and post-operative instructions were provided to the patient.

After the tissue was well healed, the tooth was further prepared by removing an additional 2 mm of facial structure with a diamond bur. This procedure was necessary due to the severe discoloration of the existing tooth structure and the negative shading effects it would have under the new restoration. Since there was no pulpal tissue to be concerned with, this additional reduction was easily obtained

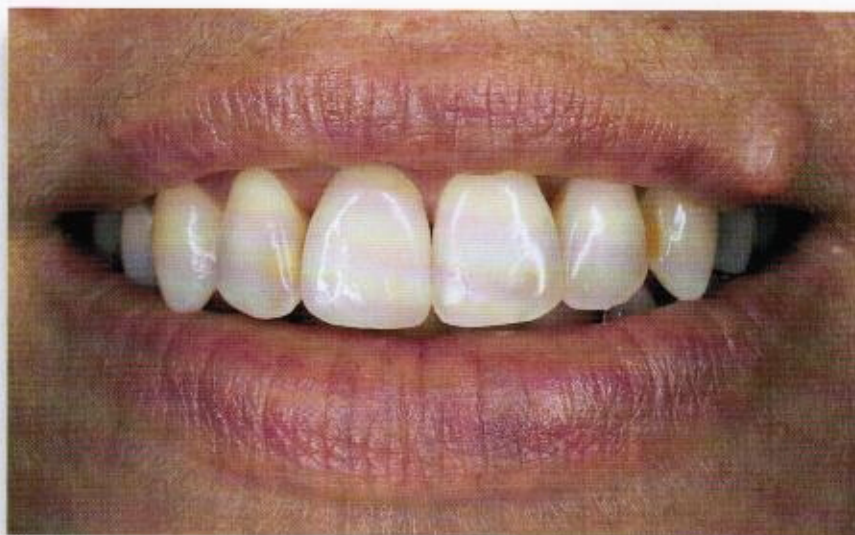


Figure 4: Final smile showing balance, symmetry, and esthetic harmony with the adjacent dentition!

without clinician or patient concern. Subsequently, a light shade of a hybrid composite resin (A-1, Prodigy, Kerr, Orange, CA) was placed using proper adhesion techniques into the specially prepared area to mask the zone of severe staining.¹² The preparation was then completed and final impressions were taken. (Figure 2)

This process removes any surface contamination and acidifies the porcelain surface, which increases the efficacy of a silane coupling agent. The acid was thoroughly rinsed off and the restoration was air-dried.

The tooth was re-temperized in the same manner except a thin layer of petroleum jelly was first applied over the facial preparation area to prevent the flowable "coping" composite from bonding to the "masked-out" area. This would facilitate the removal of the temporary at the final cementation appointment. The temporary was held in place interproximally and the patient was instructed to floss only with a floss threader under the contacts and to avoid biting into anything on that tooth.

The impressions along with pre-operative photographs, slides, and study models were sent to the laboratory technician. A highly-detailed laboratory prescription outlining the desired porcelain shades to be used was also enclosed. Dentin lobe characterization, surface texture, incisal edge pattern, and the desired shape contours were also diagrammed and noted. The patient was also instructed to see the lab technician prior to the completion of the restoration for a final "detailing and perfecting" of the restoration. The author feels that

this step is critically important when an anterior esthetic restoration is prescribed, especially in single-unit cases.

VENEER PLACEMENT

The IPS Empress veneer was returned from the lab etched internally with hydrofluoric acid. The temporary was removed and the veneer was tried in with the Variolink try-in pastes (Ivoclar/Williams, Amherst, NY) for the patient's approval and to view the esthetics prior to final cementation. The white shade of the try-in paste was selected as the best overall color. The 22µm film thickness of Variolink makes it ideal for ensuring the accurate placement and marginal adaptation of the restoration.¹³ Upon verification of marginal integrity and approval from the patient, the restoration was ready for final cementation. After try-in, the internal surface of the veneer was cleaned and etched for 60 seconds with a 35% phosphoric acid (Ultra-etch, Ultradent Products, South Jordan, UT). This process removes any surface contamination and acidifies the porcelain surface, which increases the efficacy of a silane coupling agent.¹⁴ The acid was thoroughly rinsed off and the restoration was air-dried. A silane coupling agent (Monobond-S, Ivoclar, Amherst, NY) was then applied to the internal surface of the restoration, left undisturbed for 60 seconds, then air-dried. Silane coupling agents have been shown to increase the bond strength between the porcelain and the resin cement and to decrease microleakage.^{15,16} An unfilled resin (Heliobond, Ivoclar, Amherst, NY) was then applied to the internal surface of the restoration and thinned with air accordingly. The restoration was placed

in a light-protective container to prevent the premature setting of the unfilled resin prior to final cementation. A rubber dam and retraction cord were placed to obtain complete moisture control. The tooth preparation was cleaned with an antibacterial scrub containing chlorhexidine (Concepsis, Ultradent Products, South Jordan, UT), rinsed, then dried. The 35% phosphoric acid etchant, noted previously, was then applied to the entire preparation for 15 seconds, rinsed, then lightly air-dried, so as not to desiccate the tooth. Tubulicid Red (Global Dental Products, North Bellmore, NY) was placed on the preparation for its antibacterial, cleansing, and rewetting properties and the preparation was lightly air-dried. Monobond-S was then applied to the area "masked-out" with the hybrid composite resin and allowed to air dry for 60 seconds. The preparation was then primed (Optibond FL, Kerr, Orange, CA) utilizing several applications. The tooth was lightly air-dried, with the subsequent application of Optibond Dual-Cure

The initial preparation phase consisted of removing all overlapping aspects of the four incisors, both from the facial and lingual aspects.

adhesive (Kerr, Orange, CA). The veneer was filled with the corresponding white shade of Variolink luting cement (Ivoclar Williams, Amherst, NY) and seated completely. Excess cement was removed first with a rubber tip instrument followed by a brush tip, then spot-cured into position for three seconds each from both the mid-facial and mid-lingual surfaces with a 2 mm Argon laser light tip. Additional excess cement was



Figure 5: Initial photograph of patient.



Figure 6: Close-up of her smile illustrating the esthetic problems with the maxillary lateral and central incisors.



Figure 7: An incredible esthetic result with an award-winning smile!

then removed and floss was passed through the contacts. A de-oxygenating agent (DeOx, Ultradent Products, South Jordan, UT) was applied to all margins and final curing was completed from both the facial and lingual aspects with an 8 mm Argon laser light tip for 20 seconds each.

The occlusion, laterotrusive, and protrusive movements were checked and adjusted after the rubber dam was removed. Final finishing in the traditional manner was completed using fine carbide and diamond finishing burs, finishing strips, and polishing cups and points. The final restoration seen in Figures 3 and 4 demonstrates esthetic harmony, excellent periodontal response, as well as uniform balance and symmetry. The marginal integrity of the restoration is indistinguishable from the surrounding dentition. The patient was extremely pleased with the final result.

CASE TWO

A 33 year-old female (Figure 5) presented desiring an improved smile (Figure 6). She was not happy with the rotations of her maxillary right lateral and central incisors and the "depressed in" appearance of her maxillary left central and lateral incisors. She had expressed a desire to have her teeth restored quickly and without orthodontics because she was attending a family function in approximately four weeks from the time she came in. Clinical, periodontal, and radiographic examinations were performed and after discussion with the patient, the decision was made to place IPS Empress Veneers on the maxillary lateral and central incisors. It was mutually agreed upon that the shape and position of the cuspids did not warrant veneer treatment. One area of particular concern was the extensive amount of opacity that existed in all her teeth, in particular her maxillary and mandibular cuspids and posterior teeth. Detailed communi-

cation with the laboratory to incorporate these opacities within the selected shades would be vital in order to insure clinical and esthetic success.

PREPARATION PROCEDURE

The initial preparation phase consisted of removing all overlapping aspects of the four incisors, both from the facial and lingual aspects. This would re-establish more even facial and lingual planes upon which to prepare the teeth to "ideal" veneer preparation specifications." The teeth were then prepared according to the veneer guidelines previously discussed. Final and opposing arch impressions were taken along with a bite registration. The teeth were temporized in an identical manner as in Case One, and the case was sent to the lab with all the necessary information as described in the previous case.

FINAL CEMENTATION

The veneers were tried in to verify esthetics and marginal integrity in an identical manner as described in Case One. The pre-placement protocol for the veneers was also identical as in Case One and was completed after the try-in stage. The only difference in the pre-placement protocol for the teeth preparations was that Monobond-S was not necessary, since no "masked-out" resin was used on the preparations; Optibond FL (Kerr, Orange, CA) light-cured adhesive was used instead of the Optibond Dual Cure Adhesive. The Optibond FL adhesive is solely light-cured and allows for more operator seating time when placing multiple restorations versus the dual-curing adhesive which may preliminarily set before all

the restorations are placed and thus, create marginal voids and improper seating of the final restorations. The white shade of Variolink was chosen as the final shade. Upon completion of the pre-placement protocol for both the veneers and the teeth preparations, with the exception of the application of the Optibond FL adhesive, the veneers were ready for final cementation.

Veneer placement would begin with the central incisors. After all four teeth were primed, following a pre-placement protocol identical to Case One, Optibond FL adhesive was placed on the central incisor preparations in a thin layer. The cement was placed in both veneers and the two central incisor veneers were seated together. Excess cement was first removed using a rubber tip instrument then followed with a small brush tip. Both veneers were held together and spot-cured into position for three seconds each from both the mid-facial and mid-lingual surfaces with a 2 mm Argon laser light tip. Additional excess cement was then removed. Optibond FL adhesive resin

was applied to the lateral incisor preparations and the lateral incisor veneers were placed one at a time in an identical manner as previously described. Floss was passed through the contacts prior to final polymerization to remove further excess cement and to prevent the bonding of the restorations together. A de-oxygenating agent (DeOx, Ultradent Products, South Jordan, UT) was applied to all veneer margins and final curing was completed from both the facial and lingual aspects for 20 seconds each with an 8 mm Argon laser light tip.

All functional movements were checked and adjusted after the rubber dam was removed and final finishing was completed using fine carbide and diamond finishing burs, finishing strips, and polishing cups and points. The final restorations demonstrated outstanding characterized esthetics, ideal contours, form, and shape, and excellent periodontal health. The dramatic improvement in her smile is noted in Figure 7 and the marginal adaptation of the restorations are invis-




Figure 8: A very happy patient with her new smile!

ible from the actual tooth structure. The patient was thrilled with the final result! (Figure 8)

CONCLUSION

The beauty and versatility of the IPS Empress system is well known among esthetic dentists and ceramists. To achieve the desired and predictable esthetic results requires a thorough treatment analysis of the restorative condition to be corrected. Understanding proper preparation principles, techniques, and porcelain design is critical to maximize the final outcome. Clinicians who are performing these esthetic procedures must have advanced technical skills and utilize the proper armamentarium sequence if their results are to be successful both esthetically and functionally.

When all factors have been accounted for, the end result will reflect the importance that cosmetic dentistry has in the ability to improve our patients' lives and to provide continuous gratification for the clinician, ceramist, and patient. 

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