Treatment of a Class II division 1 in a late mixed dentition patient using Invisalign® treatment with mandibular advancement

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Executive summary:

1. Invisalign treatment with mandibular advancement is effective for treating Class II malocclusions during the pubertal peak period of a patient's growth phase.
2. Being able to treat the bite at the same time as the alignment is very efficient, and since the appliance is comfortable, aligner wear compliance is good.
3. Patient education on how to properly engage the mandibular advancement feature at the very beginning of treatment is critical to success of this treatment.
4. The iTero® intraoral scanner and Invisalign® treatment outcome simulator are efficient and effective digital tools for communicating treatment plans to address the patient's primary concerns during the initial consultation.
5. Vivera® retainers can be made to go on top of bonded wire retainers, to help keep the overjet and overbite correction stable over the long-term.

Additional details about this case can be found online at the Invisalign Gallery: **https://global.invisaligngallery.com/treatment/t-1091/**

Initial records:

Age of the patient:
12 years, 3 months

Sex: Female

Patient/parent's chief concern(s):

"My teeth don't fit [together] well, and I noticed [that] my chin is [set] back."

Diagnosis:

Skeletal

- Convex facial profile
- Class II skeletal relationship

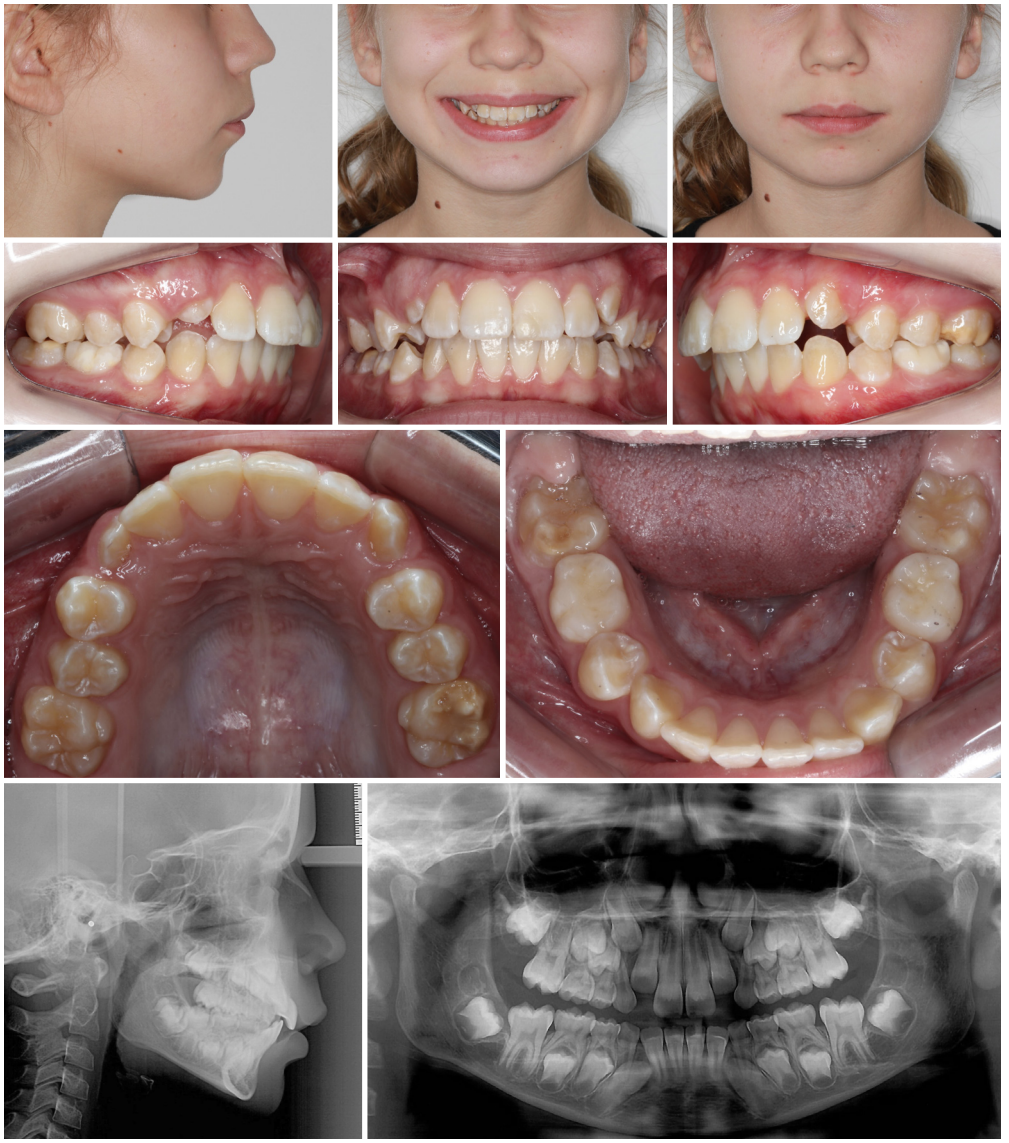
Dental

- Late mixed dentition
- Class II, division 1 incisors
- Right:
  - Severe Class II molar relationship
  - Moderate Class II canine relationship
- Left:
  - Severe Class II molar relationship
  - Moderate Class II canine relationship
- Upper: Mild upper crowding
- Lower: Mild lower crowding (with E-space still available)
- Dental midlines: Centered, with no deviations during jaw opening and closing
- TMJ: asymptomatic

Enamel defect

The patient initially presented with a developmental defect of the enamel on some molars and incisors, which was diagnosedas mild molar-incisor hypomineralization (MIH). No pain or sensitivity was noted, so after completing Invisalign treatment, the restorative plan only consisted of applying a fluoride varnish to protect against additional demineralization.

Photos and radiographs:



Initial cephalometric measurements[1]

Measurement	Initial	Norm
SNA	83.3˚	82˚
SNB	76.5˚	80˚
ANB	6.8˚	2˚
Interincisal	115.9˚	130˚
U1/NA	22.2˚	22˚
L1/NB	35.1˚	25˚
FMA (FH/MP)	25.6˚	25˚
IMPA (L1/MP)	105˚	95˚

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

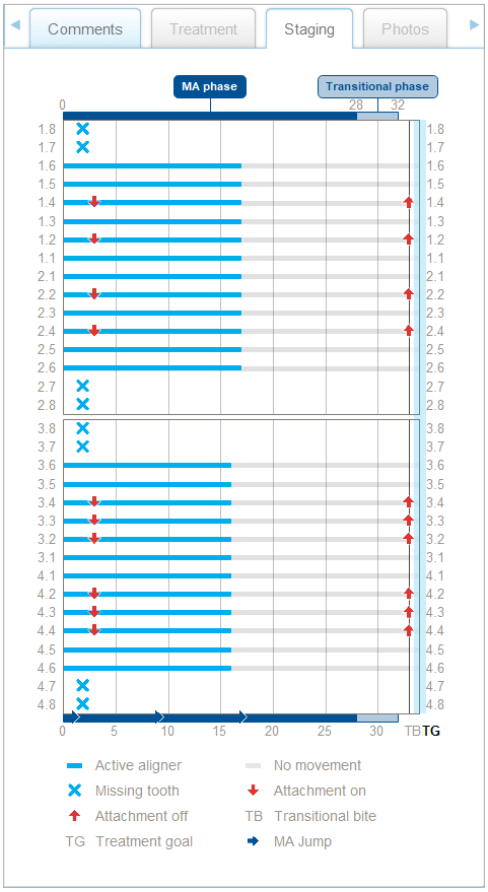
Treatment plan:

Correct the Class II malocclusion using Invisalign® treatment with mandibular advancement in order to minimize the side effects of Class II elastics use during the bite correction phase. Detail the alignment and bite correction with additional aligners without precision wings once the molar relationship has been corrected to mild Class II or better. Class II elastics may be needed during the finishing phase. Retain the results achieved with bonded lingual wires and Vivera® clear retainers (on top of the wire) at night.

ClinCheck® set-up:

The ClinCheck treatment set-up with the precision wings and attachments is shown above. We positioned the mandible to an edge-to-edge bite during the mandibular advancement phase.

Our ClinCheck treatment set-up with the precision wings and attachments hidden. Eruption compensation features for the upper permanent canines were added to allow the permanent canines to erupt into the desired position for a Class I relationship.



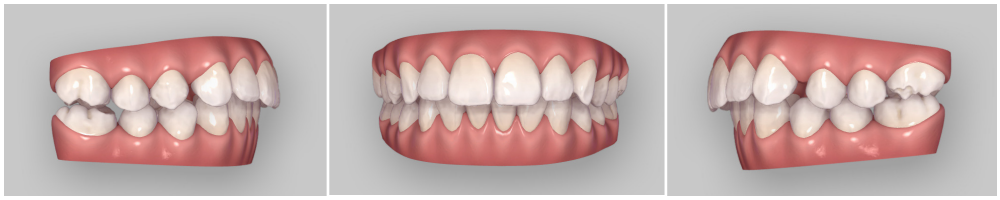
The staging of the initial aligners. Since the incisors were Class II, division 1 and the arches were quite well coordinated, a pre-mandibular advancement phase was not needed.

Progress records:

Initial aligner seating:

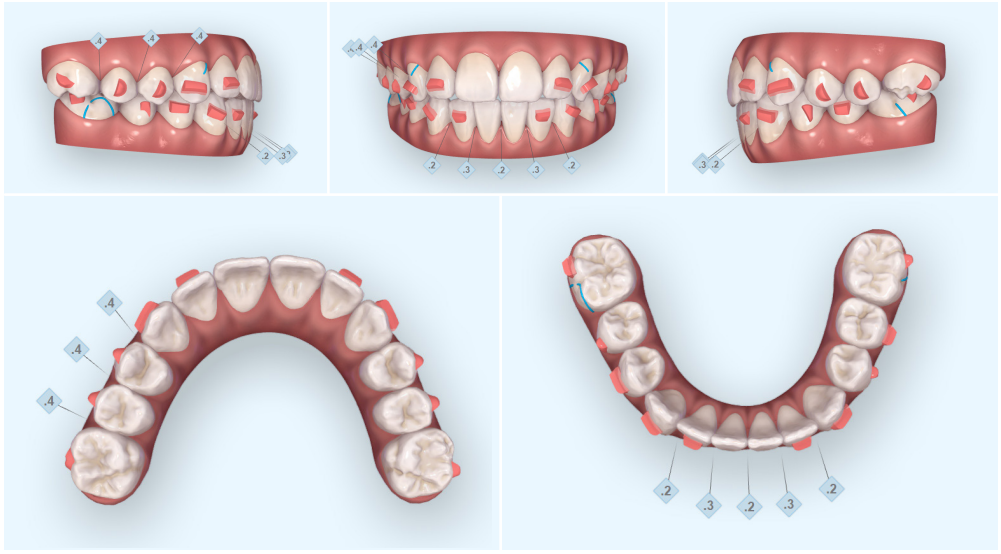
Patients need to be educated on how to properly engage the mandibular advancement feature at the very beginning of treatment. Our patient was able to position her aligners in a stable position even during sleep. If the patient cannot close their mouth correctly to fit the precision wings properly during sleep, light vertical elastics may be needed to stabilize the engagement of the precision wings.

Post-mandibular advancement scan:



After the mandibular advancement phase, the right side molars were slightly Class II and the left side molars were Class I. A new intraoral scan was taken, and since the amount of A-P correction needed was well within what aligners with sequential distalization and Class II elastics could treat to achieve a Class I relationship bilaterally, the additional aligners were ordered without precision wings.

Treatment goal of the additional aligners:



U:33, L:28, + 3 U/L overcorrection aligners were used to tighten interproximal contacts. A button cutout was used on the lower right first molar instead of a precision cut for Class II elastics, because the lower right first molar could benefit from a little extrusion.

Additional aligners progress:

At 14 months into treatment (stage #24 of the additional aligners), the patient was still demonstrating good aligner fit, good oral hygiene, and good elastics wear compliance.

End of treatment records:

Age of patient: 13 years, 8 months

Treatment length: 17 months

Number of aligners used:

- Upper: 32 + 36 = 68
- Lower: 32 + 36 = 68

Aligner change interval prescribed :
7-day aligner changes (1-week wear)

Auxiliaries used (if any, such as buttons/ elastics, sectional appliances):
During the additional aligners phase (8 months), Class II elastics (0.25”, 4.5 ounces) were used for 20-22 hrs./day, from the upper canines (precision cuts) to the lower first molars (bonded button on the lower right, precision cut on the lower left).

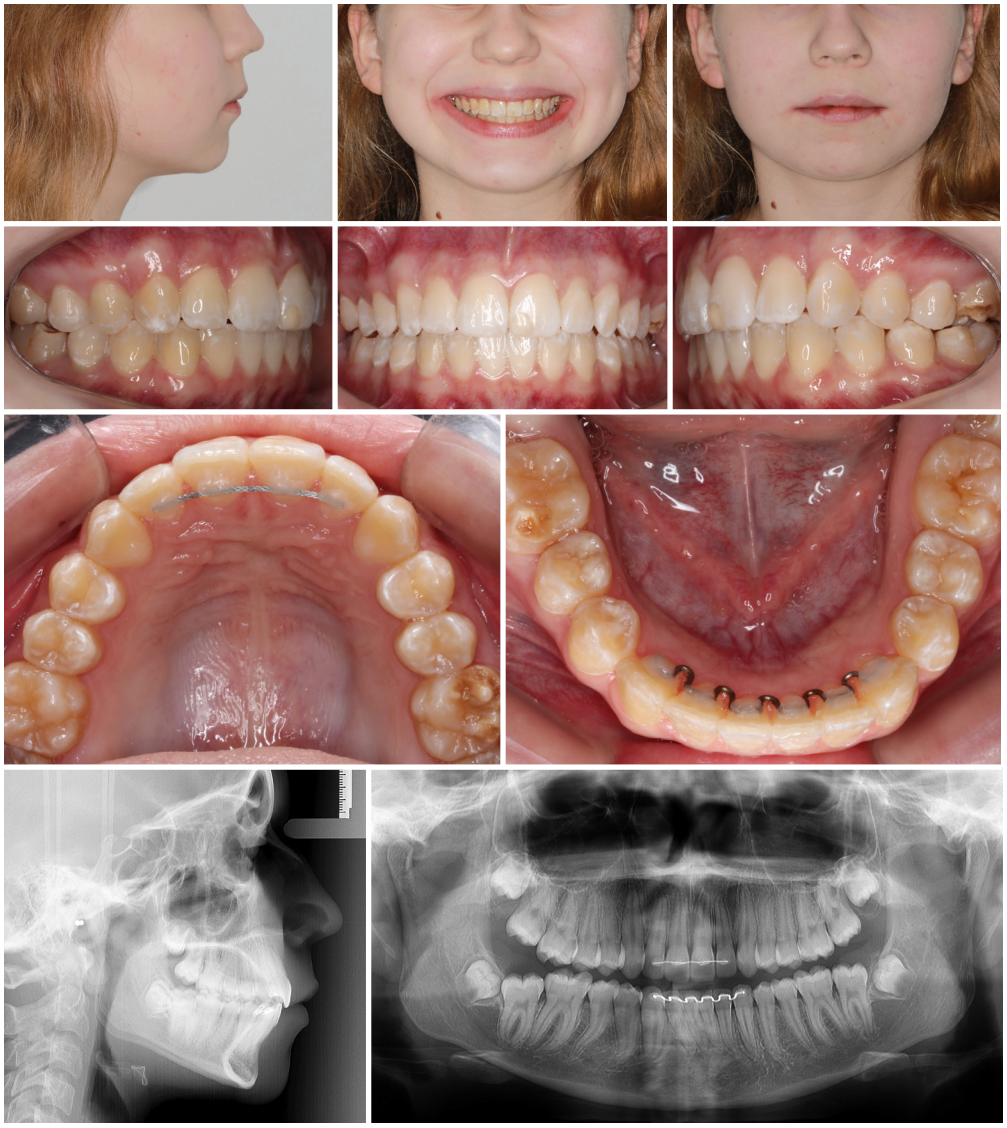
Appointment scheduling:
For the first 3 months of treatment, the patient was scheduled for an in-office visit every month. After that, the visits were scheduled for every 2 months.

Emergency office visits:
None.

Retention

- Upper: A bonded lingual retainer (2-2) was placed immediately after treatment completion, and a Vivera® clear retainer worn on top of that for bedtime only (the Vivera retainer was made to cover the bonded wire).
- Lower: A bonded lingual retainer with vertical loops for flossing access was also placed (3-3), and a Vivera clear retainer worn on top of that for bedtime only (the Vivera retainer was made to cover the bonded wire).

End of treatment photos:



A Class I molar and canine relationship was achieved, along with centered midlines and good interdigitation of the teeth. The post-treatment radiographs revealed good root and alveolar bone conditions. Extraction of the third molars was indicated.

Initial and final cephalometric measurements[1]

Measurement	Initial	Final	Norm	Change
SNA	83.3˚	82.4˚	82˚	-0.9˚
SNB	76.5˚	76.7˚	80˚	+0.2˚
ANB	6.8˚	5.7˚	2˚	-1.1˚
Interincisal	115.9˚	122.6˚	130˚	+6.7˚
U1/NA	22.2˚	14.7˚	22˚	-7.5˚
L1/NB	35.1˚	37˚	25˚	+1.9˚
FMA (FH/MP)	25.6˚	26.3˚	25˚	+0.7˚
IMPA (L1/MP)	105˚	106˚	95˚	+1.0˚

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

Follow-up records:

Excellent stability of the Class II correction was demonstrated 1-year post-treatment, along with normal overjet and overbite, and a well-balanced and esthetic smile. Tooth whitening was performed after orthodontic treatment.

Clinical discussion

This patient initially came to my orthodontic clinic with her mother, who was about to start Invisalign® treatment that day. When the daughter also expressed concerns about her teeth and her facial profile, we offered to scan her teeth with our iTero® scanner and run the Invisalign treatment outcome simulator. After seeing what could be possible for her smile and bite with Invisalign treatment, the daughter was very excited about moving forward with treatment as well (along with her mother).

Since the patient had proclined lower incisors with her Class II skeletal relationship, we planned to treat the bite and the retrusive mandibular profile using Invisalign treatment with mandibular advancement. Additional Invisalign aligners with Class II elastics would only be used after the sagittal relationship was improved to a mild Class II or better, in order to minimize the side effects of Class II elastics (i.e., clockwise mandibular rotation from molar extrusion, excessive lower incisor flare). This patient had division 1 incisors, no significant upper molar rotations present, and only a mild curve of Spee with no immediate protrusive interferences, so a pre-mandibular advancement phase was not needed. A pre-mandibular advancement treatment phase may be needed in patients with immediate protrusive interferences (like in a Class II, division 2 or with a deep curve of Spee), but in Class II, division 1 patients, this step may not be required.

Overall, the patient's compliance with aligner wear was great, since the Invisalign appliances were comfortable. Her oral hygiene was also excellent throughout treatment. In 17 months, we were able to achieve a Class I molar and canine relationship with centered midlines and solid interdigitation of all the teeth. The results we achieved remained stable 1-year post-treatment.

Cephalometric tracing analysis showed that the overjet was corrected through a slight reduction in ANB, but mostly through upper incisor uprighting. As expected, the mandibular advancement phase allowed the Class II relationship to be corrected without significantly opening the vertical relationship or proclining the lower incisors much further. Had the case been treated with Class II elastics only, we could have seen greater bite opening from clockwise rotation of the mandible and/or significant additional flaring of the lower incisors. The retroclination of the upper incisors, slight proclination of the lower incisors, and slight increase in vertical dimension were side effects of the Class II elastics used during the additional aligners phase.

Today, Invisalign treatment with mandibular advancement is our preferred choice for growing patients with Class II mandibular deficiency, because of the control of tooth movement and the orthopedic effects being realized at the same time. Pediatric patients and their parents greatly appreciate the comfort and convenience of the appliance. Regarding this specific patient, everything worked perfectly all throughout treatment. The treatment experience that was provided exceeded the patient's expectations, especially since she had a close friend at school who was being treated by another doctor using a fixed mandibular protractor during the same time period and experienced many broken appliances along with discomfort as a result. We completely agree with a recent journal publication that the Invisalign treatment with mandibular advancement is very comfortable, esthetic, and easy to handle. Concerns about whether the patient will wear and properly care for their Invisalign appliances tend to be overblown when compared to the treatment alternatives. In practice, these concerns are not a big issue and can easily be managed with good communication.

Other recommendations to enable greater success with the Invisalign mandibular advancement appliance are the following:

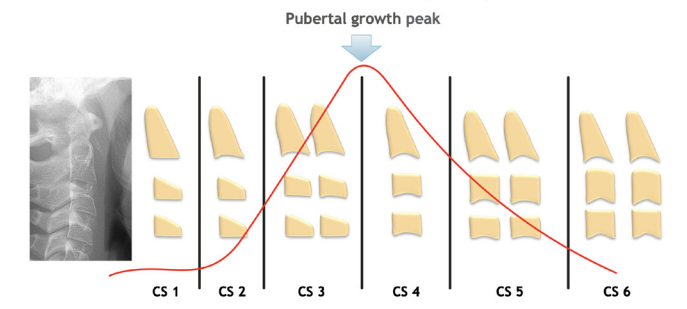
1. Evaluate the patient for the presence of sufficient teeth (or use attachments) in each quadrant for anchoring the mandibular advancement appliance to each arch.
2. Identify the pubertal peak period of your patient in order to initiate treatment at the optimal time (see Clinical Insights section for details).
3. Stay positive throughout the patient's treatment, even if treatment takes longer than expected. Additional scans and the use of Class II elastics to complete treatment is complementary just like with other orthodontic appliances, and does not mean that the treatment is a failure.

Clinical insights: General clinical strategy for Class II correction with Invisalign® mandibular advancement aligners

For young patients with mandibular deficiency, we will usually monitor the skeletal age of the patient in order to determine when to start orthodontic treatment during their growth spurt. The goal is to avoid extractions of permanent teeth and/or orthognathic surgery, so whenever possible, starting treatment in teenagers with Invisalign treatment with mandibular advancement is preferred while craniofacial growth is still in process. In patients with mandibular growth already completed, Class II malocclusions can be corrected by using Class II elastics with upper distalization mechanics, with only the dentoalveolar component being responsible for the correction of the malocclusion.

In order to monitor the growth phase of the patient, we usually analyze the height of the patient (compared to their parents and any older siblings), as well as radiographs (typically a lateral cephalogram to determine their cervical vertebral maturation, or a hand-wrist film). Patients in stages CS1-CS2 may benefit from treatment later, whereas patients in stages CS5 and CS6 are more likely to require elastics, extractions, and/or orthognathic surgery in order to achieve an ideal outcome.

Stages of cervical vertebral maturation

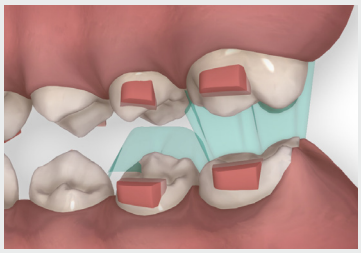


Once removable functional appliance treatment begins, the doctor needs to analyze at each appointment how the precision wings in the aligners are engaging against each other. The lower wings must be positioned in front of the upper ones, not on top or behind, so the lower arch can slide forward and the mandibular growth be directed in the proper direction. If the precision wings occlude against each other and bend buccally, the teeth covered by the aligners may tip towards the buccal as an unwanted side effect. In these situations, patients need to be shown how to correctly articulate their aligners. Light vertical elastics may also be needed (particularly while the patient sleeps) in order to ensure proper engagement of the precision wings.

If the mandibular growth does not match the anterior-posterior increments programmed into the aligners on a one-week wear schedule, we can increase the aligner wear time per aligner to 2 weeks (or even 3 weeks if necessary), to give the jaw extra time to catch up. Only if the aligners stop fitting well (because of the eruption of the permanent teeth, for example) or if we need significant additional A-P correction, will we re-scan the patient for additional mandibular advancement aligners. If minor A-P correction is needed after the mandibular advancement phase, we will use Class II elastics instead of precision wings during the additional aligners phase, like we did for the patient in our case report.

If the patient becomes unable to engage the wings properly because the mandibular growth has not caught up with the advancement increment, then a new scan should be taken and additional aligners made with smaller mandibular advancement increments built into the treatment plan.

Another clinical tip when using the mandibular advancement feature is to increase the aligner stability as much as possible with lingual attachments, especially if the crown heights are short, or some teeth are missing in the posterior region (and therefore retention of the aligners is compromised). Horizontal attachments can be requested on the lingual surfaces of the posterior teeth, since no buccal attachments can be placed on the side where the precision wings are located.



Horizontal rectangular attachments added to the lingual surfaces of the posterior teeth (by doctor's request) to increase the retention of the mandibular advancement aligners. Gingivally-beveled rectangular attachments can also be requested if less aligner retention is needed.

In the past, I primarily used the Herbst appliance for Class II correction, but these patients reported a lot of discomfort. The parents would also complain about the emergency visits needed in order to repair any broken parts. The Invisalign mandibular advancement aligners with precision wings is now my treatment of choice for growing patients with Class II mandibular deficiency. Being able to treat the bite at the same time as the alignment is very efficient, and since the appliance is comfortable, aligner wear compliance is great.

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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