

2001 • Volume 13 • Number 1

JOURNAL OF ESTHETIC AND RESTORATIVE DENTISTRY

*Official Publication of the American Academy of Esthetic Dentistry,
Japan Academy of Esthetic Dentistry, International Federation of Esthetic Dentistry,
American Academy of Cosmetic and Adhesive Dentistry, Australian Society of Aesthetic
Dentistry and the Belgian Academy of Esthetic Dentistry*

PRESORTED
STANDARD
U.S. POSTAGE
PAID
EASTON, PA
Permit No. 207

Treatment Planning for Porcelain Veneer Restoration of Crowded Teeth by Modifying Stone Models

STEVEN T. CUTBIRTH, DDS*

ABSTRACT

The three-dimensional result attainable through porcelain veneer restoration of crowded teeth can be preoperatively determined by diagnostically altering stone study models of the patient's dentition. Techniques for diagnostically preparing and waxing the stone dental models are described in this article, along with the corresponding postoperative restorative results of representative cases.

CLINICAL SIGNIFICANCE

Patients with malaligned teeth who are not willing or able to undergo straightening of their teeth with orthodontics, nonetheless may be able to attain straight teeth concomitant with the restoration of their teeth with modified porcelain veneer restorations. This article describes a straightforward treatment planning technique for altering study casts preoperatively, to accurately predict and guide the postoperative outcome.

(*J Esthet Restor Dent* 13:29–39, 2001)

It is sometimes difficult to visualize the final result attainable through porcelain veneer restoration when the teeth are not ideally aligned. Normally, it is desirable to reposition crowded teeth orthodontically, prior to veneer restoration. Interdisciplinary treatment to achieve optimal esthetic and restorative results should always be the first treatment approach offered to the patient. However, some patients are unwilling to undergo orthodontic treatment, for a variety of good reasons, even though they desire an attractive smile. Forgoing orthodontic treatment is not necessarily the restorative dentist's first choice, but intelligent patients sincerely seeking

esthetic dental correction are sometimes simply unwilling to submit to orthodontic braces. When is it appropriate to restore crowded anterior teeth with indirect porcelain veneers without insisting on preliminary orthodontic treatment?

Normally, veneers should not be considered if orthodontics alone or in combination with bleaching or minor bonding would produce an acceptable result. However, if the teeth are to be veneered even if orthodontics were performed, then it may be acceptable in some cases to proceed with veneer restoration without first straightening the teeth. Currently, this approach is often

acceptable and advantageous in routine, uncrowded cases in which the teeth to be veneered may be prepared through the interproximal contacts, particularly if existing composite restorations exist.

Ideally, porcelain veneers should be prepared using intraenamel preparations. The durability of enamel bonding and the unyielding support of the underlying enamel are critical to long-term success of porcelain veneers. However, porcelain veneer restorations used to restore teeth that are in need of orthodontic repositioning often require preparations extending into dentin, to achieve proper alignment. Nonethe-

less, if the resulting preparations largely encompass the tooth, often like a three-quarter crown, the design of the preparations will better protect the bonding interface, even if some of the underlying preparation is in dentin. Regardless, as much enamel as possible should always be maintained, particularly along marginal areas.

Preoperatively, the dentist must be able to ascertain three-dimensionally the final restorative result attainable. Computer imaging does not provide enough information, because this method of diagnostic evaluation offers only a two-dimensional assessment. Diagnostically prepared and waxed stone study models offer the dentist and patient a near-exact, three-dimensional preview of the final restorative result.

CLINICAL TECHNIQUE

Following a comprehensive examination of caries, the periodontium, occlusion, temporomandibular joints, muscles of mastication, soft tissue, existing restorations, and smile, alginate impressions (Identac, Cadco, Oxnard, California) were made of the maxillary and mandibular teeth and poured in dental plaster (white Velmix, Kerr, Romulus, Michigan) according to manufacturers' instructions.^{1,2} Each patient was interviewed for approximately 30 minutes, prior to the clinical examination, to review their dental and medical histories and to determine their perception of their

dental condition and needed treatment as well as their appreciation and understanding of dentistry.³ The particular circumstances of each patient are described as individual case presentations. The primary complaint of each patient was that of displeasure with his or her smile, and each desired esthetic dental restoration.

The stone study models were mounted on semiadjustable Hanau articulators in a centric-relation-occlusion position with an arbitrary facebow.⁴ Care was taken to ensure that the "bow" of the facebow was parallel to the floor when the record was taken. This step ensured a facebow mounting on the articulator that provided the correct alignment of the study models. Normally, the interpupillary line serves as a "parallel to the floor" reference. The interpupillary line should be checked with the patient standing erect, to ensure that it is indeed parallel to the floor.

A separating disk (#18, SS White, Philadelphia, Pennsylvania) mounted on a dental lathe was used to cut interproximally completely between any overlapping teeth. A No. 25 Bard-Parker blade (Beckton Dickson AcuteCare, Franklin Lakes, New Jersey) was used to shave the facial surfaces of the maxillary anterior teeth on the stone models so that the stone teeth were ideally aligned in the dental arch. The same blade was used to recontour any incisal edges

that extended incisally past an ideal incisal plane. The incisal plane of the maxillary anterior teeth was accessed during the examination appointment to determine parallelism to the upper lip line. Photographs of the anterior teeth, with the upper lip in repose, were taken and used as a guide during recontouring of the teeth on the stone model. The cut and contoured stone models were then waxed to determine the attainable restorative result (Life-Like Presentation Wax, Whip mix, Louisville, Kentucky).

The preoperative cut and waxed models (three models) for each patient were then analyzed to determine the appropriateness of proceeding directly to veneer restoration of the crowded teeth, without orthodontics. The following questions must be considered relative to the final treatment alternatives pursued:

1. Would the teeth still require veneers if orthodontic treatment were performed? If the answer to this question is "No, the teeth would not require veneers if orthodontics were performed," then restoration with porcelain veneers normally should *not* be undertaken.
2. Will the tooth reduction required be extreme, resulting in virtually no remaining enamel or even requiring endodontics? If yes, then the importance of orthodontics should again be stressed to the patient in light of

these findings, or crowns may need to be considered.

3. Will the gingival margins and papillae be symmetric and of appropriate height following restoration?
4. Will the restored tooth lengths and widths be appropriate?
5. Will the long-term health of the teeth, periodontium, and dental pulps be compromised by the altered tooth contours?
6. Will oral hygiene be compromised?
7. What are the circumstances of the patient, and why does he or she wish to proceed with veneer restoration without first undergoing orthodontic treatment to correct dental misalignment?
8. Will the final restorative result, with veneer restoration alone, satisfy the patient and dentist?

CASE PRESENTATIONS

Case 1

A 20-year-old female presented with a Class II, Division 2 occlusion (Figure 1). Additionally, the teeth were misshapen and discolored, and the maxillary lateral incisors were disproportionately small. She was depressed about her smile and desired esthetic correction.

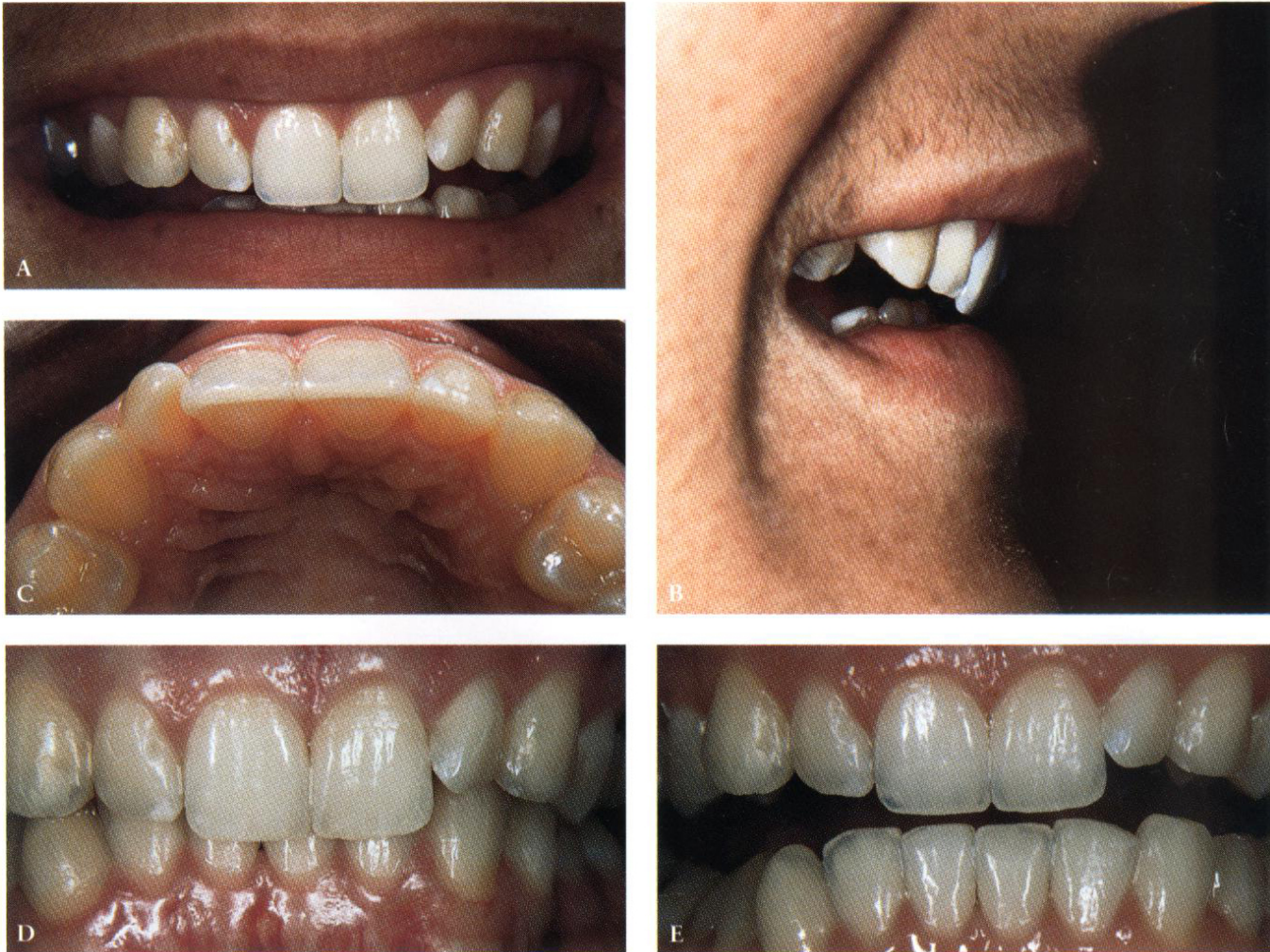


Figure 1. A-E, Case 1. The patient presented with Class II, Division 2 occlusion. Note disproportionately small lateral incisors.

Following clinical examination as previously outlined, the patient was referred to an orthodontist for evaluation. The orthodontist referred her to an oral and maxillofacial surgeon for evaluation. Together, the two specialists recommended orthodontic treatment to straighten the teeth, followed by a mandibular

surgical advancement to correct the Class II occlusion, followed by porcelain veneer restoration of the maxillary anterior teeth to correct the discoloration and misshapen appearance of the teeth.

The patient and her parents were unwilling to consent to the mandibu-

lar advancement surgery. They were apprehensive of the facial changes that would occur as a result of the surgery and did not feel the patient's appearance was deficient enough to warrant the possibility of lip paresthesia or even the slight risk associated with a general anesthetic. Without the mandibular advance-

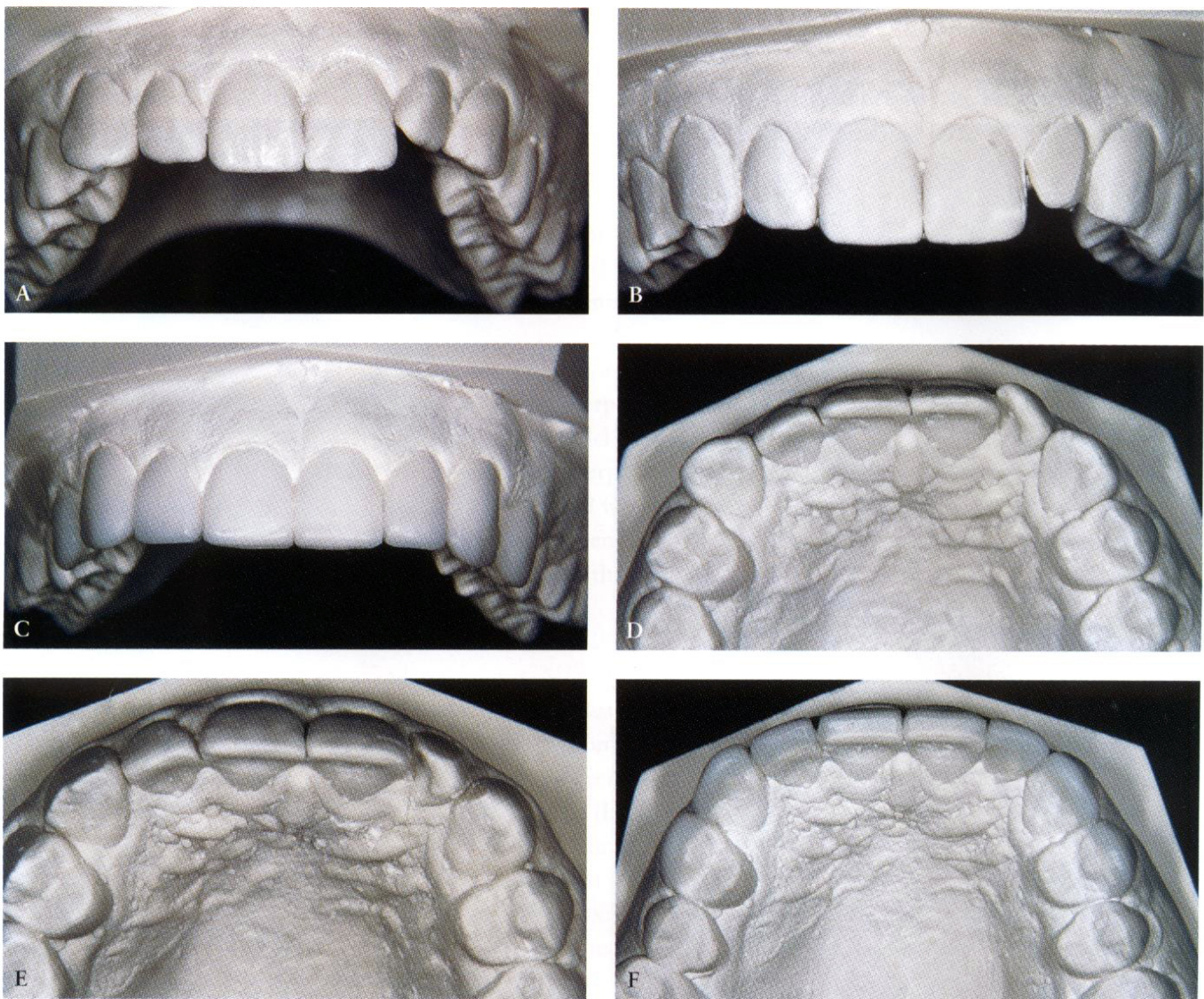


Figure 2. A–E, Study models were cut and waxed to determine tooth preparation requirements and restorative outcome without preliminary surgery and orthodontics.

ment surgery, orthodontic treatment would create a Class II occlusion, eliminating the existing centric occlusion coupling of the central incisors. Additionally, the patient was in her second year of college and did not wish to spend several years in orthodontic braces. Immediate esthetic improvement was important to her.

At the family's request, the patient's study models were cut and waxed to determine the tooth preparation that would be necessary and the restorative outcome if veneers were placed without preliminary orthognathic surgery and orthodontics (Figure 2).

Following model re-shaping and wax-up, it was discovered that limited tooth preparation would

be required and that an esthetic result could be achieved with modified porcelain veneers alone. The compromise of this treatment was that the restored maxillary central incisors would be approximately 1 mm thicker facial-lingually than the unrestored teeth (see Figure 2, F). Upon viewing the waxed maxillary model, the patient felt the increased central incisor tooth thickness would not be a problem for her. To test the patient's ability to accept the extra central incisor thickness, composite bonding was placed on the facial surfaces of the maxillary central incisors to simulate the increased veneer thickness. After 1 month of evaluation, the patient reported no problem with speech or lip function and was comfort-

able with the extra incisor thickness. No adverse effects on the periodontium were noted.

At the tooth preparation appointment, the altered study model was used as a guide. The facial surfaces of the maxillary right first bicuspid and cuspid and the left lateral incisor were first shaved facially into the ideal arch alignment with a coarse diamond instrument (Figure 3, A). Next, through and through interproximal cuts were made on the mesial and distal surfaces of the left lateral incisor, since this tooth overlapped the left central incisor (Figure 3, B and C).

Following this recontouring, the maxillary left first bicuspid through the right first bicuspid teeth were



Figure 3. A, Ideal arch alignment was achieved by shaving the facial surfaces of the maxillary right first bicuspid and cuspid and the left lateral incisor with a coarse diamond instrument. B and C, Though and through interproximal cuts were made on the mesial and distal surfaces of the left lateral incisor.

prepared for veneers, impressed, and provisionalized.⁵⁻⁸ Final porcelain veneers were seated and cemented in a conventional manner.⁹

Preparing and waxing the preoperative study model afforded a near exact preview of the final restorative result (Figure 4).

Case 2

A middle-aged female presented with overlapping, tetracycline-stained teeth desiring esthetic cor-

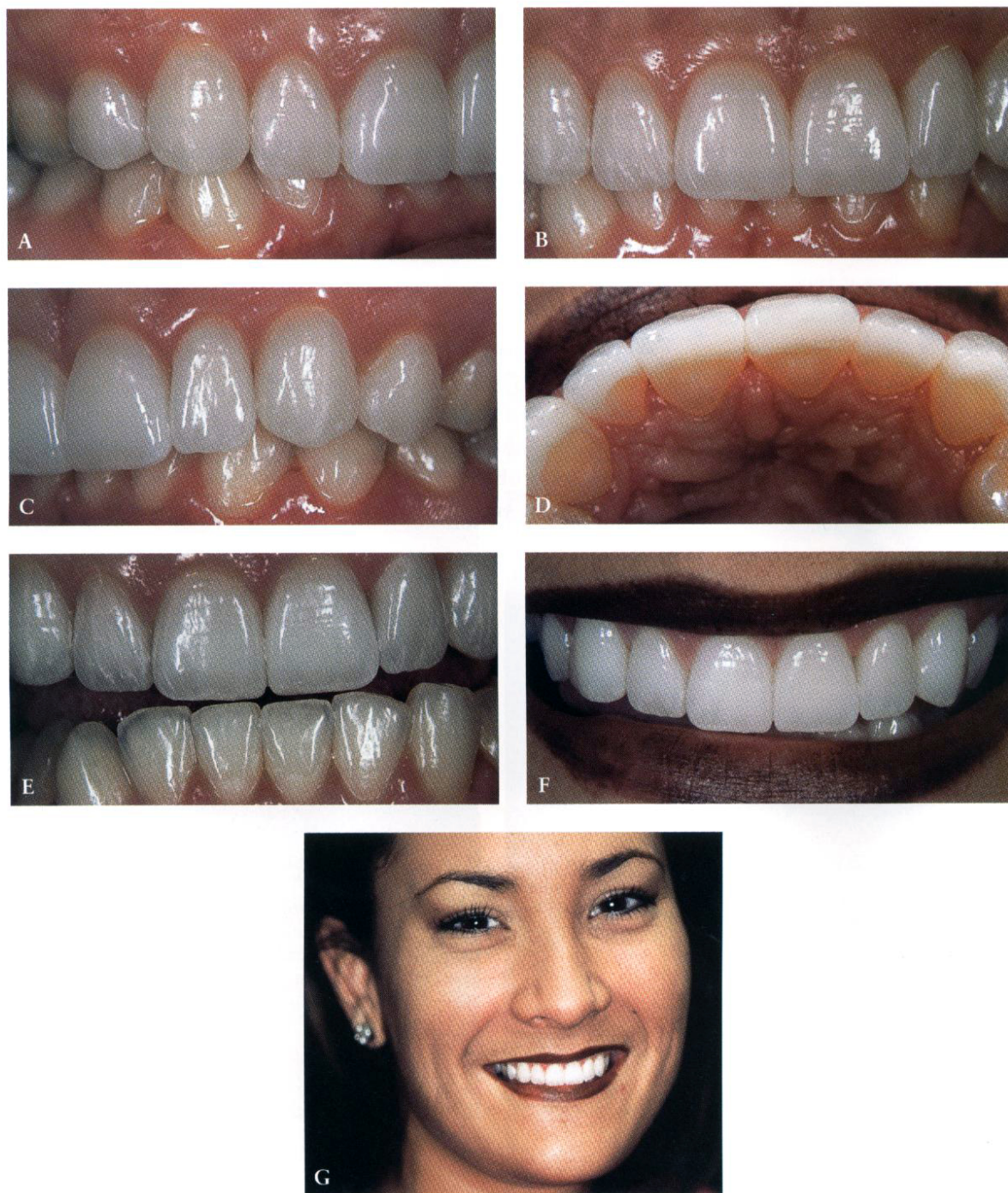


Figure 4. A-G, Views of final restorations.

rection (Figure 5). She traveled extensively with her business, and insisted that orthodontics was not an option. She asked if an attractive smile could be produced without braces. Since veneers would be required even if orthodontics were performed, the preoperative study models were prepared and waxed, to preview the restorative possibility.

On the stone study model, the facially protruding maxillary anterior teeth were shaved facially into the correct arch alignment with a No. 15 Bard-Parker blade, followed by through and through interproximal cuts with a separating disk between teeth from the mesial of the maxillary right lateral incisor through the mesial of the left lateral incisor. The study model was then waxed to ideal dental form (Figure 6).

Upon completion of the wax-up, it was evident that (1) the amount of tooth preparation required was not dramatic and (2) the gingival margins of the maxillary left lateral incisor, cuspid, and first bicuspid were asymmetrically apical to the gingival margins of the maxillary right anterior teeth (see Figure 6, F). The patient was pleased with the waxed-up study model and was agreeable to gingival grafting to improve the symmetry of the maxillary anterior gingival margins, since this procedure required only few appointments.



Figure 5. Case 2. A-C, The patient presented with overlapping, tetracycline-stained teeth.

A periodontal connective tissue graft was performed on the maxillary left lateral incisor, cuspid, and first bicuspid. Following 4 months of healing, the patient was appointed for tooth preparation for modified

porcelain veneers. Through and through interproximal cuts were made from the mesial of the maxillary right cuspid through the mesial of the maxillary left cuspid, and the facially protruding teeth in the

maxillary anterior region were shaved facially into the proper arch position with a coarse diamond instrument following the guide generated by the study model (Figure 7). Tooth preparations for modified

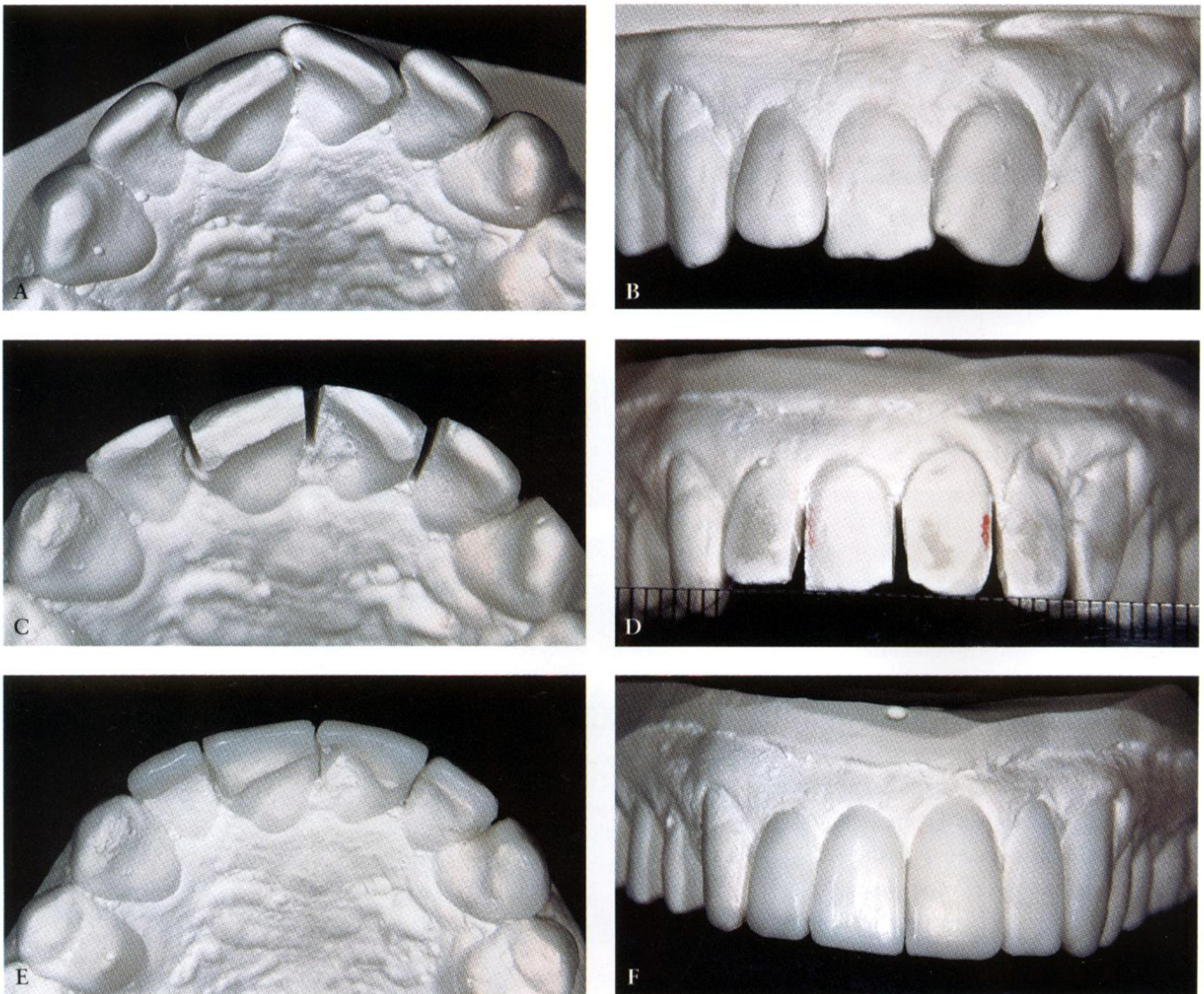


Figure 6. A and D, Preoperative stone study model of Case 2. B and E, Facially protruding maxillary anterior teeth were shaved facially into correct arch alignment and through and through interproximal cuts were made. C and F, The altered study model was waxed to ideal form. Note asymmetric gingival margins.

etched porcelain veneers were then completed. Impressions were made, provisional veneers were fabricated, and final porcelain veneers were placed (Figure 8).

The preoperative study model preparation and wax-up afforded a preview of the final result attainable with porcelain veneer restorations. The wax-up also highlighted the maxillary anterior gingival margin discrepancy that was not as obvious when examined clinically.

CONCLUSION

A method for accurately predicting the three-dimensional outcome of restoring slightly to moderately crowded anterior teeth with modified porcelain veneers has been presented. The author acknowledges that orthodontic treatment should normally be instituted prior to veneer restoration of crowded or malpositioned teeth. If a smile satisfactory to the patient and dentist can be produced with orthodontics alone, or with orthodontics in conjunction with bleaching or minor composite augmentation, then porcelain veneers should *not* be a treatment option under normal circumstances. This technique is considered *only* if veneers would be required even if orthodontic teeth straightening were performed.

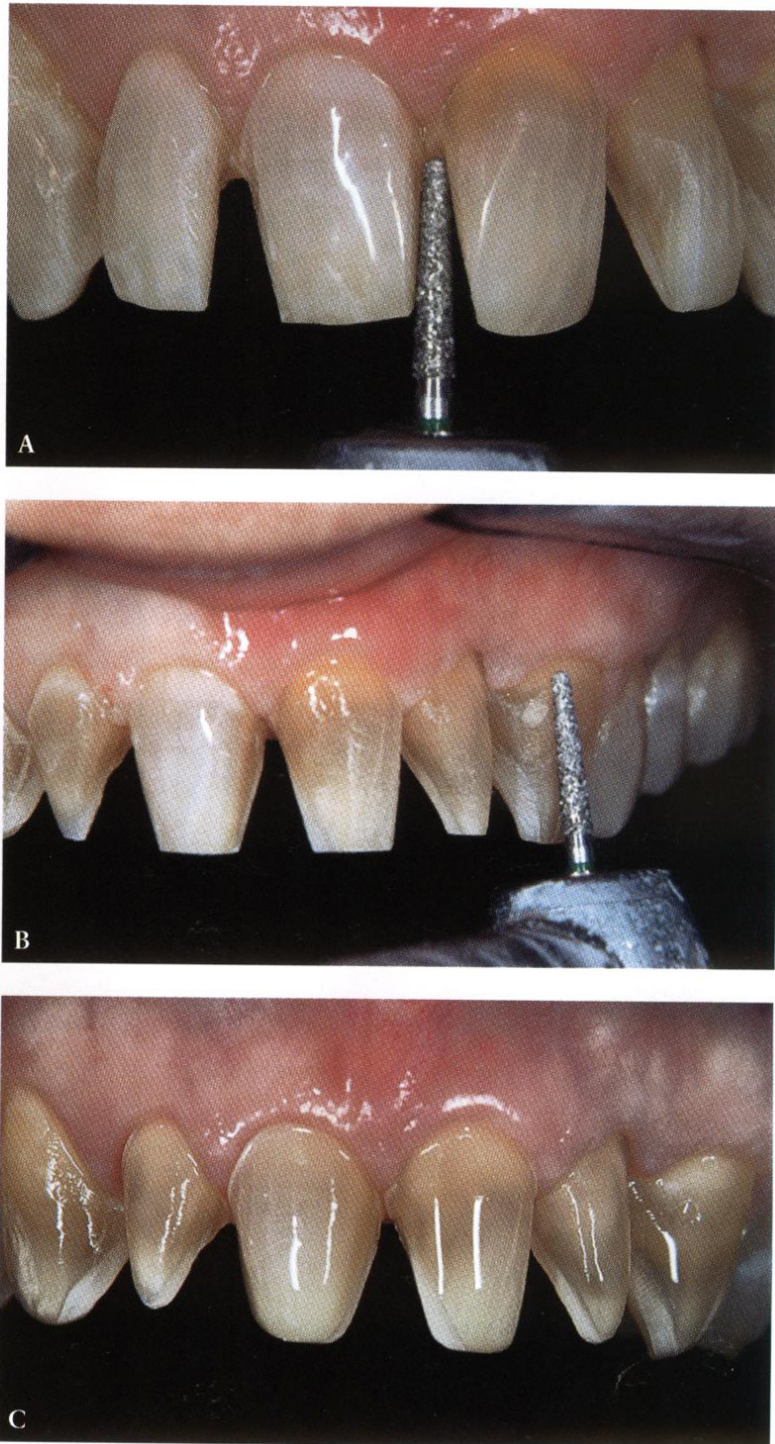


Figure 7. Tooth preparations. A, Through and through interproximal cuts; B, arch alignment corrected by facially shaving anterior teeth; and C, preparation for modified etched porcelain veneers.

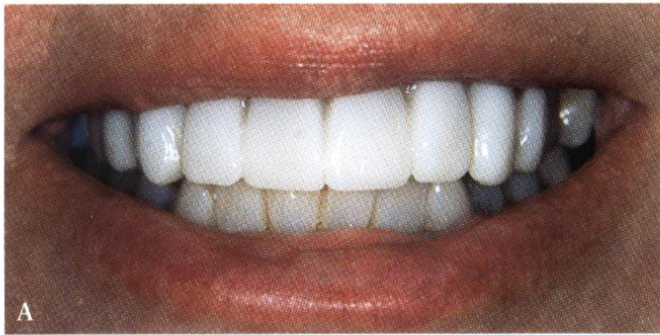


Figure 8. A, View of provisional restoration. B-H, Views of final restoration.

DISCLOSURE AND
ACKNOWLEDGMENTS

The author thanks Dr. Pat Allen, a Dallas periodontist, Baylor College of Dentistry Professor, and Section Editor for the *Journal of Esthetic and Restorative Dentistry*, for the periodontal grafting performed in Case 2; Mr. Asami Tanaka, CDT, of Chicago, for fabrication of the porcelain veneers in both cases; Mr. John Brown III, CDT, of Waco, Texas, for waxing the cut study models in both cases; and Ms. Rupal Patel and Mr. Trevor Gor, graduate students under the supervision of Dr. Ray Wilson, Professor of Physiology at Baylor University, for their assistance.

REFERENCES

1. Randolph LM. Taking alginate impressions. *Dent Asst* 1985; 4:25-27.
2. Roswick NA, Simon WJ. The pouring of models. *Dent Asst* 1974; 43:9-17.
3. Continuum I. The new patient examination. Key Biscayne, FL: Pankey Institute for Advanced Dental Education, 1981.
4. Dawson PE. Evaluation, diagnosis, and treatment of occlusal problems. St. Louis: CV Mosby, 1974:132-145.
5. Garber D. Porcelain laminate veneers: ten years later. Part 1: tooth preparation. *J Esthet Dent* 1993; 5:57-61.
6. Brady WF. Reversible hydrocolloid impression techniques. *J Calif Dent Assoc* 1985; 13:40-47.
7. Nasser B, Ontiveros J. A predictable and accurate technique with elastomeric impression materials. *Am J Dent* 1999; 12:161-163.
8. Cutbirth S. Provisionalization for porcelain veneers using bis-acrylate and polyvinylsiloxane matrix. *Pract Periodont Aesthet Dent* 2000; 12:308-312.
9. Cutbirth S, Geller W. Restoration of maxillary anterior teeth with porcelain laminate veneers. *Pract Periodont Aesthet Dent* 1999; 11:443-445.

Reprint requests: Steven T. Cutbirth, DDS,
1613 Lake Success, Waco, TX 76710

© 2001 BC Decker Inc