An Interdisciplinary Approach to Restorative Treatment with Clear Aligners

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Abstract
Interdisciplinary treatment is sometimes the best approach for complicated restorative cases or cases in which the restorative outcome may be compromised by a less than ideal preexisting occlusion. These patients generally prefer an esthetic orthodontic appliance, as their treatment goals are primarily restorative. Clear aligners, which utilize the power of digital treatment planning to assist with planning the space for the final restoration, are uniquely suited for prerestorative orthodontic treatment. This article presents three cases that address, respectively, redistributing space between the anterior teeth for veneers, preparing a single-tooth implant site, and creating posterior occlusal clearance.

Key Words: aligners, veneers, implants, TADs, ortho digital treatment planning
“The occlusion was finished without anterior occlusal contact to minimize the lingual tooth preparation on the maxillary incisors and in anticipation that the veneers would lengthen the incisal edges of the anterior teeth.”
Introduction

Complex restorative cases often require an interdisciplinary approach for optimal treatment outcomes in esthetics, form, and function. Recent innovations in technology, such as temporary anchorage devices (TADs), digital treatment planning with clear aligners, and digital smile design, have revolutionized treatment planning for patients presenting with multiple dental issues that require complex interdisciplinary treatment. This article discusses three cases that illustrate how a prerestorative phase of clear aligner treatment can facilitate a more ideal restorative outcome.

Case 1: Redistributing Spaces for Veneers

For restorative patients requiring anterior veneers or crowns, an optimal restorative outcome often can be achieved by integrating minor orthodontic tooth movements into the treatment plan. These minor adjustments may include:

- correcting rotations prior to veneer placement
- leveling gingival margins to facilitate restoration of worn incisal edges
- aligning the dental midline with the facial midline
- redistributing space where tooth size discrepancy exists.

A 62-year-old female presented with a Class III skeletal malocclusion with anterior crossbite. Both maxillary and mandibular incisors were retroclined. The mandibular dental midline was canted to the left. The posterior teeth in both dental arches were heavily restored (Figs 1a-2b). The patient had a mildly concave profile with insufficient lip support and an unesthetic smile arc (Figs 3a-3c). The panoramic radiograph showed moderate bone loss and several endodontically treated teeth. Single-tooth implants had replaced #12 and #19 (Fig 4).

The treatment plan involved correcting the anterior crossbite through maxillary incisor proclamation and improving the lip support through labial movement of the maxillary incisors. The maxillary incisors would also be extruded to increase incisal display on smiling. The dental midline would be aligned with the facial midline, and the current dental compensations for the Class III skeletal pattern would be maintained. Ultimately, veneers were planned for the maxillary anterior segment, and a remake of the implant crown was planned for #12.

In the ClinCheck software plan (Invisalign, Align Technology; San Jose, CA) specific instructions were given to procline the maxillary incisors and move them labially, in combination with extrusion, to improve the incisal display on smiling. Interproximal reduction was requested in the mandible to resolve crowding while maintaining the pretreatment mandibular incisor inclination. The posterior occlusion was not changed and the implant crowns were not moved in the treatment plan.

Treatment

Precision-cut hooks for Class III elastics were placed on the maxillary first molars and mandibular canines. Extrusive attachments were placed on #7, #8, and #10. An optimized root control attachment was placed on #9. The power ridge feature was applied to the mandibular incisors to prevent excessive retroclination, as they were retracted to correct the anterior crossbite (Fig 5).

Spaces were left mesial and distal of the maxillary lateral incisors to facilitate veneer placement. The occlusion was finished without anterior occlusal contact to minimize the lingual tooth preparation on the maxillary incisors and in anticipation that the veneers would lengthen the incisal edges of the anterior teeth (Fig 6).
Figures 3a-3c: Pretreatment facial photographs.

Figure 4: Pretreatment panoramic radiograph.

Figure 5: Software showing the projected posttreatment anterior view.

Figure 6: Software showing the projected posttreatment anterior overjet view.

Figures 7a-7c: Postorthodontic right lateral, anterior, and left lateral views.

Figures 8a & 8b: Postorthodontic maxillary and mandibular occlusal views.
Figures 7a through 8b show the occlusion after orthodontic treatment. Pretreatment and posttreatment cephalometric radiographs shown earlier indicate the change in maxillary and mandibular incisor inclination. The maxillary incisors had lingual root torque placed for proclination. The mandibular incisors were uprighted slightly. The patient wore the final aligners at night as retainers until the restorative phase was completed. Figures 9a through 11 show the occlusion after the restorative treatment was completed. New maxillary and mandibular clear vacuum-formed retainers, to be worn at night, were then made for both arches.

“"The treatment plan involved correcting the anterior crossbite through maxillary incisor proclination and improving the lip support through labial movement of the maxillary incisors.”"
Case 2: Preparing the Single-Tooth Implant Site

Patient History
A 14-year-old female presented with a congenitally missing #7, a peg-shaped #10, and a Class I malocclusion with mesial eruption of #11 into the #10 site, resulting in a Class II canine relationship. A midline diastema was present and the mesial surface of #10 was coincident with the facial midline (Figs 12a-12c).

Treatment Plan
The interdisciplinary treatment plan included opening space for a single-tooth implant restoration to replace the missing #7, preparing #10 for veneer placement, and closing the midline diastema. The dental midline would be aligned with the facial midline. A single-tooth implant would replace the missing #7 and a veneer would be placed to restore the peg-shaped #10 to normal morphology. The pretreatment root inclinations of #6 and #8 were parallel (Fig 13). Bodily movement would be required to open up space for single-tooth implant placement. A minimum of 7 mm of space would be required; this space would be created through distal movement of #6 and mesial movement of #8, which also would effectively close the midline diastema. Maximum anchorage would be required on the right buccal segment to move the canine into a Class I canine relationship. Tooth #10 would require some minor extrusion, although some occlusal clearance was planned to allow for veneer placement without incisal reduction.

Treatment
Optimized root control attachments were placed on #6 and #8 for bodily movement to create the implant site. Optimized anterior extrusive attachments were also placed on #9 and #10 for incisor extrusion to increase the amount of overbite in the finished occlusion (Fig 14). At stage 6, a pontic for the missing #7 appeared on the maxillary aligner; this was filled with a tooth-colored polyvinyl siloxane pontic material for esthetic purposes. The pontic increased in mesiodistal width as space was progressively created at the implant site (Fig 15).

At the end of the first series of 21 aligners, #6 had been successfully distalized into a Class I position. The midline diastema was closed and the dental midline was coincident with the facial midline. There was space created mesial and distal to #10 to facilitate veneer placement. A panoramic radiograph (Fig 16) was taken at this time to assess the root inclinations adjacent to the implant site. The root inclinations appeared parallel and there was an adequate space of 6.9 mm in mesiodistal width created for implant placement. Additional aligners were made to coordinate the dental arch widths and to establish canine guidance on the right side. The final occlusion prior to implant placement and restoration is shown in Figures 17a through 20.

Figures 12a-12c: Pretreatment intraoral right lateral, anterior, and lateral views.

Figure 13: Pretreatment panoramic radiograph.

Figure 14: Software showing the attachment design, projected pretreatment anterior view.

Figure 15: Software showing the pontic and planned space for implant placement, projected posttreatment view.
Figure 16: Panoramic radiograph of treatment progress showing root inclinations adjacent to the implant site are parallel.

Figures 17a-17c: Postorthodontic right lateral, anterior, and left lateral views.

Figures 18a & 18b: Postorthodontic maxillary and mandibular occlusal views.

Figure 19: Pretreatment smile.

Figure 20: Postorthodontic smile.
Case 3: Creating Posterior Occlusal Clearance

Patient History:
This case was referred to a restorative specialist for implant placement in the mandibular right quadrant. Due to longstanding tooth loss, the opposing dentition had hyper erupted, leading to inadequate occlusal clearance for placement of implant-supported crowns (Figs 21a-22).

The patient had a long list of problems:
• deep bite
• missing teeth (including all third molars)
• endodontically treated #5, #14, and #18
• the implant placed at the site of #19 was not ideal, and the implant crown had failed three times
• hypererupted #4, #3, and #2 led to inadequate occlusal clearance for restoration of the mandibular right quadrant.

Treatment Plan
The interdisciplinary treatment plan included orthodontics to intrude the maxillary right posterior teeth to create posterior occlusal clearance for restorative treatment in the mandibular right quadrant. The deep bite would be decreased and the maxillary and mandibular incisors would be aligned. The #28 site would then be restored with a single-tooth implant crown and the single-tooth implant at the #19 site would be repositioned and the crown remade.

Intrusion
Intrusion of the maxillary right posterior teeth was programmed into the software plan (Fig 23). When assessing anchorage requirements for intrusion, attachments should be placed anterior to the teeth that are to be intruded. In this case, attachments were placed on #29 and #27. Tooth #28 was a porcelain crown; no attachments were placed on this tooth. For mandibular anterior intrusion to level the Curve of Spee and correct the deep bite, anchorage attachments were placed on #28, #21, and #20.

The Tooth Movement Assessment guide showed that #3 and #2 were intruded 1.6 and 1.7 mm, respectively (Fig 24). The software shows that these tooth movements are in the advanced category and would be difficult to execute with clear aligners. If there was a distal third molar in occlusion with an opposing tooth in the mandibular arch, then there could be adequate anchorage for the intrusion programmed. However, in this case, it was clear that the intrusion programmed would require additional anchorage to express clinically.

Two TADs were placed on the buccal and lingual aspects of the interdental area between #3 and #2, and the patient wore an elastic between them in addition to the aligners (Figs 25 & 26). The TADs provided the anchorage required for the posterior intrusion programmed into the aligners to be expressed clinically. As a result, the posterior intrusion was successful, and the posterior occlusal plane was leveled with interocclusal clearance provided for restorative treatment in the mandibular right quadrant (Figs 27a-27c).

Posttreatment occlusal results showed that the maxillary right posterior teeth were successfully intruded, the occlusal plane leveled, and adequate posterior occlusal clearance provided for restorative treatment in the mandibular right quadrant. The TADs were left in place during the immediate post-treatment retention period, and the patient continued to wear the elastic over a clear vacuum-formed retainer at night until restorative treatment was completed in the mandibular right quadrant and occlusion was established (Figs 28 & 29).

Figures 21a-21c: Pretreatment intraoral right lateral, anterior, and left lateral views.

Figure 22: Pretreatment panoramic radiograph.
Figure 23: Software plan showing the amount of planned intrusion of posterior teeth.

Figure 24: Tooth Movement Assessment sheet showing advanced (black) and moderately difficult (blue) tooth movement.

Figure 25: Right lateral view showing the buccal TAD placement and elastic.

Figure 26: Occlusal view showing the palatal TAD and elastic wear.

Figures 27a-27c: Postorthodontic intraoral right lateral, anterior, and left lateral views.

Figure 28: Pretreatment smile.

Figure 29: Postorthodontic smile.
Summary
The use of clear aligners as a prerestorative phase of orthodontic treatment is an excellent adjunct for facilitating a more ideal restorative outcome. Clear aligners offer several advantages, including allowing the clinician to maintain excellent control when maximum anchorage is required. Software can be used to plan the projected orthodontic outcome and the results can be shared with the restorative dentist when planning the final teeth positions.

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The images shown for the second and third cases are reprinted with permission from the author’s work, Clear Aligner Technique. Chicago: Quintessence, 2018.

References


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Disclosure: Dr. Tai teaches and lectures internationally for Align Technology and is an Invisalign Diamond Plus Provider.

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