

Two approaches to correction of Class II in teenage patients: Herbst appliance and Invisalign® treatment with mandibular advancement.

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Tips for a successful Class II treatment

Functional appliances are part of a broad clinical tool kit we use for efficient comprehensive orthodontic care. We use functional appliances in combination with other orthodontic appliances that all play a role in achieving the desired result. As such, in order to be successful with any functional appliance treatment, you have to understand the role the appliance plays, its mechanism, and its limitations.

In our practice, we use functional appliances not to stimulate additional mandibular growth, but to direct any remaining mandibular growth horizontally as much as possible. We believe that even if a functional appliance is able to stimulate a brief period of accelerated growth, the overall amount of mandibular growth will eventually normalize back to the baseline. As such, what we are mostly influencing is not the amount of growth, but the direction of growth. The more horizontal and the less vertical the mandibular growth, the better.

As with traditional functional appliances, the main advantage of Invisalign treatment with mandibular advancement is that we do not have to depend entirely on extended periods of Class II elastics wear compliance for success. The integrated design with precision wings simplifies the process, which improves patient compliance and reduces the need for elastics. In doing so, whenever we have a very large overjet to resolve, the same mechanisms we are targeting with traditional functional appliances, we are using with Invisalign aligners as well, but without all the extra appointments to repair broken appliances.

At the same time, reducing the need for elastics does not mean that we are completely eliminating the use of Class II elastics. Similar to other functional appliances like the Herbst, the use of Class II elastics may be required after the functional appliance phase is discontinued. After the mandibular advancement aligner phase, we will typically follow up with Additional Aligners to continue leveling the curve of Spee, during which we may also use Class II elastics to fine-tune the anterior-posterior (A-P) correction. Expecting any functional appliance to be a magic bullet that will correct A-P discrepancies without any use of elastics is unrealistic and will likely lead to miscommunication and disappointment of the patient and the parents.

Prior to the availability of Invisalign aligners with mandibular advancement, we used to use the Herbst appliance as our primary functional appliance for Class II correction. After the Herbst phase, a period of elastics and correction of posterior open bite was typical, because advancing the mandible quickly when a curve of Spee is present usually leads to bite opening around the premolars and molars until the curve of Spee is leveled. The same can also be expected of any other functional appliance system, and Invisalign treatment with mandibular advancement is no different, because both are essentially targeting the same mechanism of action. Both are trying to maximize horizontal jaw growth by positioning the mandible forward while removing interferences in the occlusion. The advantage of Invisalign treatment, however, is greater patient comfort and better esthetics, along with greater efficiency because the Invisalign mandibular advancement feature is integrated into the aligner. The Invisalign appliance is also less prone to breakage compared to the Herbst appliance, so emergency office visits are rare, which the patients, their parents, and our staff greatly appreciate.

Since Invisalign treatment with mandibular advancement will be most effective when certain clinical criteria are met (e.g., at least 2 mm overjet present, < 7 mm deep bite, > 3 mm clinical crown height, etc.) the exact timing of when the feature will appear in the aligner sequence will vary from patient to patient. For some patients (e.g., Class II, division 1), the feature will appear closer to the start of treatment. For other patients (e.g., Class II, division 2), a series of initial aligners without the precision wings is likely needed first for leveling and aligning, so the precision wings will appear later.

Therefore, what is important to communicate to the patient, is that they are receiving Invisalign treatment, and that different aligner features may appear at different times – whether it be the precision wings, or certain attachments, or precision bite ramps, or elastic hooks and button cutouts – and each of these features are a part of the Invisalign system as a whole. Setting the wrong expectations over what features will appear and when can lead to confusion and uncertainty, but this problem can easily be avoided with proper communication.

Case example

Initial records:

Age of patient: 15 years old

Sex: Male

Chief concern: The parents were very concerned about the patient's mandibular development (his sibling was previously treated with the Herbst appliance).

Diagnosis:

- Convex facial profile with a retrognathic mandible
- Moderate (end-on) Class II, right and left
 - Division 2 incisors
- Normal facial taper
- Excessive vertical display when smiling
- Narrow arches with teeth tipped inward
- Moderate upper and lower crowding with severe incisor rotations
- Deep bite



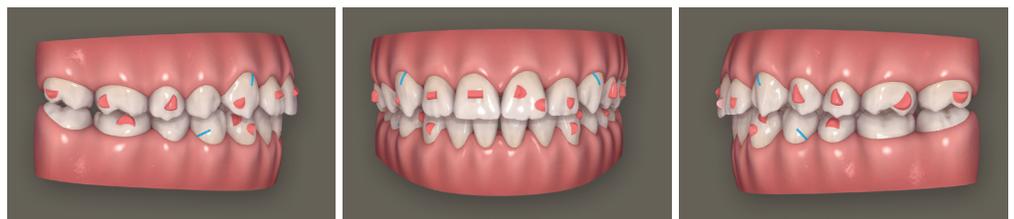
Treatment plan:

- Decompensate the Class II deep bite with a pre-mandibular advancement ("pre-MA") aligner phase
- Advance the mandible with Invisalign® mandibular advancement aligners to limit the quantity of Class II elastics needed during the treatment
- Re-scan the teeth and bite as needed to finish the arch coordination with Additional Aligners (using Class II elastics during this phase as needed to fine-tune the occlusion)
- Retention – Vivera® retainers with bite ramps

Intraoral scans and ClinCheck® set-ups from the beginning of treatment to the end



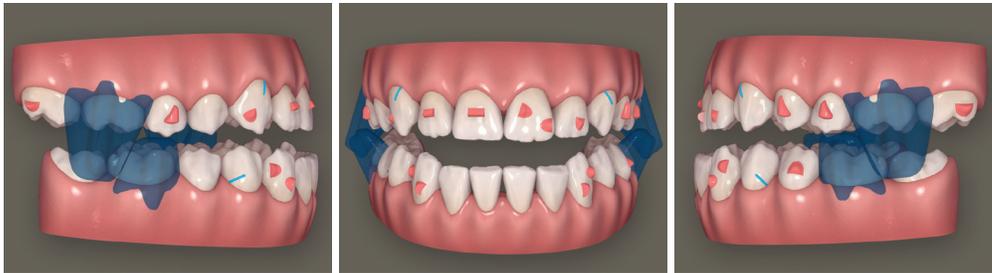
Initial scan of the patient. Bilateral moderate Class II division 2, deep bite, constricted arches, and moderate upper and lower crowding.



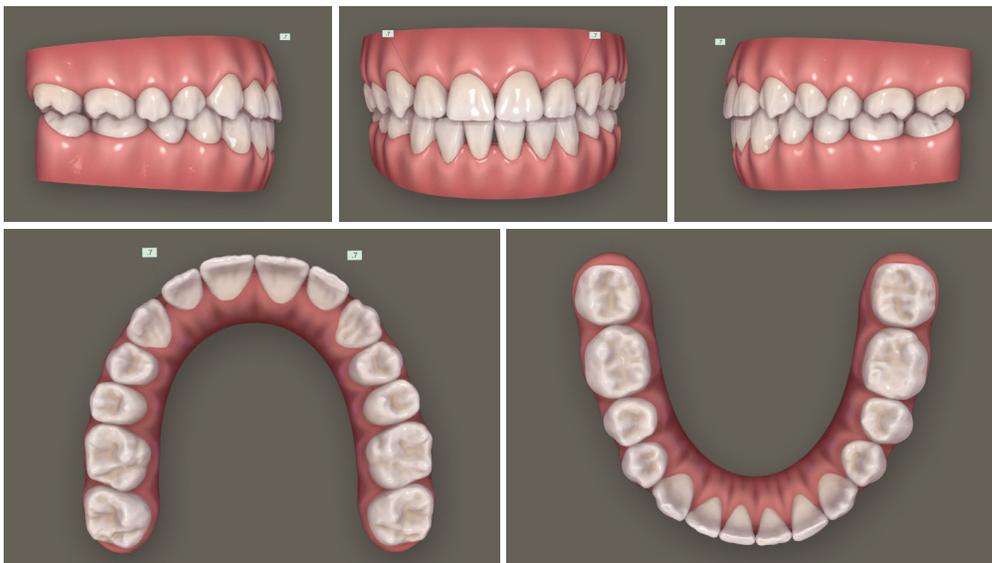
Stage #21 (of 51) of the pre-mandibular advancement phase (i.e., no precision wings for aligners #1-21). These aligners are designed to procline the upper incisors and start leveling the curve of Spee before the precision wings appear.



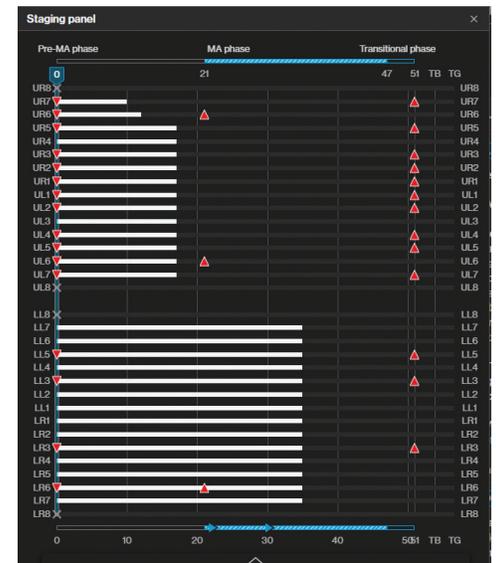
At aligner #22 (shown here), the precision wings for mandibular advancement appear. An in-person office visit once the patient reaches this aligner stage is critical, so that the patient learns how to engage the precision wings properly. The Precision Cuts (U3s/L4s) are for light vertical elastics in case the patient cannot engage the precision wings when they sleep.



Stage #47 (of 51) of the mandibular advancement phase (aligners #22-47 had precision wings). At this stage, the teeth are fully aligned, and the arches are coordinated in Class I. Aligners #48-51 are "transitional" aligners – the last mandibular advancement stage (#47) repeated four more times. This is done so that the mandibular advancement is maintained with fresh aligners while any Additional Aligners are being ordered.

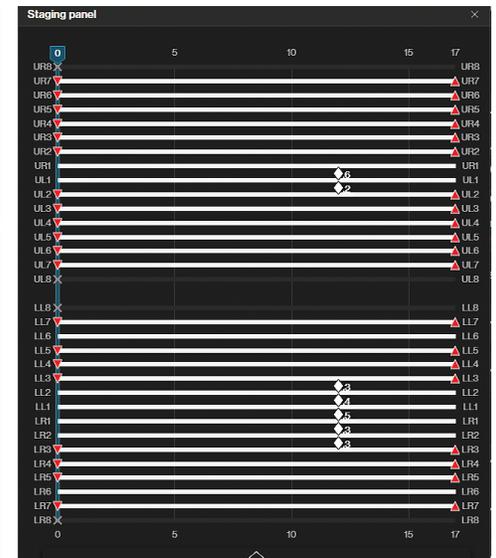
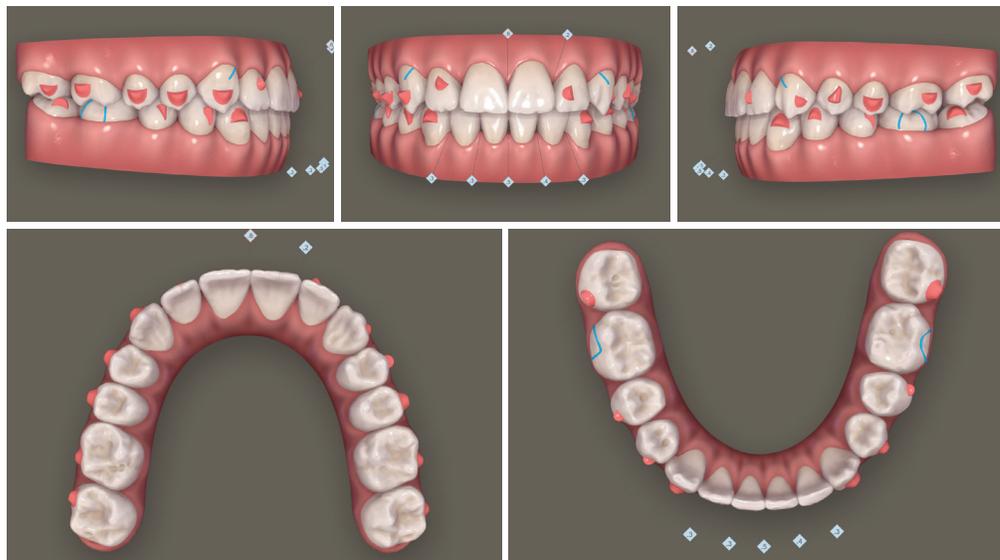


The treatment goal with all the aligner features hidden. Spaces distal to the upper lateral incisors were initially planned due to a tooth-size discrepancy, but these were later closed when lower interproximal reduction was needed to eliminate the open gingival embrasures ("black triangles") around the incisors.





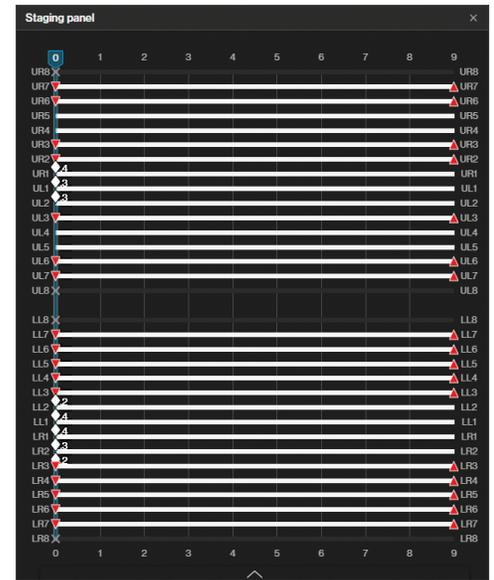
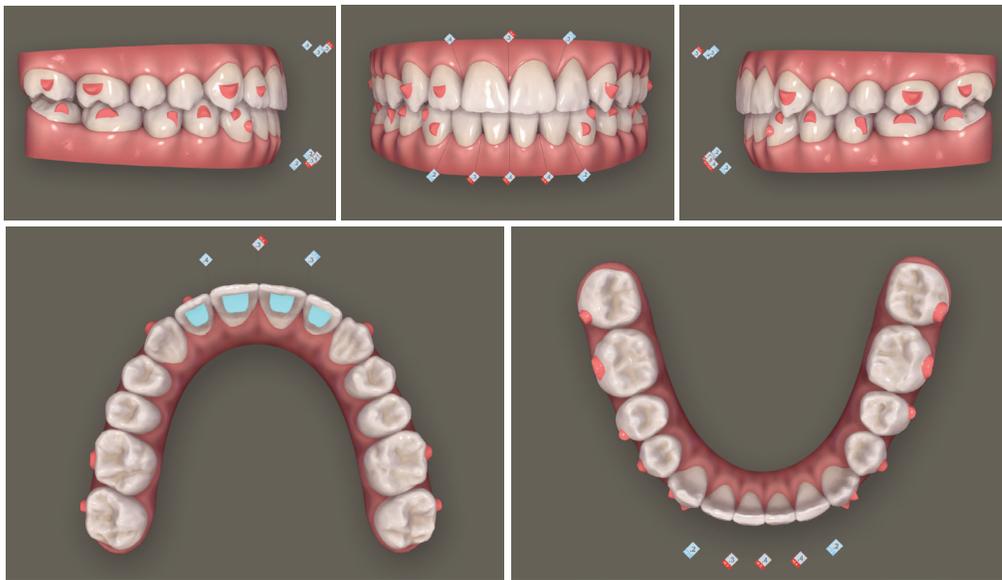
After 8 months of treatment (34 of 51 stages), an open posterior occlusion was present due to the steep curve of Spee. Since the sagittal relationship at this time was almost Class I, the initial aligners were discontinued, and the teeth were re-scanned for Additional Aligners with precision wings, in order to focus on leveling the curve of Spee.



In the Additional Aligners set-up, the curve of Spee was leveled through incisor intrusion and posterior extrusion. Class II elastics with bonded buttons on the lower first molars provided an extrusion component while the A-P correction was fine-tuned. IPR was planned on the anterior teeth to minimize the open gingival embrasures ("black triangles").



After 16 (of 17) Additional Aligners (5 months later), the lateral open bite was almost completely corrected. A new scan was taken to reduce a few open anterior gingival embrasures with Additional Aligners and IPR.



Set-up and staging for the second Additional Aligner series (9 U/L stages). Since the Class II was already resolved, additional Class II elastics were not needed, but precision bite ramps and Optimized attachments were added to help level the curve of Spee a bit more.

Final results and cephalometric analysis:

After 17 months of Invisalign® treatment with mandibular advancement, the patient had a great finish and an amazing smile. A Class I bite was achieved, the deep bite was corrected, the crowding was resolved, and the open anterior gingival embrasures were eliminated. The facial profile was also less convex and more balanced.

End of treatment photos:





The lateral cephalometric tracings showed a 2.5° reduction in ANB, no change to the vertical skeletal relationship, moderate proclination of the upper incisors, and slight proclination of the lower incisors.

Initial and final cephalometric measurements¹

Measurement	Initial	Final	Norm	Change
SNA	79.6°	77.8°	82°	-1.8°
SNB	77.3°	78.0°	80°	+0.7°
ANB	2.4°	-0.1°	2°	-2.5°
Interincisal	142.8°	136.4°	130°	-6.4°
U1/NA	19.8°	25.3°	22°	+5.5°
L1/NB	15.0°	18.5°	25°	+3.5°
FMA (FH/MP)	17.1°	17.0°	25°	-0.1°
IMPA (L1/MP)	89°	92°	95°	+3°

Discussion

The elegance of Invisalign® treatment with mandibular advancement solution is that the treatment plan is simplified by not having to use a separate functional appliance system. A sizeable Class II malocclusion can be turned into something much more manageable to treat, and the patient is able to stay in aligner treatment the entire time, instead of switching between different appliance systems.

Limiting the total duration of Class II elastics use is the main advantage of using the mandibular advancement feature with Invisalign aligners. The parents had been very concerned about their child's mandibular development because his sibling also had a retrognathic mandible and the brother had been treated with a fixed Herbst appliance. They loved the idea of a more comfortable removable Class II corrector built into the Invisalign appliance. Treating this patient with aligners and Class II elastics only (without the precision wings) could have been a viable approach, but not having to depend on elastics wear throughout the entire treatment was much more reassuring to the parents. Class II elastics ended up being worn for only two months, during the first set of Additional Aligners.

Because of the division 2 incisors, a pre-mandibular advancement phase was needed to remove the anterior interferences caused by the retroclined upper central incisors. By flaring out the central incisors first and leveling the curve of Spee with the initial "pre-MA" set of aligners (the aligners without precision wings), the anterior contacts were removed so that the growth of the mandible could be directed as forward as possible during the mandibular advancement phase.

When selecting a case for mandibular advancement, always remember that every patient is a candidate for Invisalign treatment. Invisalign treatment with mandibular advancement is only one option we can leverage to help achieve our treatment goals. We may still use elastics with button cutouts and other features as part of the aligner plan. We may find that the precision wings are not deployed in the aligners right away. We may need a pre-mandibular advancement phase first. To set proper patient expectations, avoid creating expectations that may not be aligned with how the treatment goal will ultimately be accomplished.

¹To reduce tracing bias, the lateral cephalometric films were re-traced by an independent third-party lab (RMO data services).

In the event that pre-mandibular advancement aligners are used, we always want to schedule an additional in-office visit with the patient in the chair the first time the precision wings appear in the aligners. The reason for this is because we need to show our patients how to properly engage the precision wings in a consistent manner once they appear, and we want them to avoid habits that will introduce side effects. Specifically, any biting on the wings instead of interlocking should be avoided because this can cause the molars to flare buccally. Also important during this visit is the removal of any attachments used during the pre-MA phase, along with the placement of any new attachments needed.

In addition to follow-up visits in the office, we can use the Invisalign® Virtual Care platform to check the fit of the patient's aligners along the way. We will check to see if a centric occlusion-centric relation (CR-CO) discrepancy is present and we look for symmetric bilateral engagement of the wings. We do not want only one side engaging properly, or any biting wing-to-wing. Damage noted on the wings and/or buccal flaring observed on the posterior wings suggest that the patient may be improperly biting on the wings. If the patient is unable to re-engage their wings properly with additional instructions, a new scan for Additional Aligners is usually needed.

The key point to communicate is that we are simplifying the orthodontic treatment process and reducing the need for elastics in patients with a large overjet. In doing so, we are targeting the same approach with Invisalign treatment that we use with traditional functional appliances. If we were previously relying entirely on Class II elastics compliance for success in a case, with mandibular advancement aligners, we are reducing this risk and turning it into a much more manageable situation whereby Class II elastics are only used after we transition out of the mandibular advancement phase and into the finishing aligners to button up the case.

After the Herbst phase, a period of elastics and correction of posterior open bite was typical, because advancing the mandible quickly when a curve of Spee is present usually leads to bite opening around the premolars and molars until the curve of Spee is leveled. The same can also be expected of any other functional appliance system, and Invisalign treatment with mandibular advancement is no different, because both are essentially targeting the same mechanism of action.

If you have Invisalign treatment results from your practice that you would be interested in sharing with your peers, please submit your cases to the Invisalign Gallery at:

 submit.InvisalignGallery.com

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