Exploring Minimally Invasive Options
Managing Demands, Expectations, and Outcomes

INRODUCTION
Directly related to increased focus on “the smile makeover” in the media, patients no longer visit their dentist simply for preventative cleanings or required treatments. Whether they require treatment or not, patients are now demanding the ideal “Hollywood smile” through elective cosmetic treatments. Following the concept that “the best dentistry can sometimes be (no or less) dentistry,” dentists must carefully manage patient expectations and demands to prevent doing harm.

In the dental industry, a smile with no existing restorations, caries, or discoloration is considered a healthy smile. However, dentists often encounter patients whose cosmetic goals are not considered essential for their oral health. In these cases, dentists often look for the most difficult or most dramatic solution to the patient’s problem when considering treatment options. Although dramatic treatment is required in some cases, many patients simply want to improve the appearance of their smile. Consequently, orthodontics or other conservative approaches should be the first recommendation when no pathology is present.

Although important to patients, there are many factors involved when restoring teeth. Alignment, shape and contour, surface morphology, opposing functional surfaces and incisal edge positions all need to be taken into consideration prior to any aesthetic work. However, when concerned with only aesthetics, minimally invasive (MI) procedures may be accomplished through the utilization of an additive dentistry model. Requiring excessive removal of sound tooth structure in many instances, the subtractive model was highly invasive and often resulted in over-preparation of the dentition. Less invasive, the additive model used by many dentists today focuses on the preservation of sound tooth structure to improve the patient’s oral health and provide long-term results.

For example, rather than preparing all anterior teeth and placing conventional veneers to improve crowding, orthodontic treatment to move or shift the position of the teeth is now considered the treatment of choice. Demonstrating the shift in treatment philosophies, modern dentists now improve smiles without pathology through MI dentistry.

Abilities to Provide Minimally Invasive Techniques Has Advanced
Aiding dentists in these types of treatment, a variety of viable and advanced materials now provide an even greater ability to fabricate aesthetic restorations, while still following the concept of nonmaleficence. Although conventionally an invasive procedure, placing veneers has become a MI treatment option that requires no to minimal preparation of tooth structure. Vastly improved from traditional porcelain materials, dentists now have the ability to provide strong and aesthetic all-ceramic veneers, without damaging or removing excessive amounts of tooth structure.

Although new materials and techniques have simplified MI aesthetic treatments, the dentist must still educate the patient on the potential risks associated with even the most MI treatments. The patient must be presented the available options, assisted in the decision process, and educated on the outcome of the decisions by the dentist, who is both a provider and advisor to the patient. After a decision has been made, the dentist should always attempt to provide the most MI and sound dentistry possible in any given situation.

The following case report demonstrates an example of a patient who had initially presented to the office seeking arguably invasive and excessive treatment with conventional veneers for her otherwise healthy anterior maxillary dentition, in order to obtain a more aesthetic and proportional smile.

CASE REPORT
Diagnosis and Treatment Planning
In 2007, a 35-year-old female patient presented to our office with cosmetic concerns about her anterior maxillary dentition (Before Image, Figures 1 and 2). Specifically, she wanted her teeth to be whiter, longer, completely symmetrical, and in perfect alignment. Basing her treatment demands on the fact that “all of my friends have veneers,” the patient was demanding invasive

continued on page xx
sive veneers on teeth Nos. 5 to 12. Although a possible and viable treatment option, it was noted that the patient did not present with tooth decay, periodontal issues, or occlusal pathology. As a clinician, I was uncomfortable with the idea of providing veneers for only cosmetic reasons, so repositioning the teeth with removable aligner tray therapy (Invisalign [Align Technology]) and whitening to correct discolorations was the suggested course of treatment. Displeased and unenthused with the MI treatment plan, the patient declined treatment. However, she did remain a patient in our practice and continued her schedule of regular hygiene appointments for more than 4 years.

In 2011, we revisited the patient’s concerns regarding the aesthetics of her smile. Allowing for a more conservative treatment plan and MI preparation, some new and reliable restorative materials had since become available. Therefore, it was decided that the patient would be able to safely and predictably undergo a cosmetic restoration of the maxillary anterior teeth.

During patient consultation, digital photographs were taken and evaluated to determine the best treatment plan. During this appointment, the patient’s goals for her smile were also discussed. From these discussions and observations, a treatment plan was decided upon, which included whitening of the lower arch, laser recontouring of the gingiva as needed, and restorations on teeth Nos. 5 to 12, and tooth No. 22, utilizing thin lithium disilicate veneers.

Selected as the material of choice for this case, pressable lithium disilicate ceramic (IPS e.max Press [Ivoclar Vivadent]) provides the fit, form, and function of traditional pressable ceramics, but with greater strength.3-6

In addition, this lithium disilicate material exhibits the optical properties necessary to create aesthetic and naturally appearing restorations.3-6

Prior to any restorative work, the patient’s oral health was evaluated for dysfunction or pathology. Initially, a joint vibration analysis (BioResearch Associates) was completed to assess the health and function of the temporomandibular joints. A full range of digital radiographs (Schick Technologies) and digital photographs (Sz Pro [Fuji]) were then taken, along with an earless face-bow (Kois Earless Face-Bow (Panadent)) record was taken. The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx

Selected as the material of choice (Figure 1).

After confirming that no underlying conditions were present, diagnostic impressions were made using a vinyl polysiloxane (VPS) impression material (Position Penta Quick [3M ESPE]; Directed Flow Impression Trays [3M ESPE]) to aid in the fabrication of the provisional and definitive restorations. While evaluating the patient’s occlusion, it became apparent that a veneer restoration was needed on tooth No. 22 to establish ideal canine guidance. A full periodontal charting was then completed, followed by an oral cancer screening and a close evaluation of all teeth for signs of decay.

Once it was determined that the patient was in good oral health, preparation for MI veneers began.

Clinical Protocol
The patient was anesthetized with 3
carpules of 4% articaine hydrochloride solution with 1:100,000 epinephrine (Septocaine [Septodont]) using a computerized anesthetic injection system (The Wand [CompuDent Inc]). The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx

In addition, this lithium disilicate material exhibits the optical properties necessary to create aesthetic and naturally appearing restorations.3-6

Prior to any restorative work, the patient’s oral health was evaluated for dysfunction or pathology. Initially, a joint vibration analysis (BioResearch Associates) was completed to assess the health and function of the temporomandibular joints. A full range of digital radiographs (Schick Technologies) and digital photographs (Sz Pro [Fuji]) were then taken, along with an earless face-bow (Kois Earless Face-Bow (Panadent)) record was taken. The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx

In addition, this lithium disilicate material exhibits the optical properties necessary to create aesthetic and naturally appearing restorations.3-6

Prior to any restorative work, the patient’s oral health was evaluated for dysfunction or pathology. Initially, a joint vibration analysis (BioResearch Associates) was completed to assess the health and function of the temporomandibular joints. A full range of digital radiographs (Schick Technologies) and digital photographs (Sz Pro [Fuji]) were then taken, along with an earless face-bow (Kois Earless Face-Bow (Panadent)) record was taken. The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx

Clinical Protocol
The patient was anesthetized with 3
carpules of 4% articaine hydrochloride solution with 1:100,000 epinephrine (Septocaine [Septodont]) using a computerized anesthetic injection system (The Wand [CompuDent Inc]). The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx

In addition, this lithium disilicate material exhibits the optical properties necessary to create aesthetic and naturally appearing restorations.3-6

Prior to any restorative work, the patient’s oral health was evaluated for dysfunction or pathology. Initially, a joint vibration analysis (BioResearch Associates) was completed to assess the health and function of the temporomandibular joints. A full range of digital radiographs (Schick Technologies) and digital photographs (Sz Pro [Fuji]) were then taken, along with an earless face-bow (Kois Earless Face-Bow (Panadent)) record was taken. The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx

Clinical Protocol
The patient was anesthetized with 3
carpules of 4% articaine hydrochloride solution with 1:100,000 epinephrine (Septocaine [Septodont]) using a computerized anesthetic injection system (The Wand [CompuDent Inc]). The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx

Clinical Protocol
The patient was anesthetized with 3
carpules of 4% articaine hydrochloride solution with 1:100,000 epinephrine (Septocaine [Septodont]) using a computerized anesthetic injection system (The Wand [CompuDent Inc]). The lips and cheek were then retracted (OptraGate [Ivoclar Vivadent]) to help make our work more efficient and to maximize patient comfort throughout the duration of the procedure. While allowing the anesthetic continued on page xx
to take effect, a pre-reduction was performed using a diamond bur (KS6SC 025 [Komet USA]) on any areas that were aligned out of the desired arch form. Utilizing the initial diagnostic wax-up and a soft-tissue diode laser (Odyssey Navigator [Ivoclar Vivadent]), areas that indicated the need for recontouring of the gingiva were corrected to provide ideal gingival symmetry, being careful to observe the biologic width.2

After both tooth and gingival pre-recontouring, a silicone putty matrix (Sil-Tech [Ivoclar Vivadent]) was made from the laboratory wax-up, filled with a bis-acrylic provisional material (Protemp Plus [3M ESPE]), and seated on the unprepared teeth. The silicone putty matrix was allowed to stay in the mouth for 3 minutes until the bis-acrylic material was set. Then, the matrix was removed, leaving a mock-up in place intraorally; this would be used as a blueprint for the final proposed restorations and as an ideal guide for the preparations.

Tooth preparation then began with a diamond depth cut bur (828-026 [Komet USA]), which included facial depth cuts of 0.5 mm in 3 planes and incisal depth cuts of 1.0 mm. To ensure perfect accuracy, and in order to conserve as much tooth as possible during preparation, the bis-acrylic provisional shell was prepared into as though it were tooth structure. This meant that some areas were prepared within the provisional material, while others were completed in tooth structure. Each tooth was prepared sequentially with the LD0526 kit (Komet USA) containing the KS series (KS0 010, KS1SC 012, KS3SC 016, KS6SC 025, and KS5SC 031) burs; for minimal or no preparation, and to prevent sharp angles or J-shaped margins.

After the initial preparations were completed, the interproximal areas were smoothed with a flame-shaped diamond bur (FSD6EF [Komet USA]). The facial and palatal surfaces were then smoothed with the 8856 021 (Komet USA) very fine diamond bur, which mimics the KS burs in general shape, but possesses a slightly more tapered contour to eliminate undercuts. Facial reduction was eventually completed at a depth of approximately 0.8 mm from the outer surface of the bisacrylic provisional shell. Utilizing an electric handpiece (ElectroTorque [KaVo]) at a reduced speed of 15, preparation continued to the margins. The margins were made extremely smooth because this is critical to the success of the case; the smoother the preparation the more accurate the impression and the die are, and the easier the seating procedure will go.3 Once complete, the preparations were polished with a progression of finishing and polishing system discs (SoF-Lex [3M ESPE]). Using water spray, the incisal edges of all the preparations were also rounded.

Following the completion of the preparations, a series of photographs was taken (with and without stump shades) for communication with the laboratory team. A master impression was then taken using a heavy body VPS impression material (Imprint [3M ESPE]) in an impression tray (Directed Flow Trays), and a regular body VPS impression material (Imprint) placed directly on the teeth and margins.

Since all the teeth required veneers, the silicone putty matrix (the same one initially used for the mock-up) was used to lock them in place. The teeth were then coated with an antibacterial desensitizing solution (Telio Desensitizer [Ivoclar Vivadent]) and coated with a fourth-generation primer-only (OptiBond FL [Kerr]) and air-thinned. Lined with bisacrylic provisional material (Br Luxatemp, [DMG America]), the matrix was placed over the preparations. After allowing the provisional material to cure for 3 minutes, the matrix was gently removed and the facial and palatal surfaces were trimmed of excess provisional material with finishing carbide burs (Komet FS6 014 and 7408 023) intraorally.

Figure 13. To develop characterization in the restorations, internal powder effects were placed on the cutback surfaces.

Figure 14. The internal powder effects were fired.

Figure 15. Full-contour enamel powders were used to further build the restorations.

Figure 16. The full-contour enamel powders were fired.

Figure 17. A red wax-based pencil was used to mark the height of contour for the interproximal deflection zones, which were then developed with a diamond-based rubber wheel.

Figure 18. Prior to cleaning and glazing, rotary diamonds were utilized to develop the surface lobes and perikymata.

Figure 19. The cleaned and glazed restorations were placed on the master die model.

Figure 20. The restorations were tried-in to confirm fit, function, and marginal integrity.

Figure 21. The central incisors were tried-in individually to verify proper fit, then seated together.

Figure 22. Postoperative retracted view of the definitive restorations demonstrated improved aesthetics.

Figure 23. Postoperative smile of the patient’s dentition showed great improvement in color, shape, and spacing.

Figure 24. Postoperative lateral view of the patient’s smile demonstrated natural optical qualities that mimicked the surrounding dentition.

continued from page 00

continued on page xx
Exploring Minimally Invasive Options... continued from page 00

The gingival embrasures were then opened to eliminate compres-
sion of the gingival tissue and the for-
mation of black triangles on seating
day. Occlusion was verified and the provisional
erosions were polished using a series of polishing cups and points
(Astropol [Ivoclar Vivadent]). Finally, a very light coating of a low-viscosity
polish/sealant was placed on the facial surfaces of the temporary restora-
tions (BisCover LV [BISCO Dental Products]).

After completion of the provisional
restorations, the patient was instructed to make the clinician aware of any aesthetic or functional
changes that were required prior to fabrication
of the definitive restora-
tions (Figures 4 and 5). Any required
changes were then communicated to the laboratory and all corrections
were made to the initial model (Figure
6). Essential to the success of pro-
visionalization stage, proper hygiene
technique was demonstrated to the
patient (Figure 7).

Dental Laboratory Protocol
All diagnostic information and records, including clinical photo-
graphs and the Kois earless face-bow
transfer plate, were sent to the dental
lab team to assist in the fabrication
of the wax-up and the silicone
putty matrix, which were used to fabri-
cate the both the provisional and defin-
itive restorations (Figure 8). A matrix
of the modified provisional model was
then created and a jeweler’s wax injec-
tor was used to create an exact duplica-
tion on the lubricated master dies
(Figures 9 and 10). Prior to sealing the
margins for investing, form and func-
tion were developed in the wax up.

After spruing and investing, the wax restorations were ready to be
burnt out and pressed using a high-
temperature hold (Figure 12). The trough, or
undercut, was then colored using high (Vanilla) and low (Gray) value
steins (Universal Steins [Ivoclar Vivadent]), to impact the incisal
dges. Shade BL2 bleach dentin
(Universal Steins), was then applied to emulate internal dentin
and/or mamelons (Figure 13).

Following application, the pow-
ders and steins were fired under full
vacuum to 750°C at a climbing rate of
60° per minute, with a one minute
high temperature hold (Figure 14).
Opal clear (OE1) and high value (T1)
emulsion powders were then carefully
segregated over the internal effects to
create an optical filter, which gave the
internal effects a natural appearance
(Figure 15). The contour of the restora-
tions was then finalized and the restorations were bisque baked
(Figure 16).

After bisque baking, a diamond
buffer (ZDL884Z-018-1 [Cardinal
Rotary Instruments]) was used to smooth
the surfaces, then to shape and contour the restorations. A red pencil
was used to mark the desired heights of the contours to aid in the develop-
ment of the interproximal deflective
zones (Figure 17). The facial lobes and
surface textures were then created using the diamond bur (ZDL884Z-018-1) (Figure 18).

A non-fluorescent glaze paste (IPS
emax Ceram Glaze Paste [Ivoclar
Vivadent]) was applied to the final-
ized surfaces of the restorations and
fired under full vacuum to 740°C at a
rate of climb of 70° per minute, with a
one minute high temperature hold.

To lessen the brassy appearance
caused by the artificial glaze, the flat
surface of a knife-edged carborundum
filled white rubber wheel (G322
(Cardinal Rotary Instruments)) was
used carefully, to ensure the desired
number of perikymata were main-
tained. To finish creating the desired
luster, a knife-edge diamond polisher
(U6125-250-1 [Cardinal Rotary In-
struments]) was used to replicate the
surfaces of the natural dentition (Figure
19).

Upon completion, the gingival
interproximal spaces were scrutin-
ized against the hard-tissue model to
ensure that black triangles were not
present (Figure 20). To prepare the restorations for delivery, the internal
aspects of the finalized restorations
were then carefully cleansed with an
aluminum oxide microblaster and
etched with 5% hydrofluoric acid
ing gel (Ceramic Etching Gel
[Ivoclar Vivadent]) for 20 seconds.
The lithium disilicate restorations were
then delivered to the clinician and
patient for final seating.

Delivery Appointment
To guarantee normal lip and facial gin-
gival areas, as well as patient comfort,
when fitting the restorations only the
left and right palatal areas were anes-
ethetized with three fourths carpule of
Septocaine on each side using the
Wand. The provisionals were then
removed and the preparations cleaned
cleaned with hydrogen peroxide in a metal-
dental infuser tipped syringe (Ultra-
dent Products). To clean the prepara-
tions further, a pumice slurry (Consese-
sis Scrub [Ultradent Products]) and
rotary brush (ICB Brushes [Ultradent
Products]) were used.

The lithium disilicate veneers for the central incisors were first tried-in
separately; and then together to verify
fit, contacts, and the overall appear-
ance (Figure 21). Composite based try-
in gel (VarioLink Veneer [Ivoclar
Vivadent]), in shade +2, was used since
the patient desired extremely white
the patient then evaluated the restorations for shade, length, and
overall aesthetics.

Once it was certain that the cos-
metic aspects of the restorations were
satisfactory, the veneers were ready to
be seated. The restorations were then
removed and the internal surfaces

continued on page xx
tack tip (Ivoclar Vivadent) was then used on the central-facial position of each tooth, to “tack” the veneers into place for 2 seconds each. After tack curing, a cat’s tongue brush (Princeton Art and Brush Company) was used to remove excess cement from the labial and palatal surfaces, as well as the interproximal areas. The goal during excess cement removal was to remove as close to 100% of the extruding cement as possible, without “pulling” the cement from the margins. In the author’s opinion, this technique saves time during the polishing and clean-up stages. Additionally, it has proven the most effective way for the author to visualize proper seating of the veneers prior to the final cure.

Teeth Nos. 8 and 9 were seated first to evaluate for canting, improper seating, or other general seating errors. To ensure full surface hardness, the 2 teeth were then coated with an oxygen barrier gel (Liquid Lens [Danville Materials]) and cured fully with the LED curing light (Bluephase [Ivoclar Vivadent]) for 20 seconds each on the facial and palatal surfaces. The veneers for teeth Nos. 5 to 7 were then seated and cured using the same technique. Lastly, teeth Nos. 10 to 12 were seated using the same method.

After all veneers had been seated and light-cured, final finishing and polishing was completed utilizing a sequence of diamond and carbide burs (FS/DF 010, FS/DF 010, FS/DF 010, 8274, 016, 274EF 016, 8379 023, 379EF 023) from kit LD0531 (KOMET USA), a diamond polishing system (Optrafine [Ivoclar Vivadent]), and a diamond polishing paste (Dishine [VH Technologies]).

Upon completion of the procedure, the veneers demonstrated excellent fit, function, and aesthetics, appearing indistinguishable from the surrounding natural dentition (Figures 22 to 24, After Image).

CLOSING COMMENTS

Combating caries, emergency repairs, and preventative care, are only few of many factors that must be considered before performing any restorative procedure. Although a thorough understanding of materials and techniques is necessary, maintaining open communication with the patient at all times is crucial to ensure the success of any case. By discussing MI options, the effects of treatment on the existing dentition, patient expectations, and realities, the dentist has the opportunity to educate the patient and assist the patient in making the proper treatment choice. Further, an open dialogue among the patient, dentist, and the dental laboratory team will help to ensure that the patient’s expectations and goals are met.

References

Disclosure: Dr. Engleberg reports no disclosures.

Mr. Jones is a Fellow member of the American Academy of Cosmetic Dentistry (AACD), making him one of the only 4 ceramists in the world to hold this honor. He is also an AACD accreditation examiner and recently served 4 years on the AACD Board of Directors. Mr. Jones currently owns and operates a boutique laboratory, Smiles, Inc, in Boise, Idaho, where his exclusive service is smile design including complex, full-mouth reconstruction. Founder and codirector of Total Team Advantage, the semi-annual live patient seminars where dentists and technicians are taught hands-on smile design, Mr. Jones is also an international lecturer, author, and instructor on advanced dental ceramics. He can be reached at (208) 368-0206.

Disclosure: Mr. Jones reports that he receives honoraria from Ivoclar Vivadent for lecturing.

Dr. Engleberg earned his doctor of dental surgery degree from the Indiana University School of Dentistry. He has committed himself to a career of continuing education on the most state-of-the-art procedures and techniques and codirects his multidisciplinary study club in the Chicago suburbs. His Arlington Heights, Ill. practice’s focus is primarily on adult cosmetic and restorative dentistry (ahsmiles.com). Dr. Engleberg enjoys lecturing and has published articles on cosmetic dentistry, full-mouth rehabilitation, and porcelain veneer techniques. He is also a codirector of Total Advantage Live, an over-the-shoulder and hands-on course teaching cosmetic dentistry techniques from treatment planning and preparation through laboratory synergy and case completion to dentists (totaladvantage-live.com). He can be reached at (847) 259-6988.