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John L. Brabant graduated with a Bachelor of Dental Surgery (Honours) from the University of Sydney, where he also completed his Master of Dental Science (Orthodontics). Dr Brabant has been invited to speak at several Invisalign summits and forums in the past. In 2018 he will be lecturing extensively on the Invisalign System at many international meetings, including in France and China, as well as presenting at the 2018 Asia Pacific Invisalign Summit in Singapore. Dr Brabant has worked for 32 years as a private specialist focusing on orthodontics and his practice, Evolve Orthodontics, won a Telstra Business Award in 2012. He is the founder of the Carevan Foundation, a non-profit organisation that aims to reduce poverty and help the homeless and disadvantaged in rural Australia. Dr Brabant has been awarded the Order of Australia Medal (OAM) for his services to dentistry and to the homeless.

Treating Mandibular Retrognathism using Invisalign Treatment with Mandibular Advancement

The patient, a male primary school student, was 11 years of age at the time of first presentation. The patient and his parents were mainly concerned with the crowding of his front teeth and retruded lower jaw. They were looking for an alternative treatment to conventional braces and indicated preference for a clear orthodontic device.

Clinical presentation

The patient presented with mandibular retrognathism, in addition to upper and lower anterior crowding and deviation of the mandibular midline (Figure I).

Clinical findings

- Convex, posteriorly divergent profile resulting primarily from mandibular retrognathism.
- Skeletal Class II malocclusion.
- Class II division 1 molar relationship.
- Excessive overjet of 4–5 mm and deep overbite of 60%.
- Mild anterior crowding in the upper and lower arches.
- Deviation of the mandibular midline to the right by 3 mm.
- Constricted and narrow maxillary arch form.
- Mesiolingual rotations of teeth 33 and 43 with the roots tipped mesially.
- Depth of the curve of Spee: 2 mm.

Treatment goals

- Improve facial profile through forward movement of the mandible.
- Achieve Class I molar relationship.
- Obtain normal overjet and overbite.
- Relieve upper and lower anterior crowding.
- Coordinate the mandibular midline with the facial midline.
- Expand the upper arch.

Figure I. Before treatment: Intra- and extra-oral images



- Upright teeth 33 and 43.
- Level the curve of Spee.

Treatment approach

The patient was at the early permanent dentition stage and so was recommended the Invisalign Treatment with Mandibular Advancement in accordance with his and his parents' wish for a transparent orthodontic device. Invisalign Treatment with Mandibular Advancement was chosen to facilitate simultaneous forward movement of the mandible, levelling of the curve of Spee and expansion of the maxillary arch for alignment of the dentition. A three bite jump advancement was used in 2 mm increments. Class II elastics were used for correction of the deviated mandibular midline.

Initial treatment phase (mandibular advancement phase)

This phase was conducted to correct the mandibular retrognathism, as well as to align and level the dentition. Precision Wings integrated

Figure II. Initial ClinCheck staging pattern

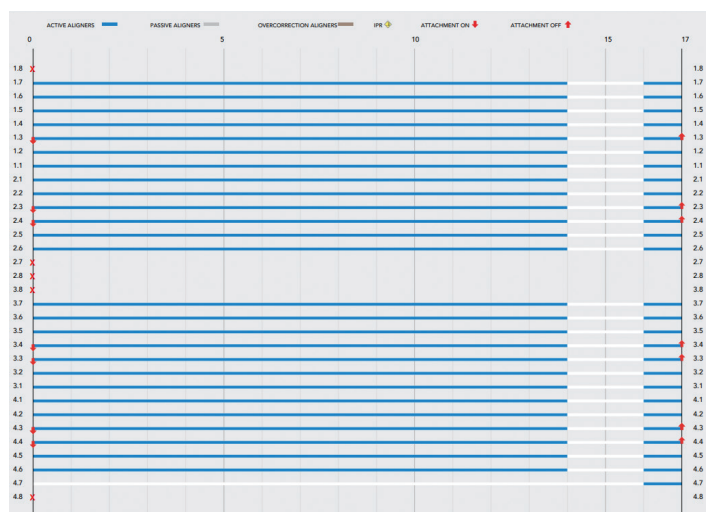


Figure III. Insertion of the aligners with Precision Wings for simultaneous mandibular advancement and alignment of the dentition



into the aligners held the mandible in a forward position whilst simultaneously correcting the dental malocclusion and crowding issues (Figure III), thereby eliminating the need for Class II elastics, which were not used during this phase.

Prior to treatment, an iTero scan was performed for development of the ClinCheck treatment plan (Figure II). A total of 17 upper and lower aligners were determined to be required and attachments were placed on the teeth prior to aligner wear. During this phase, aligners were changed fortnightly and the patient was seen every 6 weeks.

The patient was compliant in his aligner wear and the Precision Wings fitted well in the dentition, although there was some flexing. The patient was educated on the need to keep the Precision Wings engaged.

Refinement phase

The goals of refinement were to correct deviation of the mandibular midline, as well as resolve the bilateral posterior open bite that had developed during the initial treatment phase. Development of the open bite was not of concern as it commonly occurs in mandibular advancement cases. Open bites can be resolved through levelling of the curve of Spee, intrusion of maxillary and mandibular anterior teeth, and extrusion of maxillary and mandibular premolars and molars.

Following completion of the initial treatment phase, new intra-oral iTero scans were taken to develop the refinement stage of the ClinCheck treatment plan (Figure IX) and a total of 40 upper and

lower aligners were determined to be required. During this phase, aligners were changed weekly and the patient seen every 6 weeks, while the attachments were again placed on the teeth prior to aligner wear.

The mandibular midline discrepancy was corrected by distalisation of the lower left posterior teeth, as well as nightly wear of Class II 3/16" 3.5 oz elastics on the right side with aligners 10 to 40. A Precision Cut on tooth 13 in addition to a button cutout and bonded button on tooth 46 were used to facilitate the Class II elastic wear.

Treatment details

Active treatment time

- Initial treatment phase: 7 months.
- Refinement phase: 8 months.

Aligners used

- 17 + 40 upper aligners.
- 17 + 40 lower aligners.

Attachments

Initial treatment phase

- Optimised Deep Bite Attachments on teeth 34 and 44.
- Optimised Root Control Attachments on teeth 13, 24 and 43.
- Optimised Rotation Attachments on teeth 24 and 33.

Refinement phase

- Optimised Deep Bite Attachments on teeth 24, 25 and 45.
- Optimised Root Control Attachments on teeth 12, 13, 14, 15, 23, 33, 34, 43 and 44.
- Optimised Rotation Attachment on tooth 35.
- Conventional horizontal rectangular attachments (3 mm) on teeth 16 and 26.

Retention

Upper and lower fixed lingual wire retainers were used along with removable nightly upper and lower Tru-Tain retainers for 12 months.

Treatment outcome

Favourable results were achieved at completion of the treatment (Figures IV–IX and Table 1). At the completion of treatment the patient's mandible was advanced, leading to an improvement in his facial profile, achievement of a Class I molar relationship and a normal overjet. The upper arch form was sufficiently broadened and the curve of Spee levelled leading to achievement of a normal overbite and alleviation of the upper and lower anterior crowding. The mandibular midline discrepancy and malaligned teeth were also corrected. Overall, good alignment, angulation and inclination of the dentition were achieved together with closure of the bilateral posterior open bite. Invisalign Treatment with Mandibular Advancement enabled simultaneous correction of the mandibular retrognathism and alignment of the dentition, leading to a much shorter treatment time. The patient and his parents were delighted with the treatment outcome and pleasantly surprised at how quickly improvements could be seen.

Figure IV. After treatment: Intra- and extra-oral images



Figure V. Panoramic radiograph before (top) and after (bottom) treatment

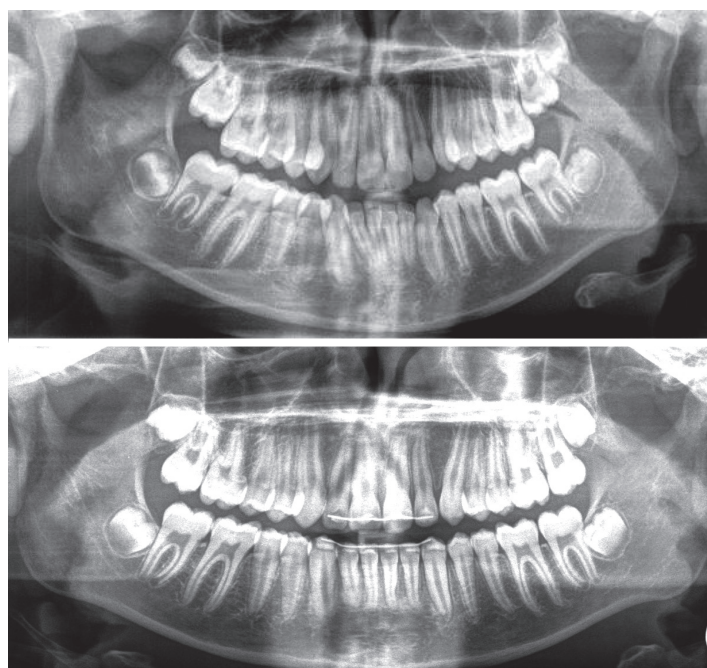


Figure VI. Cephalometric radiograph before (left) and after (right) treatment

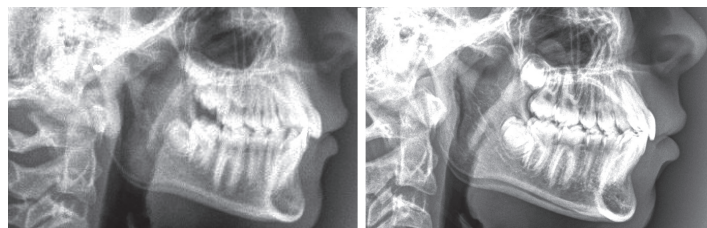


Figure VII. Overjet prior to (left) and following (right) the completion of treatment



Figure VIII. Superimposed tracings of the lateral cephalometric radiographs before and after treatment

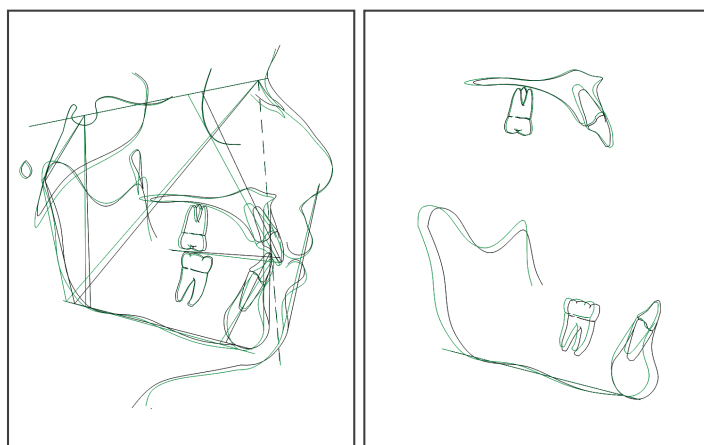
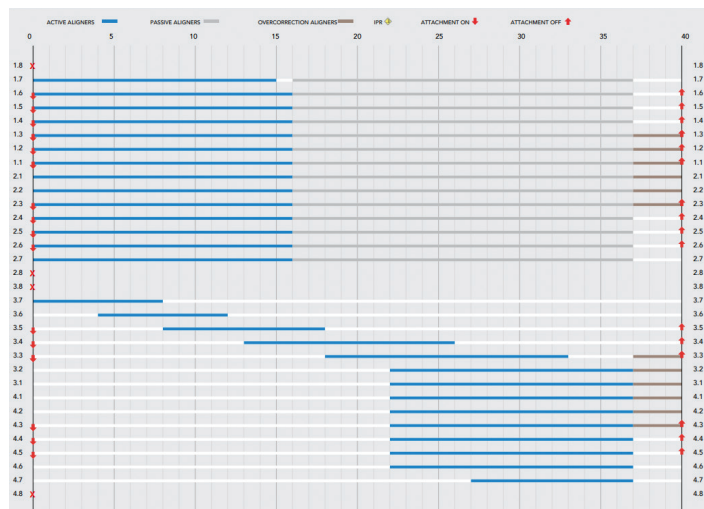


Figure IX. Final ClinCheck staging pattern



Clinical tips

- Retention can be enhanced by increasing the number of Optimised Attachments, or by using conventional horizontal rectangular attachments rather than Optimised Attachments during the mandibular advancement stage.
- Attachments should be modified during the refinement phase in accordance with the treatment objectives.

Table 1. Pre- and post-treatment cephalometric analysis measurements

Group/Measurement	Norm	Pre-treatment	Post-treatment	Difference
Cranial Base				
SN (mm)	72.5	68.5	68.4	-0.1
S-Ar (mm)	32.5	29.7	30.3	0.6
SN-Ar (°)	124.0	132.2	134.3	2.1
Maxilla & Cranial Base				
SNA (°)	82.0	83.9	81.0	-2.9
A-N Perpendicular (mm)	0.0	1.0	-1.7	-2.7
Mandible & Cranial Base				
SNB (°)	80.9	79.7	78.5	-1.2
Pog-N Perpendicular (mm)	-5.0	-3.1	-5.4	-2.3
Maxillo/Mandibular				
ANB (°)	1.6*	4.2*	2.5*	-1.7*
Co-A (mm)	89.0	82.1	82.3	0.2
Go-Me (mm)	71.0*	58.0*	61.4*	3.4*
Co-Gn – Co-A (mm)	20.8*	21.0*	22.6*	1.6*
Wits Appraisal (mm)	-1.0*	0.6*	-2.2*	-2.8*
Vertical Growth Forecast				
S-Go (mm)	72.1	73.3	72.8	-0.5
Na-Me (mm)	112.1	103.4	104.9	1.5
S-Go/N-Me (%)	65.0	70.9	69.3	-1.6
ANS-Me (mm)	65.3	60.2	60.3	0.1
Ar-Go-Na (°)	56.2	52.6	52.1	-0.5
Na-Go-Me (°)	70.2	65.3	64.9	-0.4
Ar-Go-Me (°)	125.8	117.9	117.0	-0.9
Jarabak (°)	395.8	386.0	387.1	1.1
Ar-Go (mm)	42.3	49.0	47.9	-1.1
Articular Angle (°)	143.4	136.0	135.8	-0.2
Mand Plane to SN (°)	34.1	26.0	27.1	1.1
Ba-Na*Pt-Gn (°)	0.0	3.3	0.3	-3
Soft Tissue				
Col-Sn-UL (°)	102.0	123.9	116.4	-7.5
Upper Lip – S Line (mm)	0.0	1.9	2.9	1
Lower Lip – S Line (mm)	0.0	1.6	4.0	2.4
Anterior Tooth Position				
U1 – SN (°)	102.4	103.4	106.6	3.2
L1-MP (°)	95.0	101.4	106.4	5
U1 – NA (mm)	4.3	2.2	5.3	3.1
L1-APo (mm)	2.7	-0.1	3.5	3.6
U1-L1 (°)	130.0	129.1	119.8	-9.3

* Values are indicative of forward movement of the mandible.

- Patients should be educated on the importance of the Precision Wings and their correct positioning in the mandible in order to appropriately engage them.
- Several aspects should be carefully monitored during patient follow-up visits, including engagement of the Precision Wings and any distortion, the molar and canine relationships, the degree of overjet and overbite, as well as the development of a dual bite.

Impact on clinical practice

This case demonstrates that Invisalign Treatment with Mandibular Advancement effectively enables forward movement of a retruded mandible in adolescent patients, leading to an improvement in their facial profile. Use of this system also decreases the overall treatment time required compared with conventional two-phase treatments, due to its ability to simultaneously advance the mandible and facilitate alignment of the dentition.

Conclusion

This 11-year-old patient presented with mandibular retrognathism in addition to an excessive overjet, deep overbite and upper and lower anterior crowding. He also had a deviated

mandibular midline, narrow maxillary arch and malaligned teeth. Invisalign Treatment with Mandibular Advancement was chosen to facilitate simultaneous forward movement of the mandible, levelling of the curve of Spee and expansion of the maxillary arch for alignment of the dentition. At the completion of treatment the patient's mandible was advanced, leading to an improvement in his facial profile in addition to the achievement of good alignment, angulation and inclination of the dentition. Class II elastics were used during the refinement phase for successful coordination of the mandibular midline. This case demonstrates that Invisalign Treatment with Mandibular Advancement effectively enables simultaneous forward movement of a retruded mandible and alignment of the dentition in adolescent patients.

Author disclosure

Dr John L. Brabant was provided an honorarium from Align Technology, Inc., for his contribution towards the creation of this case report.

Five key take away points:

- 01 It is an effective treatment option for adolescent patients at the early permanent stage who wish for treatment with a transparent orthodontic device.
- 02 Enables simultaneous correction of mandibular retrognathism and alignment of the dentition, leading to a much shorter treatment time.
- 03 Precision Wings integrated into the aligners hold the mandible in a forward position, eliminating the need for Class II elastics.
- 04 In this case, good alignment, angulation and inclination of the dentition were achieved together with correction of the retruded mandible.
- 05 The patient and his parents were delighted with the treatment outcome and surprised at how quickly improvements could be seen.