

The case for moderate “guided prep” indirect porcelain veneers in the anterior dentition. The pendulum of porcelain veneer preparations: from almost no-prep to over-prep to no-prep

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Abstract

In a historical pendulum of porcelain veneer preparation concepts, an oversimplified version of the so-called “no prep” approaches has resurfaced. A case from the USC student clinics is presented, which could be easily considered by many as a “no prep” veneer case. Moderate tooth preparations guided by natural morphology were used instead with a great benefit on the

final outcome. While it is widely accepted that minimally invasive restorative approaches should be favored, a certain controversy exists regarding strictly noninvasive approaches. The purpose of this article is to re-emphasize the concept of guided tooth preparations, based on natural tooth morphology (given by a wax-up and a mock-up), a customized and sensible approach to indirect ceramic veneer tooth preparations.

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The clinician in the midst of a historical pendulum

In the last decade, a serious trend for (over)simplification of anterior bonded porcelain restorations has re-emerged, the so-called “no prep”, approaches.¹⁻⁶ Already popular in the 1980s, those non-invasive approaches had been hindered during the 1990s to 2000s by “aggressive ceramic preparations”⁷ as the result of simple but overly aggressive laboratory methods (original pressable ceramics). The current resurgence of oversimplified methods appears as logical response to the 1990s to 2000s preparation euphoria and was also facilitated by technological improvements to produce much thinner pressable ceramic veneers. As described by Dr Martin Goldstein in a very fair and well-presented viewpoint article,¹ it seems that veneer tooth preparation principles are in a reciprocating pendulum, balancing from a “right-wing” approach to a “left-wing” extreme. The clinician may find himself navigating in the midst of those “conceptual winds”, even experiencing a certain amount of guilt for not being able to adapt to those changing concepts. But the dentist, using scientific evidence along with his common sense and experience, should always remain the captain of his boat. The success of clinical dentistry should not be measured as the amount of treatment sold to the patient (usually obtained by following market-based trends). The treatment strategy should not be a choice based on current trends, even less on market-based approaches and other “tricks” to seduce the patient (eg, to address an-esthesia-phobia). This article will demonstrate that knowledge, wisdom and ex-

perience should be combined in a careful, customized recipe that should lead to the right treatment for a specific individual, a treatment that will respect the principles of enamel preservation while delivering what was pledged to the patient through the appropriate diagnostic approach, wax-up/mock-up and informed consent.

Perils of preparation “extremes” – “less is more”, up to a point

Before choosing a treatment strategy, it is worth looking at the perils of preparation extremes. The collateral effects of aggressive approaches will be discussed first. They can be seen as having consequences with a “domino effect” impacting function and mechanics all the way to biology and esthetics. When veneer preparations begin looking like $\frac{3}{4}$ crown, it is known that a substantial amount of coronal substance has been lost,⁸ leading to increased coronal flexibility and strains.⁹ A biomechanical recovery will be possible only through appropriate enamel and dentin bonding.¹⁰ However, enamel may not be saved unless a strong additive concept is applied.^{11,12} On the other hand, efficient dentin bonding requires additional steps such as the resin coating technique,¹³ which is also called immediate dentin sealing (IDS).¹⁴ IDS is also recommended to decrease the risks of postoperative sensitivity.¹⁵ Those additional steps are paramount because the longevity of porcelain veneers will be affected if dentin bonding is not achieved correctly.¹⁶ In some rare cases, especially when veneers are used in “impatient” patients as a substitute to

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orthodontic treatment (the so-called “instant-ortho” cases), particularly aggressive preparation is used to compensate for inadequate tooth position. This, in turn, might even endanger pulp vitality. The next collateral effect of deep preparations, especially at the margins (deep chamfers/shoulders), is the absence of “contact lens effect”. Because of the thickness of the porcelain, the chameleon effect is lost and the transition with the tooth becomes more visible, like that of a crown. This often calls for subgingival margins, to hide this transition, which, in turn, might conflict with periodontal health and long-term maintenance.

A radical answer to the aforementioned issue was required. While they are presented as a much simpler alternative to traditionally prepped veneers, “no-prep” veneers must be considered with extreme caution. They might superficially appear very simple to the dentist, but from the laboratory perspective, fabrication and handling of ultrathin veneers is particularly challenging. The first difficulty is to obtain a natural shape without bulky margins and overhangs. The margins are usually layered thicker than normal then thinned carefully under microscope with a rubber wheel (in the laboratory) or on the tooth after bonding. This is a very technique-sensitive procedure, without which the ceramic will not look like it is emerging from under the gingiva but rather it will look like it is sitting on it. Thin margins are at risk of chipping during handling, requiring additions of luting composite of further finishing with a bur after bonding. It must be reminded that intraoral polishing ceramics (post-bonding marginal finishing), even though possible, will never match

the surface quality of laboratory finished surfaces. This questions the long-term maintenance of such restorations as well as the esthetic outcome of those no-prep porcelain “chips” with visible supragingival margins. For those (dentists and dental technologists) who are not ready to spend the time and effort in those delicate procedures to obtain appropriate fit and contours, a simple solution is to plan the restorations as a symmetrical pack (six or ten-pack) to keep and balance those morphological and marginal mistakes. In specific cases where significant changes of the interdental surface are required (diastemata, black triangles), non-invasive preparations will not allow the fitting of the veneer at the mesiolingual and distolingual margins due to the retentive contours of the tooth. Flattening of the interdental surface is required, precluding the no-prep approach. Delivery of thin porcelain shells on unprepared teeth is particularly challenging because it calls for the use of very thin composite resins to prevent bending forces during seating. Highly flowable composites are obtained by either decreasing the filler content or adding more diluent resins to the matrix, or combining both. In each case there is cost to those modifications that is paid in the form of material properties (increased shrinkage, decreased elastic modulus, wear resistance and strength). In addition, the flow of the luting composite resin makes it even more difficult to seat those veneers that lack primary positional stability on the tooth due to their contact lens shape. In view of the above, it can be concluded that the no-prep approach, supposedly more simple and efficient, is in fact more complicated and more technique sensitive than other techniques.

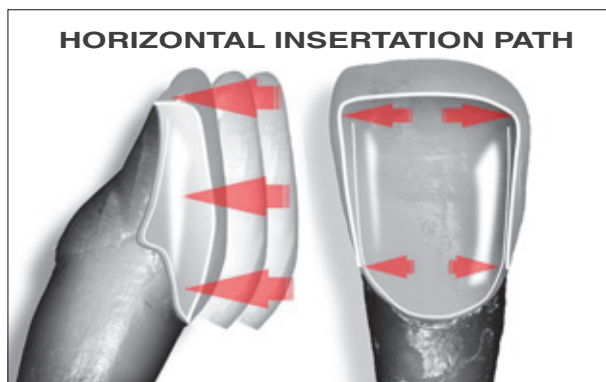
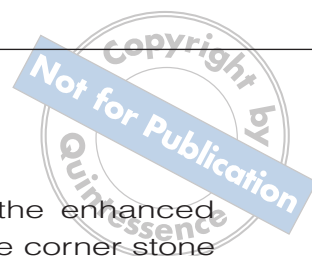


Fig 1 Horizontal insertion of the porcelain veneer should be prioritized because it will allow a conservation preparation that conforms better to the original triangular shape of anterior teeth.

Data about follow-up and maintenance of ceramic “chips” and absolute no-prep veneers is therefore awaited to confirm the claims that it is a viable and simple procedure. Finally, it should be reminded that no-prep cases are often treatable with direct class 4 composite resin restorations (isolated problems) or should be approached indirectly with composite resin (more extended cases) to solve most of the aforementioned difficulties.

The case for moderate guided preparations based on wax-up and mock-up

In view of the above, moderate tooth preparation can still be deemed the golden standard for ultimate esthetic result and tissue conservation. It addresses the need for a simple and efficient indirect ceramic veneer technique. The answer to the preparation dilemma is found in the selective reduction of tooth substance guided by a mock-up that mimics the golden reference, the wax-up itself.

This wax-up represents the enhanced natural dentition and is the corner stone of the entire approach.

Moderate guided preparations will marginally affect coronal stability. Most of the time, the additive wax-up allows to maintain the preparation entirely or at least in majority within enamel,¹¹ limiting the need for IDS. The use of shallow chamfers (0.3–0.4 mm) still allows for a good chameleon effect of the margins, producing supragingival margins that are totally invisible, which, in turn, will facilitate periodontal health and long-term maintenance. From the laboratory perspective, fabrication and handling of those restorations is far less challenging than no-prep veneers. The marginal chamfer allows for a natural emergence, optimal relationship with the soft tissues and provides good porcelain support during finishing and fitting of the margins, resulting in much less risk of chipping during handling. Because of the optimal marginal contour and fit, luting composite resin excesses and flashes can be removed solely manually, with a sicle scaler or a scalpel blade, after polymerization. In those more difficult cases involving significant changes of the interdental design (diastemata, black triangles), preparations with a horizontal insertion path (Fig 1) will facilitate the fitting of the veneer at the mesiolingual and distolingual margins. Delivery of more traditional porcelain veneers is a straightforward procedure because regular composite resins can be used, showing optimal material properties (decreased shrinkage, increased elastic modulus, wear resistance and strength). Seating and positioning the restorations is facilitated by their excellent primary stability



Fig 2 Preoperative views revealing short tapered maxillary anterior teeth (a to c) and non-uniform color/translucency (d, picture taken using polar_eyes filter).

and marginal fit. Significant amount of data about follow-up and maintenance of those restorations is available. A major progress in this moderate approach to tooth preparation is the systematic use of a frontal insertion path (Fig 1).¹⁷ This specific preparation design is particularly conservative because it respects the natural interdental divergence towards the incisal edge, while simultaneously allowing significant wrapping of the same interdental surfaces (required for managing interdental triangles or diastemata).

Case study

A case is presented, that was treated by a student (second author and also teach-

ing assistant in the newly redesigned Dental Morphology, Function and Esthetics class directed by the first author) who was supervised by the first author at the USC undergraduate student clinics. The laboratory work was performed by the third author. Enamel only was prepared in a minimally invasive approach, no dentin was exposed. The case illustrates optimally the concept of the moderate, mock-up-guided preparation. It includes a specific challenge due to abnormal existing tooth shapes (small and tapered maxillary anterior teeth) (Figs 2a to 2c). Cervical proximity between the central incisors was such that it kept the soft tissue papilla particularly flat. An additional challenge was given by

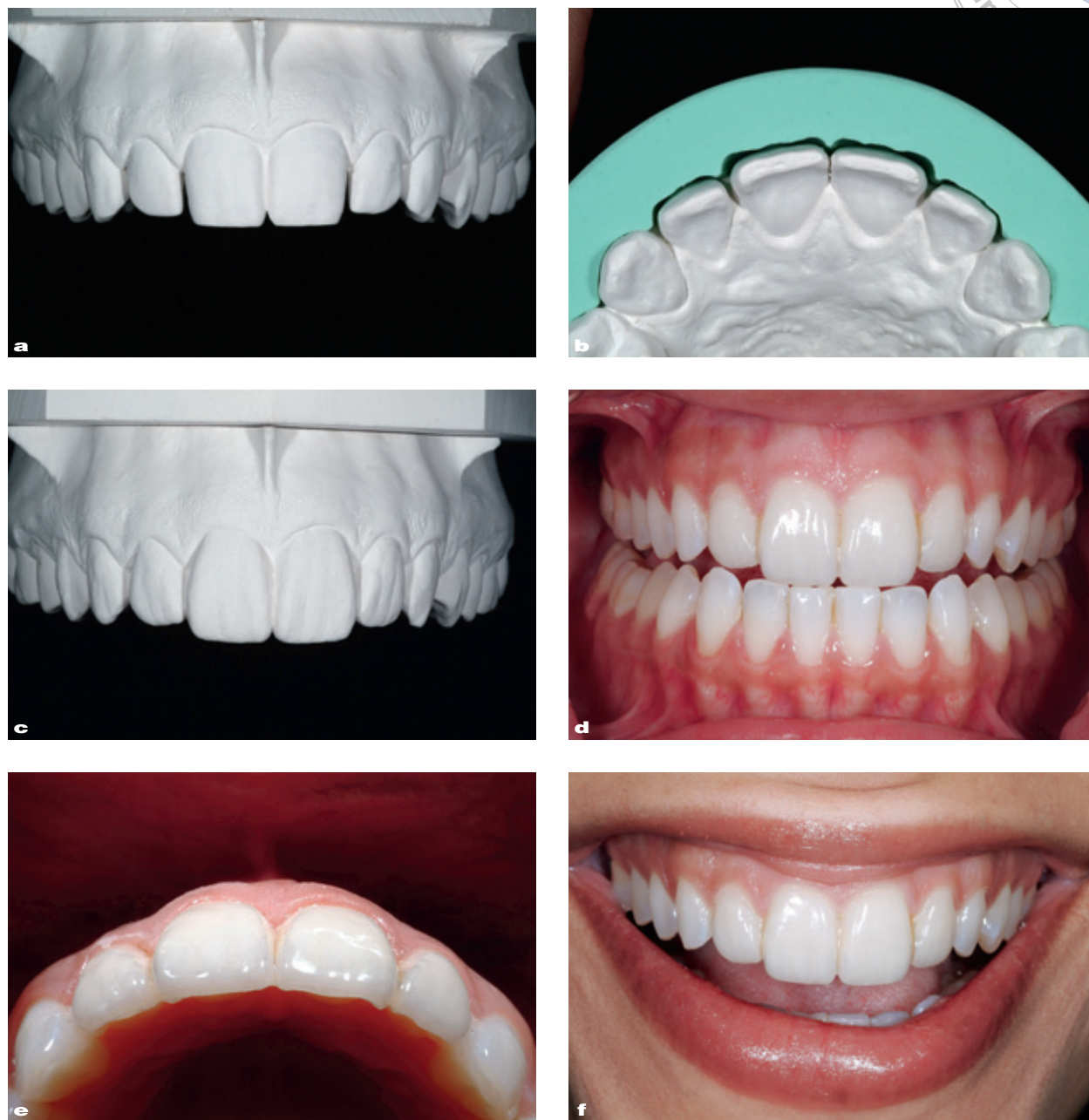


Fig 3 Laboratory diagnostic work. Preoperative cast (a), same cast with horizontally sectioned silicon index of wax-up (b) and stone replica of wax-up cast (c). Prep-less direct intraoral mockup made by dental student using silicon indexes and PMMA resin, stained and glazed (d to f). This technique is described elsewhere.^{18,19} Smile and facial integration of mockup is deemed appropriate by the patient (g to i). Function and comfort were confirmed as well.



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the lack of uniformity of the substrate's color as demonstrated by polarized light photographs (polar_eyes, Photomed) (Fig 2d). The case was traditionally planned with accurate diagnostic casts (Fujirock EP, GC) obtained from

PVS impression materials and the corresponding diagnostic wax-up (Extrude, Kerr) (Figs 3a to 3c). A totally additive procedure was used to fabricate the corresponding mock-up (Figs 3d and 3e). This technique, described else-

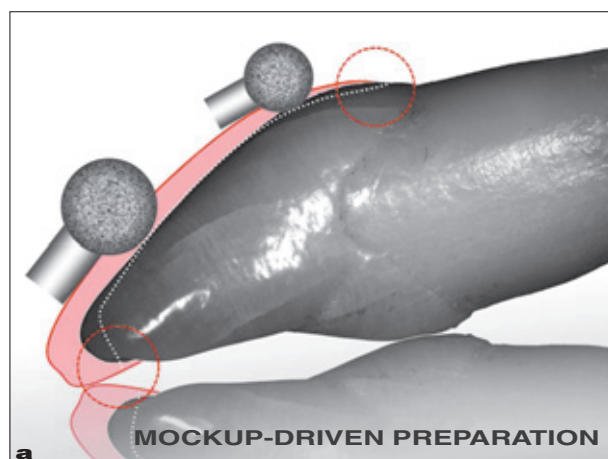


Fig 4 Mock-up-driven preparation: significant amount of tooth structure is saved by the additive wax-up used to fabricate the mock-up (in red). Calibration marks are cut with round burs (a and b) and then the tooth surface is made uniform with regular chamfer burs (c). Resulting preparations without dentin exposures and with accurate margin definition for the dental technologist to produce natural emergence and precise fit (d and e).



Fig 5 Modification of canine tips using enamel-like composite resin molded by silicon index.

where,^{18,19} is the only method to ascertain the length and shape of the future restoration and make sure that there are no interferences with function, phonetics and overall comfort of the patient (Figs 3f to 3i). The mock-up was tested for 1 to 2 weeks and upon the patient's approval, the teeth were prepared, starting with round burs to generate 0.6 mm (incisal third) and 0.4 mm (gingival third) calibration grooves (Figs 4a and 4b) and then with chamfer burs to make a uniform reduction (Fig 4c). Special attention was given to generate smooth contour and sharp finish lines for the dental technologist (Figs 4d and 4e). Veneers were fabricated with a refractory die technique and luted according to classic principles (porcelain etching/cleaning/silane, enamel etching, adhesive resin, preheating restorative composite resin as a luting cement). For optimal integration of the smile, minor composite resin additions were carried out on the canines (Figs 5a and 5b). The final postoperative views not only demonstrate the optimal result, tissue integration and the patient's response

(Figs 6a to 6e), but also the subtle effects that could be incorporated into the porcelain to recover the illusion of a normal papilla between the central incisors (Figs 7a to 7c). It goes without saying that such special effects require a moderate tissue reduction and would be limited with a no-prep approach. By the same token, particularly gentle cervical contours could be generated thanks to the marginal chamfer. This can be easily understood when comparing the natural emergence of the final work from "within" the gingiva compared to the mock-up.

Conclusion

Rather than being focused on the "prep/no-prep dilemma", clinicians and dental technologists should apply knowledge, wisdom and experience in a careful customized recipe that should lead to the right treatment for a specific individual, a treatment that will respect the principles of enamel preservation while delivering what was pledged to the patient through



Fig 6 Comparative preoperative (a) and postoperative intraoral views (b and c). Smile and facial integration of final work (d and e).

the appropriate diagnostic approach, wax-up and *in vivo* mock-up. This approach will reveal and allow the need for selective reduction of tooth substance

based on the dental technologists' needs and the ultimate goal of the restoration.

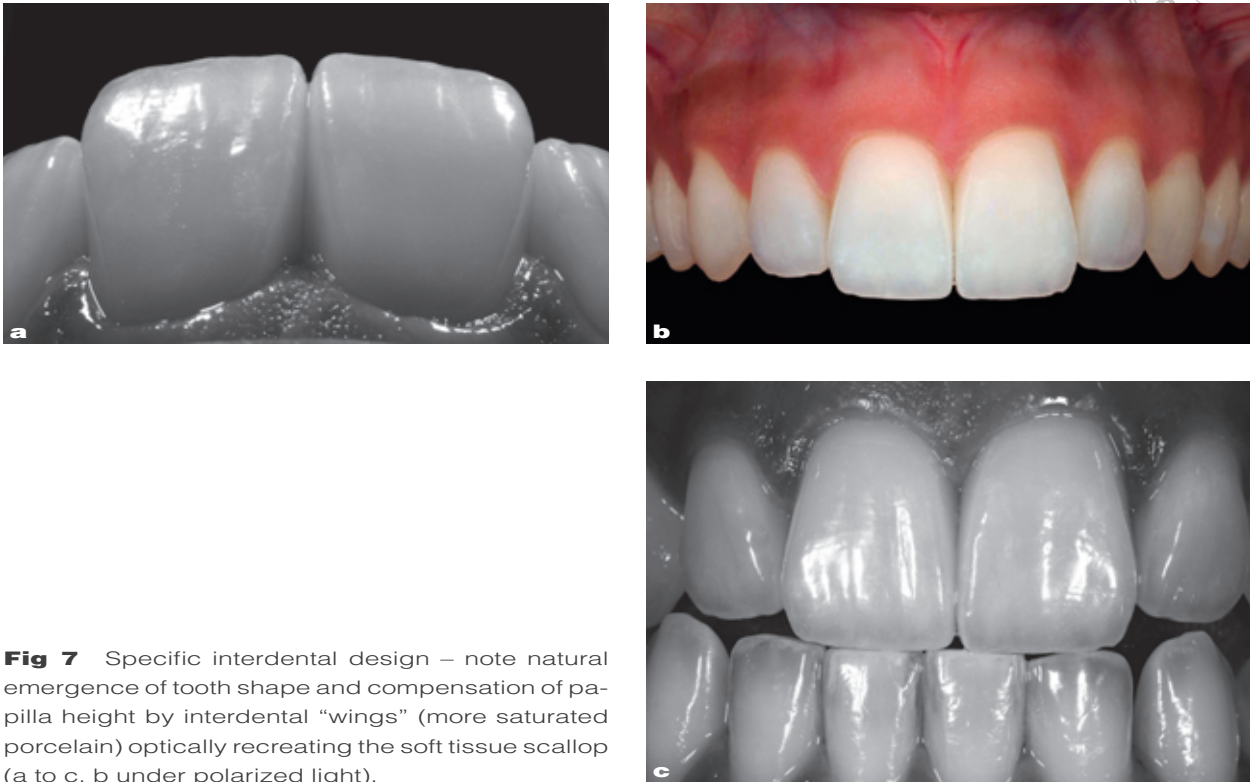


Fig 7 Specific interdental design – note natural emergence of tooth shape and compensation of papilla height by interdental “wings” (more saturated porcelain) optically recreating the soft tissue scallop (a to c, b under polarized light).

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