A Multidisciplinary Conservative Approach for Esthetic Correction of Anterior Crowding: A Clinical Case Report

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For the cosmetic dentist, anterior crowding can be a big challenge. Esthetic correction of patients with anterior crowding involves orthodontics, restorative treatment, or both. The majority of adult patients seeking smile enhancements in such cases are reluctant to wear visible orthodontic appliances and opt for a more esthetic alternative such as the Invisalign system. The case presented in this article demonstrates a multidisciplinary approach to correct severe anterior crowding using the Invisalign appliance, indirect veneers, and direct composite resin bonding to esthetically improve the patient's smile. The patient was pleased that his smile was corrected in a relatively short time with the invisible aligners. Also, the veneer preparations were conservative because the teeth were in proper alignment. Similar cases can be treated with the multidisciplinary approach described to achieve predictable results that have a positive impact on patients' lives. *Am J Esthet Dent 2013;3:264–274. doi: 10.11607.ajed.0080*

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Anterior crowding is one of the most difficult cosmetic clinical situations. Esthetic enhancement of such cases may involve orthodontics and/or veneers, or full-mouth rehabilitation. Many adult patients who desire cosmetic improvement of their crowded dentition will not consider traditional orthodontics.[1,2] The Invisalign system (Align Technology) offers an alternative for patients who are reluctant to accept orthodontic treatment.[1,2] Removable, comfortable, and nearly invisible, Invisalign is a custom-made series of clear aligners used to orthodontically move teeth.[3–5]

Using the Invisalign system, crowding can be corrected by dental expansion. All the teeth can be moved at the same time, or the first premolars through second molars can be moved and when a space distal to the canines appears, the canines move distally to create space anteriorly. This space can then be used to correct the anterior crowding.[6]

If a patient has anterior crowding and his/her esthetic expectations can be met by orthodontically straightening and bleaching the teeth, then orthodontics should be considered. However, if the teeth need to be lengthened or are disproportionate in size, then veneers are required to correct the tooth shape discrepancies after orthodontic therapy is completed. In many cases, combining orthodontics with veneers provides a conservative esthetic outcome by avoiding the aggressive tooth preparation that would be required if only veneers were used.[7]

Clinicians are continually required to implement new technologies and techniques to provide patients with restorations that mimic nature. Color matching is viewed as one of the most challenging tasks in esthetic dentistry.[8] It is difficult to match two or three incisors to the remaining natural teeth because of the multidimensional properties of color and shape. The replication of natural polychromaticity is the key to restoring natural esthetics and harmony.[9] This can be achieved through the mastery of stratification, which creates restorations with both resin and ceramic materials that invisibly blend into the surrounding dentition.[10] Stratification techniques have been used to achieve a light-composite-color relationship similar to that of natural tooth structure for the anatomic reproduction of dentin and enamel tissues to the proper thickness and position.[11–13]

The great evolution in composite materials since they were first introduced has helped achieve natural results. The range of colors, translucencies, and opacities available today enables the clinician to mimic nature. Moreover, combining the ease of handling and strength of microhybrids with the high polishability of the microfills in the final layers has resulted in restorations that are not only strong, but extremely esthetic as well.

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Fig 1 *(above)* Pretreatment full smile. Note the esthetically unpleasing smile.

Fig 2 *(right)* Pretreatment full face. The patient's smile violated a number of ideal smile design principles.

CASE REPORT

A 29-year-old male patient presented to the office seeking to improve the appearance of his teeth and enhance his smile. His chief complaint was maxillary and mandibular anterior crowding. The patient was also unhappy that the length and shape of his maxillary central incisors did not match. The maxillary central incisor had a large incisal-edge fracture and was in labioversion, thus resulting in an unpleasing smile (Figs 1 and 2). He wanted to have a symmetric, attractive smile.

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Fig 3 Pretreatment retracted frontal view. Note the labioversion of the maxillary right central incisor and the large traumatic defect involving both enamel and dentin.

Fig 4 Pretreatment occlusal view of the maxilla. Note the anterior crowding.

Fig 5 Pretreatment occlusal view of the mandible. Note the severe anterior crowding.

Clinical Examination

A comprehensive examination was performed, which included full-mouth radiographs, hard and soft tissue charting, mounted diagnostic casts, and photographs. The clinical examination revealed that the patient's maxillary right central incisor was in labioversion and had a large Class IV defect; the maxillary lateral incisors also had defective tooth structure of the incisal edge (Fig 3). The tissue heights of the incisors were uneven, resulting in the appearance of disproportional teeth sizes. The patient had a Class I canine-molar malocclusion on the right side and Class II malocclusion on the left side. He had severe anterior crowding in the maxilla and in the mandible (Figs 4 and 5). No carious lesions or periodontal concerns were noted, and he had no signs or symptoms of temporomandibular disorders. The patient desired a more pleasing smile.

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Diagnosis

The patient presented with a large Class IV defect involving loss of natural enamel and dentin of the maxillary right central incisor. The patient's smile was not esthetically pleasing and violated a number of principles of the ideal smile design, as follows:

- Excessive crowding in both arches
- Maxillary central incisor inclined labially and overlapped the right lateral and left central incisors
- Maxillary right lateral and left central incisors drifted mesially and occupying most of the right central space
- Canted axial inclination of maxillary incisors, especially the left central
- Midline canted and shifted to the patient's right
- Uneven gingival heights of maxillary incisors
- Narrow buccal corridor
- Deep bite
- Class II canine-molar malocclusion on the left side with insufficient intercuspation

Treatment Planning

Different treatment options were presented to the patient and he opted to improve his smile with rather conservative modalities. He chose to correct his maxillary and mandibular anterior crowding with Invisalign, have veneers placed on the central incisors, and have the Class IV defects in the lateral incisors restored with composite resin. The patient was happy with the natural look of his teeth and wanted the new restorations to mimic their natural characterization.

The treatment plan presented the following recommendations:

1. Invisalign appliance to achieve the following treatment goals:
   - Correct crowding of the maxillary incisors by expanding both maxillary and mandibular arches in the canine, premolar, and molar areas; interproximal reduction (IPR) and proclination of teeth
   - Expand the buccal corridor for a fuller, more esthetic, smile
   - Extrude the maxillary right central incisor to be level with the left central at the gingival line
   - Improve the axial inclination of the maxillary incisors, especially the left central
   - Improve the deep bite by intruding the mandibular incisors, while maintaining the anterior guidance and canine rise
   - Improve the midline by shifting both maxillary and mandibular midlines to the patient's left
   - Correct the relationship between molars and canines on the left side for better intercuspation
2. Feldspathic porcelain veneers on the maxillary central incisors
3. Class IV composite resin bonding on the maxillary lateral incisors
4. In-office bleaching

Invisalign Treatment

Polyvinyl siloxane impressions were taken (ESPE America), along with a bite registration (Futar D, Kettenbach

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GmbH & Co KG), radiographs, and intraoral photographs. Polyvinyl siloxane is the impression material of choice because it yields highly accurate impressions that remain stable for as long as 3 weeks and allows for multiple pours.[14]

ClinCheck is Align Technology's three-dimensional virtual image of the teeth based on the impressions sent to Invisalign. The progress of treatment can be visualized to show the natural movements of the teeth based on the proposed treatment plan. This allows the clinician to see the final phase of treatment and make any modifications. Once the layout has been designed and approved, aligners are made in sequence based on the projected ClinCheck models.

A total of 25 aligners corresponding to approximately 1 year of treatment were created to achieve the Invisalign treatment goals. The patient wore each set of aligners for a 2-week period. He was instructed to wear the aligners all the time, except during eating, drinking, and brushing. The patient presented to the office every 4 to 6 weeks for IPR and follow-up. IPR allows the clinician to create space before the actual tooth movements in an otherwise constricted area, so that there is adequate space for the necessary tooth rotations. The final treatment outcomes can be seen in Figs 6 to 9. Though this case may have initially looked complicated because of the severity of crowding in the mandibular arch, the misalignment was easily corrected within a very reasonable time and the patient was pleased with the results.

Preparation for Veneers

After orthodontic therapy was completed, there was a significant improvement in teeth alignment. However, the patient's smile was still esthetically unpleasing. To achieve the pleasing smile the patient desired, a clinical mock-up was completed using a chairside light-cured composite,[15] and the proposed new size and shape of the incisors were evaluated for esthetics, phonetics, and occlusion.[16] Two sets of a silicone putty index were fabricated: one to be used as a stent for chairside provisional fabrication, and the other as a preparation guide.[17]

Preparation of the maxillary central incisors was performed using reduction templates as a guide (pinhole preparation guide, Shofu Dental). The preparations extended 0.5 mm subgingivally, and the lingual margins were placed at the incisal marginal ridge ending in a 1.0-mm shoulder for maximum strength of the tooth and the restoration. Lingual margins should not be placed in the lingual fossa, which is the area with the highest concentration of stress on the entire tooth.[18,19] The tooth was prepared so there was 2 mm of incisal and 1.5 mm of facial space for the laboratory to develop subtle internal characterization with the porcelain.

The gingival proximal area extended lingually at the crest of the papilla to provide adequate porcelain to eliminate black triangles. Polishing of the preparations was completed, stump shades were chosen, and photographs were taken of the preparations with stump guides in view for the laboratory's

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Fig 6 Post–orthodontic treatment full smile. Note the good alignment of the maxillary anterior teeth after Invisalign treatment.

Fig 7 Post–orthodontic treatment retracted frontal view. Note the improved alignment of teeth after using the Invisalign appliance.

Fig 8 Post–orthodontic treatment maxillary occlusal view. Note the proper alignment of teeth after maxillary expansion and extrusion of the right central incisor using the Invisalign appliance.

Fig 9 Post–orthodontic treatment mandibular occlusal view. Note the proper alignment of teeth after mandibular expansion using the Invisalign appliance.

use (Fig 10). A final impression was taken, and provisional restorations were made and cemented. They were shaped with proper contours and margins to evoke good gingival and papillary response. An alginate impression of the maxillary provisionals was made and was poured in stone to be sent to the laboratory. Photographs were also taken of the provisional to facilitate laboratory communication. A few days later, the patient came in for a postoperative check of his provisionals, and the patient's teeth were bleached with the Zoom 2 whitening system (Discus Dental). Shade selection was made at the same appointment, with a color map drawing and photographs, along with shade guide.

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Fig 10 Shade tab 2M2.

Laboratory Communication

Models of the provisionals, along with the bite records, original facebow-mounted casts, and a bite fork of the prepared maxillary teeth and shade-mapping instructions were sent to the laboratory. Progressive shades were selected to blend with the patient's natural teeth.

Seating Appointment

The patient came back 2 weeks after the preparation appointment. Veneers for the maxillary central incisors were seated and checked, and interproximal contacts were adjusted. The patient was happy with the esthetic outcome, and the two veneers were cemented at the same time to control the midline (Fig 11). Note the natural-looking veneer restorations because the multilayer technique used allows natural intrinsic and extrinsic light effects, which is a unique feature of the feldspathic porcelain over pressed ceramic technique.[20]

Direct Bonding Resin Restorations

Direct bonding resin restorations for the maxillary lateral incisors were made at the same appointment that veneers were cemented. The teeth were waxed

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Fig 11 Post–restorative treatment retracted frontal view showing the final restorations with even gingival architecture and symmetrically shaped and sized central incisors.

up on the study models, and a clear polyvinyl siloxane impression (RSVP, Cosmodent) was made of the wax-up to be used in establishing the lingual contour and incisal edge position. A shade map was made prior to the start of the bonding process, before the surrounding teeth would dry out.

After local anesthesia was administered, a long bevel was created on the facial and lingual aspects of the right lateral incisor. The facial bevel was carried 2 to 3 mm beyond the fractured areas to provide room to blend composite into the gingival third of the tooth. After etching the tooth, OptiBond Solo Plus (Kerr) was applied and light cured. A stratification technique that incorporates dentin and enamel materials, specifically developed to reproduce the determined tooth anatomy, was used to reproduce the defective tooth structure. The lingual matrix was placed and a thin layer of Renamel Microfill B1 (Cosmodent) was applied and cured for 40 seconds to mimic the lingual enamel. This layer extended facially to the facial-incisal angle, creating a lingual shell to act as a support for the rest of the restoration. Occlusion was adjusted in centric and eccentric excursions prior to final finishing and polishing. Finishing and polishing are important steps because they create the ideal relationship between light and the tooth, which is fundamental to achieving the desired esthetic result.[21] After finishing and polishing of the right lateral, the left lateral incsor was etched and the same process was repeated (Figs 12 and 13).

Posttreatment full smile and facial views (Figs 14 and 15) show improved alignment of the anterior teeth and symmetry of the midline; symmetric right and left centrals, laterals, and canines; and ideal gingival level of the maxillary anterior teeth.

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Fig 12 Right lateral view showing the seamless composite resin restoration on the lateral incisor perfectly matching the adjacent veneers and natural dentition.

Fig 13 Left lateral view showing the seamless composite resin restoration on the lateral incisor perfectly matching the adjacent veneers and natural dentition.

Fig 14 *(above)* Post–restorative treatment full smile. The completed treatment reflects more symmetric right and left centrals, laterals, and canines, as well as ideal gingival level of the maxillary anterior teeth.

Fig 15 *(right)* Post–restorative treatment full face reveals an attractive and symmetric smile.

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SUMMARY AND CONCLUSION

Combining art and science is the most rewarding experience in dentistry. The case presented demonstrates how the Invisalign system successfully treated anterior crowding. The patient was pleased that his smile was corrected in a relatively short time with invisible aligners and not brackets or fixed prosthesis. Also, the veneer preparations in this case were very conservative since the teeth were aligned in the proper position.

Class IV incisal edge fractures were restored using microhybrid composites for strength followed by veneering with microfilled composites for esthetics and polishability; this made it possible to offer the patient conservative, strong, and esthetic restorations. The patient was very pleased with the final results.

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