

A Multidisciplinary Approach to the Indirect Esthetic Treatment of Diastemata

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ABSTRACT: *Even if clinicians possess a basic body of knowledge in cosmetic dentistry and skills in esthetic dentistry, many cases that present on a day-to-day basis simply cannot be restored to both the clinician's and the patient's expectations without incorporating the perspectives and assistance of several dental disciplines. Because the success of highly-demanding esthetic cases is determined by patient satisfaction, a thorough understanding of patient expectations is necessary in order to develop a treatment plan that is ideally suited for the individual patient. To facilitate the treatment planning of multidisciplinary, indirect cases the use of the new New York University (NYU) Smile Evaluation Form can enable a thorough clinical analysis of the patient's existing dentition, as well as an esthetic evaluation of the patient that takes into consideration the patient's idea of what they hope to see as a final result of their dental treatment. This article demonstrates the use of this form in treatment planning a case that required coordination of orthodontic, periodontal, oral surgery, endodontic, and restorative components to ensure the predictability of the definitive all-ceramic crown and veneer restorations.*

In today's modern practice of dentistry, it is no longer acceptable to just repair individual teeth. More and more patients are demanding a final appearance that is not only physiologically and mechanically sound, but also esthetically pleasing.¹ Therefore, as a result of a heightened esthetic awareness of our patients, a basic body of knowledge of the cosmetic dental treatment of teeth is necessary.² However, even with skills in esthetic dentistry, many cases that present on a day-to-day basis simply cannot be restored to both the clinician's and the patient's expectations without incorporating the perspectives and assistance of several dental disciplines. Further, it has been repeatedly noted that esthetic restorative success is defined by patient satisfaction. Therefore, such cases are predicated on a thorough understanding of patient expectations in order to develop a treatment plan that is ideally suited for the individual patient.



FIGURE 1 Full facial preoperative view of the patient.

Recently a multidisciplinary, indirect case was treatment planned using a new clinical evaluation form developed at the New York University (NYU) College of Dentistry. This form enables a thorough clinical evaluation of the patient's existing dentition, as well as an esthetic evaluation of the patient that takes into consideration the patient's idea of what they hope to see as a final result of their dental treatment. Adapted from the works of Abrams, Levine, and Fradeani, the form also includes areas for identifying variations from the norm.^{3,4,5} Additionally, the NYU evaluation form incorporates esthetic principles that have been developed in dentistry during the past 100 years, as well as newer concepts that are now considered key components of an attractive smile.^{3,4,5}

Interestingly, the use of this form for planning the patient's all-ceramic crowns and porcelain veneers also made it quite easy to identify those specialty disciplines (eg, periodontics, orthodontics) that would be necessary for the patient's comprehensive treatment. The final clinical result speaks volumes regarding the importance of this type of treatment sequencing and organization to address existing problems that could impact the clinical, functional, and esthetic longevity of the anticipated indirect restorations.

This article explains the step-by-step clinical application of a multidisciplinary treatment as coordinated and planned using the NYU Smile Evaluation Form. The treatment ultimately produced an ideal clinical result using indirect all-ceramic crown and porcelain veneer restorations.



CASE PRESENTATION

The patient is an African American female lawyer in her mid-20s who is in the public eye on a daily basis (Figure 1). Upon presentation, her chief complaints and expectations included not liking the “black” front tooth; not liking the “big space” between her teeth (Figure 2); and a desire for straight, white teeth that look natural for her (Figures 3 and 4).

It became immediately apparent to the clinician that this case would require the involvement of specialists from multiple dental disciplines in order to produce the restorative and esthetic makeover that the patient was describing. A conservative and biologically sound interdisciplinary treatment plan needed to be developed.

After a preliminary medical history was taken and caries risk assessment was performed, a thorough extra- and intraoral examination was conducted with the help of the new NYU Smile Evaluation Form (Figure 5). This form provided the patient with an opportunity to identify her chief complaints, while prompting the clinician to record information obtained from the facial analysis, occlusal analysis, and phonetic analysis. Side B of this form promotes an exploration of the case in greater detail by allowing the clinician to draw problem areas directly on diagrams of the anterior dentition, as well as providing horizontal and vertical components of the dental and facial analysis (Figure 6).

Additionally, a lateral facial evaluation would enable recognition of the Ricketts E-Plane, as



FIGURE 2 Unretracted view of the patient's smile. Note the dark color of the right central incisor and large diastema between teeth Nos. 8 and 9.



FIGURE 3 Retracted right lateral view showing Class I molar occlusion.



FIGURE 4 Retracted left lateral view showing Class I molar occlusion.

FIGURES 5 AND 6 New York University College of Dentistry Smile Evaluation Form. Designed by John Calamia, DMD, Jonathan B. Levine, DMD, and Mitchell Lipp, DDS. Adapted from the work of Dr. Leonard Abrams³, 1987; Dr. Mauro Fradeani⁵, 2004; and Dr. Jonathan B. Levine⁴.

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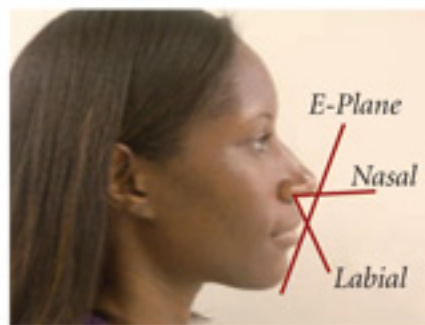


FIGURE 7 Full facial lateral view showing the E-Plane and nasolabial angle.



FIGURE 8 View of a cephalometric radiograph showing the patient's skeletal form.



FIGURE 9 Unretracted view of the patient's smile showing that the existing dental midline is left of the patient's facial midline, and gingival zeniths are unsymmetrical.



FIGURE 10 Unretracted view of the patient's smile showing axial inclinations of the six maxillary anterior teeth, incisal edge relationship to the lower lip (smile line), and high lip line.

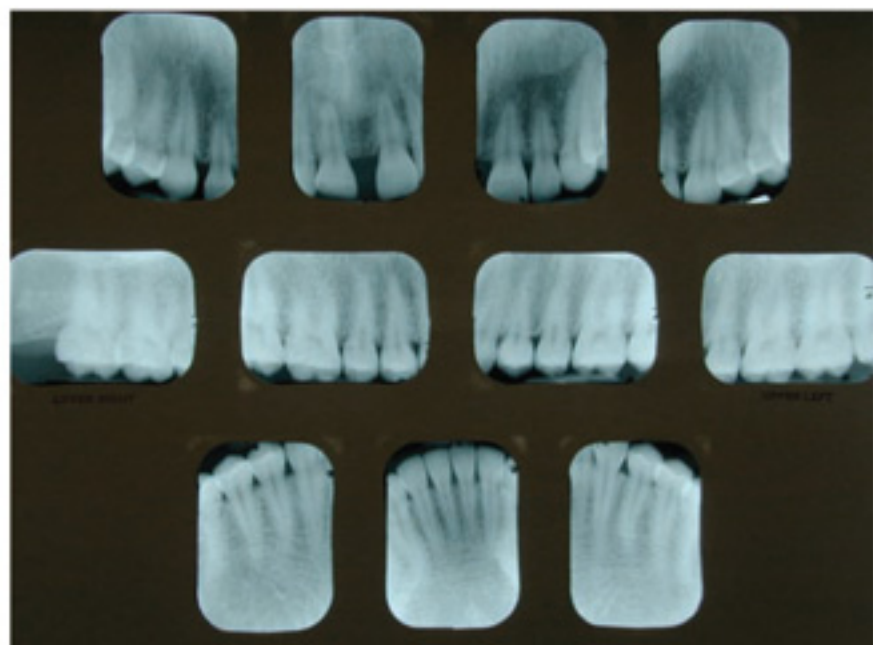


FIGURE 11 Preoperative periapical radiographs. Note that tooth No. 8 tested non-vital and has a history of trauma and fracture. It was also dark.

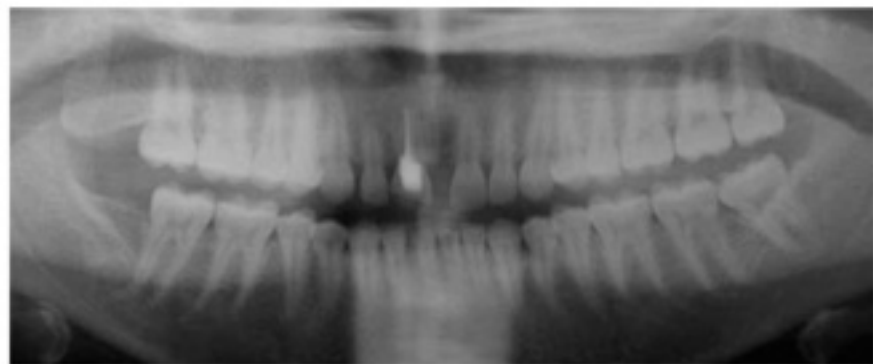


FIGURE 12 View of the panoramic radiograph taken after prophylactic root canal therapy was performed on tooth No. 8. A composite core build-up was used after endodontic access.

well as the nasolabial angle (Figure 7). A cephalometric radiograph showing the patient's skeletal form would also be a necessary component of the esthetic work-up (Figure 8).

After the smile analysis was completed, the immediate problems recorded included a maxillary dental midline shift to the patient's left and gingival zenith discrepancies in the maxillary anterior teeth (Figure 9). Additionally, although the axial inclinations of these teeth seemed to be within normal limits, this inclination needed to be preserved even if orthodontic movement was considered (Figure 10). A high lip line contributed to the need for possible gingival contouring to improve the gingival zeniths. Tooth No. 8, described by the patient as "black," tested non-vital. A full-mouth series of radiographs showed no active caries (Figure 11), but for tooth No. 8 it was determined that root canal therapy was prudent considering the investment in the planned indirect restorations. Therefore, the following disciplines needed to be considered for this case: endodontics, oral surgery, orthodontics, periodontics, and restorative dentistry.

Treatment Sequence

Endodontics

Despite a lack of physical symptoms, the benefit of prophylactic endodontic therapy was explained to the patient, and root canal therapy was performed on tooth No. 8. This would better assure the longevity of the root and the indirect restoration that it would eventually support. A titanium-based composite core material was used to restore the endodontic access, since enough tooth structure remained following access to ensure core strength. This had the effect of slightly lightening the root because the material is white opaque. Since a cast or prefabricated metal post was *not* used, this would prevent metal show-through when an all-ceramic crown would be placed as the final restoration (Figure 12).

Oral Surgery and Periodontal Considerations

Laser frenectomy, laser gingival recontouring, and gingival troughing around tooth preparations were all essential procedures to ensure the esthetics of the final treatment result. In evaluating the patient's smile, the low attachment of the maxillary frenum was believed to be involved in the cause of the patient's diastema (Figure 13). Without



FIGURE 13 Preoperative frenectomy and gingivoplasty view. The low attachment of the frenum can be seen pulling on the tissue between the central incisors and has caused an attachment mass on the lip.



FIGURE 14 Postoperative frenectomy view. The frenectomy and resection of the tissue attachment mass on the lip was accomplished using a CO₂ laser.

correcting this condition, permanently closing the diastema—either orthodontically or restoratively—would not have been possible. The only question concerned when to perform the frenectomy.

The decision was made to perform the frenectomy using a CO₂ laser^a prior to closing the diastema (Figure 14). Performing the frenectomy at this stage provided a number of advantages, including access to remove the reticular fibers between the teeth and elimination of the separating force of the frenum while closing the diastema periodontally. Since there are significantly lower numbers of myofibroblasts in a laser wound, there is a minimal degree of wound contraction and scarring that would inhibit tooth movement. Healing occurs within 10 to 14 days, with little or no scar tissue formed.^{6,7,8}

Orthodontic Treatment

Simply stated, the orthodontic component of this treatment plan was to reposition the teeth so that the midline position could be improved and the final tooth position would allow the Golden Proportion to be achieved in the definitive restorations. After the patient underwent the laser frenectomy (Figures 13 and 14), brackets were placed on the six maxillary anterior teeth. A 0.016 stainless steel arch wire (Figures 15 and 16) and power chain were used to begin closure of the spaces. In the following visits, the arch wire was upgraded to a 0.018 stainless steel, and again a power chain (Figure 17) was used from lateral to lateral. Once the diastemata had begun to close, with only a small space still present, a figure eight plastic wire was used to hold the position of the centrals (Figures 17 and 18). This would allow movement of the lateral incisors more mesially.

The power chain was used from right lateral to right central, and from left lateral to left central, allowing movement of both laterals mesially. The centrals were now too close together to allow the Golden Proportion (Figure 19). Therefore, they now were moved more distally.

After the spaces were redistributed to allow for the requirements of the planned restorations, small closed coil springs (Figure 20) were used to hold the final position. The brackets were then debonded, an impression was taken, and an Essex appliance was designed for short-term retention. The result attained from orthodontic treatment now enabled minimal preparation (ie, reduction) of those teeth to be treated with indirect restorations.

Periodontal Considerations

Once the final orthodontic positioning of the teeth had been accomplished, gingival zenith repositioning was necessary before initiating the restorative phase. The gingival contours for the final veneers were established using a diode laser^b (Figure 21). The laser gingivoplasty narrowed the remaining interdental papilla between the central incisors and created the ideal gingival zenith to reflect the new facial contours and angulations. Since there is no recession when a gingivoplasty is performed using a diode laser, the procedure was performed at the same visit as the veneer preparation and impression taking (Figure 22).



FIGURE 15 Initial view of the 0.016 stainless steel arch wire with bonded brackets from canine to canine.



FIGURE 16 The arch wire was upgraded to 0.018 stainless steel.



FIGURE 17 View of the power chain between the central incisors to start space closure.



FIGURE 18 Over-closure was maintained with a figure eight wire.

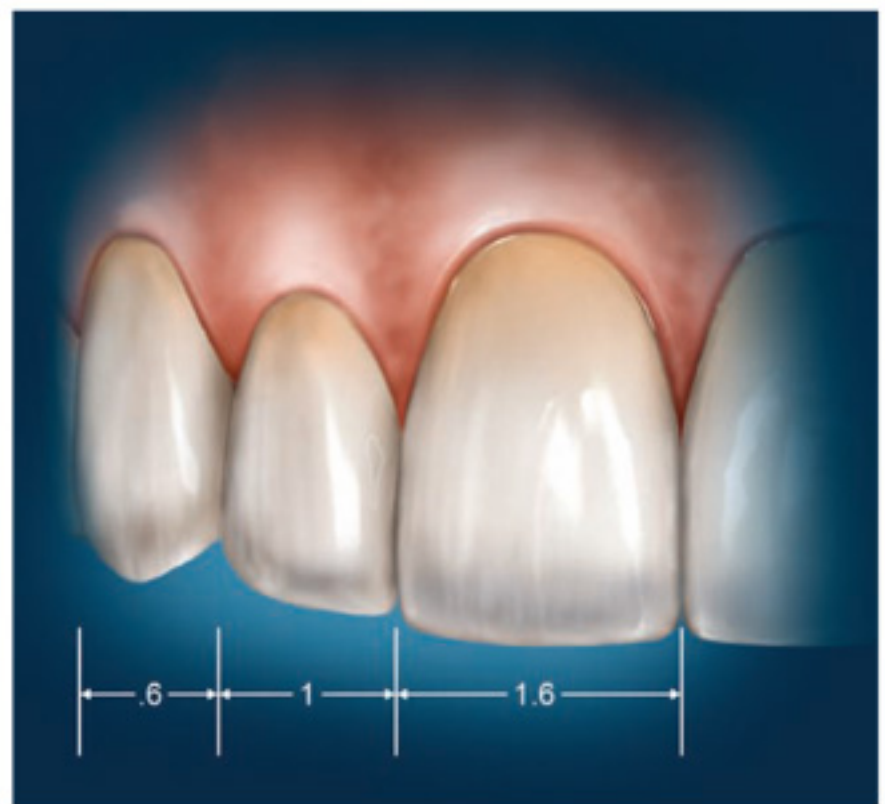


FIGURE 19 Illustration of the principles of the Golden Proportion. Adapted with permission from the American Academy of Cosmetic Dentistry (www.aacd.com).



FIGURE 20 Closed coil springs were used to maintain the positions and spaces.



FIGURE 21 Post-gingivoplasty view shows the tissue appearance accomplished using the diode laser.

^a Opus 20, Lumenis®, Inc., Santa Clara, CA

^b Diolase Plus™, Biolase, Irvine, CA

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FIGURE 22 Incisal view of the final orthodontic position of the teeth.



FIGURE 23 View of the cast of the prepared teeth.



FIGURE 24 The working cast was used by the laboratory to fabricate the restorations.



FIGURE 25 The restorations were tried on the working cast.



FIGURE 26 Closeup retracted view of the final restorations after placement.



FIGURE 27 Postoperative evaluation of the final gingival zeniths and axial contours.



FIGURE 28 Incisal view of the finished restorations showing facial and palatal embrasures.



FIGURE 29 Closeup facial view of the patient in natural smile.



FIGURE 30 Right lateral view showing the natural appearance of the final restorations.



FIGURE 31 Left lateral view demonstrating the natural appearance of the selected porcelain restorations.

Restorative Considerations

The treatment plan called for all-ceramic crowns on teeth Nos. 8 and 9 and porcelain veneers on teeth Nos. 5 through 7 and 10 through 12 (Figure 23) to establish a Golden Proportion of size and form for the maxillary anterior teeth, without any spacing. It is important to note that the mesiogingival preparations of the shoulder of teeth Nos. 6 through 9 were accomplished slightly subgingival (Figure 24). This provided the laboratory with room for gingival contouring in these areas, which would be slightly over-contoured in the emergence profile to allow a pushing and eventual shaping of the gingival papilla; these areas would become more pointed and less flat (Figures 24 and 25). A high-strength feldspathic porcelain was used for the fabrication of the final restorations, which provided an uncompromised restorative and gingival result (Figures 26 through 32). The restorations were cemented using a dual-cured resin cement^c that was applied in dual-cure mode for the crowns on teeth Nos. 8 and 9 and light-cured in the same shade to cement the porcelain veneers on teeth Nos. 5 through 7 and 10 through 12.



FIGURE 32 Full facial view of the final indirect restorative result.

CONCLUSION

A multidisciplinary approach was used in this case to successfully address the many dental needs of this patient, a lawyer in the public eye on a daily basis. By initiating the treatment planning phase with the use of an evaluation form that takes into consideration the clinician's and patient's ideal physiological, mechanical, and esthetic outcomes, dentists can better facilitate the planning process of multidisciplinary cases and, therefore, deliver a higher level of care to their patients than ever before.

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Author, please verify and spell out journal name.

^c Variolink®, Ivoclar Vivadent, Amherst, NY