Two phase treatment of a Class II division 1 patient complicated by traumatic upper incisor intrusion: A Case Report

By Dr. Roelien Stapelberg

Phase I
A female patient presented at the age of 7 years and 8 months with the complaint that one of her upper teeth was absent. She had a mild thumb-sucking habit with a tongue thrust. She had a Class II division 1 incisor relationship on a Class II skeletal base with mildly decreased vertical facial proportions.

Extra-oral examination (Figure 1a-c)
Extra-orally the patient presented with a Class II skeletal pattern convex profile and accentuated labiomentum fold. She had acceptable vertical facial proportions. The frontal examination revealed acceptable facial symmetry and balance, with the upper centerline coincident with the midfacial axis. Soft tissue examination demonstrated thin upper and lower lips with mild incompetence, as well as an acute nasolabial angle. The lower lip was retrusive to Rickett’s E-line.

Intra-oral examination (Figure 1d-h)
The patient was in the early mixed dentition and had good oral hygiene. There was no history of dental caries, and no active dental caries. Mild generalized extrinsic staining was present. Furthermore there were no restorations present. The maxillary arch was symmetric and tapered, whereas the mandibular arch was square and symmetric. Both arches had no space deficiency and had well aligned buccal segments. The upper right central incisor was missing, and the upper left central incisor was procrowned.

In occlusion, the overjet measured 10 mm, with no overbite present. The molar relationship on the left was full Class II, and the right side was ¾ Class II. The lower centerline was 2 mm to the left of the upper centerline, which was coincident with the facial centerline. There was no crossbits or discrepancies.

The Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) was S1, and the Aesthetic Component (AC) was 9.

Radiographic examination (Figure 2a,b)
The DPT demonstrated that all second molars were present and developing, as well as the lower third molars. The upper right central incisor seemed to be horizontally impacted. The cephalometric analysis confirmed our clinical findings of a Class II skeletal pattern with an ANB of 7°0’. The Wits appraisal affirmed the Class II skeletal pattern with a measurement of 7.5 mm. The vertical proportions were slightly decreased, demonstrated by the maxillary-mandibular plane angle of 97°2’ and face height ratio of 52.1%. The upper incisors were severely proclined at 128.5°, as was the lower incisors at 106.0°. The lower incisors were retracted relative to the APo line with a measurement of 0.8 mm.

Problem list
1. UR1 Horizontally impacted
2. Class II skeletal pattern due to mandibular retrognathia
3. Convex profile
4. Increased overjet
5. Lower centerline 2 mm to the left of the upper centerline
6. Aims and Objectives
7. Establish coincident centerlines
8. Maintain result until comprehensive orthodontic therapy

Treatment plan
1. Upper hybrid TPA – tongue crib appliance to assist in breaking the thumb sucking habit and relieve the present tongue thrust, while reinforcing the anchorage of the UR1 & UL1.
2. Upper 2x2 pre-adjusted edge-wise fixed appliances (0.022” x 0.028” slot) with MBT prescription.

When the position of the UR1 was at an adequate level, it was engaged on the 0.016 SS with an elastics tie. The time period from surgical exposure of the UR1 to alignment with the archwire was 5 months. The UR1 was bonded with a hybrid TPA, and an upper fixed retainer from UR1 – UL1 was placed.

Treatment assessment (Figure 1a-g)
Case one was a 7 years and 8 months old Caucasian female presenting with a Class II division 1 incisor relationship on a Class II skeletal base with mildly decreased vertical facial proportions. The mandible was retrognathic, and the maxilla normal. The malocclusion was complicated by a horizontally impacted UR1. The patient presented with no space deficiency. The upper centerline with on the facial midline, and the lower centerline was 2 mm to the left of the upper. The molar relationship was full unit Class II on the left and ½ unit Class II on the right.

Phase I treatment was deemed appropriate, and consisted of a hybrid TPA-tongue crib appliance with a 2x2 upper pre-adjusted edgewise fixed appliances (0.022” x 0.028” slot) with MBT prescription. Surgery
Aims and Objectives
1. Utilize favorable mandibular growth for improvement of the Class II skeletal discrepancy
2. Improve facial harmony and increase lower lip protrusion
3. Reduce upper incisor proclination
4. Reduce overjet to normal values
5. Establish optimal buccal segment interdigitation bilaterally
6. Establish coincident centerlines
7. Obtain lip competence at rest
8. Maintain incisor display on smiling
9. Place teeth in a position conducive to favorable facial and dental aesthetics and long-term stability
10. Retain corrected result

Treatment plan
1. Upper removable appliance while waiting for eruption of the upper second premolars and the growth spurt to occur. Appliance manufactured with an expansion screw to establish adequate maxillary dental arch width to accomplish mandibular forward posturing without occlusal interferences from a crossbite tendency, with a 2 x-spring on the 12 to obtain initial alignment.
2. Andrewson’s Activator appliance for mandibular growth stimulation with wax bite of approximately 5mm was given after the growth spurt was reached as evaluated by clinical examination. Capping of lower incisors was done on the Activator to minimize lower incisor proclination.
3. Full upper and lower pre-adjusted edgewise fixed appliances (0.022” x 0.028” slot) with MBT prescription was placed after Class I canine was achieved with the Activator.
4. Bonded upper fixed retainer individually from UR3 to UL3 and upper vacuum formed retainer to be worn at night time only and a bonded lower fixed retainer individually from LR3 to LL3.

Treatment progression (Figure 5–8)

Compliance was excellent with the upper removable appliance and expansion attained was sufficient to prevent crossbite occurrence when the maxillary was postured forward into a Class I canine relationship. After the growth spurt was attained, an Activator appliance was manufactured with forward posturing into a relative normal position in relation to A-Po line (0.6 mm).

Problem list
1. Class II skeletal relationship due to mandibular retrognathia
2. Convex profile with reduced lower lip protrusion
3. Upper incisor proclination
4. Overjet of 8.5 mm
5. Asymmetric Class II molar and canine relationship
6. 2 mm lower centerline discrepancy to the left of the upper dental midline
7. Incompetent lips at rest

A female patient presented at 9 years 4 months of age for a retention check of her fixed upper retainer, still in place from her previous orthodontic treatment (Phase I). She had a Class II division 1 malocclusion, on Class II skeletal bases, with decreased vertical proportions, bimaxillary proclination and a lower lip trap.

Phase II

Extra-oral examination
Extra-orally the patient had a severe Class II skeletal pattern with a convex profile and acceptable vertical proportions of the face. Frontal examination revealed no transverse asymmetry, and the upper centerline was on with the midfacial axis, with lower centerline being shifted 2mm to the left. Soft tissue examination demonstrated a retruded and incompetent lower lip of normal thickness. A lower lip trap was also present.

Intra-oral examination
The patient was in the late mixed dentition and had good oral hygiene. There were no restorations, and the patient was cavity free. The maxillary arch was ovoid and symmetrical with no space discrepancy. The buccal segments were well aligned, with mesial buccal rotation on the UR6 and UL6 present. The mandibular arch with ovoid and symmetrical with no space discrepancy, with a deep curve of Spee present. The buccal segments of the lower arch was well aligned.

In occlusion the overjet measured 8.5mm, with an overbite of 3.5mm (50%). The left molar relationship was ¼ unit Class II, and the right ½ unit Class II. The left canine relationship was full unit Class II, and the right was ½ unit Class II. No crossbites were present.

The dental health component (DHC) of the Index of Orthodontic Treatment Need (IOTN) was 4a, and the aesthetic component (AC) was 9.

Radiographic examination
The DPT demonstrated that all third and second molars were developing. No other abnormalities were found.

The cephalometric analysis (Table 1) confirmed a skeletal Class II antero-posterior discrepancy as demonstrated by an ANB of 3.8° and a Wits appraisal of 6.5 mm.

Both the upper and the lower incisors were severely proclined (134.7° upper & 104.5° lower), with the lower incisor in a relative normal position in relation to A-Po line (0.6 mm).

Intra-oral photographs
Figure 1 (a-h) Case 1. Pre-treatment extra- and intra-oral photographs

Figure 2 (a-b) Case 1. Pre-treatment radiographs

Figure 3 (a-f) Case 1. Treatment progression

Figure 4 (g-h) Case 1. Post-treatment extra- and intra-oral photographs

Figure 5 (a-b) Case 1. Post-treatment radiographs
Class I canine relationship bilaterally and a waxbite thickness of 5mm (Figure 5). The compliance with the Activator was excellent, and after 5 months of wear the patient was ready for fixed appliances. A cephalogram after the Activator treatment was taken and analyzed (Figure 6). The cephalometric analysis (Table 2) revealed a skeletal Class I anteroposterior relationship (ANB 3.6°, Wits appraisal 2.8 mm). The SNA reduced during the use of the Activator, which was the cause for the reduction in the ANB angle. The SNB remained almost the same. The vertical proportions indicated a mildly anterior growth rotation. The upper incisors retroclined, and the lower incisors proclined after the Activator use. The upper incisors were severely proclined with 120.0°, and the lower incisors as well with 111.3°. The lower incisors protruded in relation to APo (5.2mm). 0.022 slot preadjusted edgewise fixed appliances were placed, with the leveling and aligning phase initiated with 0.016" heat activated Nickel Titanium archwires in the upper and lower arches. The archwires progressed to 0.019 x 0.025" heat activated Nickel Titanium in the upper and lower arch, followed by customized and coordinated 0.019 x 0.025" stainless steel archwires with steel ligatures. At this stage the patient was advised to use Class II intermaxillary elastics (5/16" 3oz) bilaterally full time to correct our canine relationship after mild relapse occurred during the alignment and leveling phase of the fixed appliances. The intermaxillary elastics were continued for 4 months. During the torque expression of the rectangular steel wires, mild spaces opened in the upper arch, these spaces were closed with friction mechanics utilizing a closed elastomeric.

Figure 3 (a,b) Case 1. Upper 2x4 MBT pre-adjusted edgewise appliances with hybrid TPA-tongue crib appliance and eruption URI encouragement via elastic chain.

Figure 4 (a-g). Case 1. Post-phase 1 treatment completion extra- and intraoral photographs.
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chain from upper right to left first molars.

A cephalogram was taken after correction of the anterior-posterior relationship to check the incisor inclinations and evaluate the patient for the possibility of extractions. The upper incisors were proclined, as was the lower incisors, however the lower incisors did not procline more than the pre-treatment value, and the facial appearance accepted the increased proclination. Therefore no ex- tractions were done to decrease the incisor proclination.

Finishing and detailing was done on a .016 stainless steel wire. The estimated treatment time for Case 1 treatment was 24-30 months. The actual treatment time was 22 months. Retention was initiated with an upper vacuum formed retainer and a lower fixed 3-3 retainer.

Case 1 assessment (Figure 9)

Case 1 presented to the orthodontic clinic at the age of 7 years 8 months, with a Class II division 1 incisor relationship on a Class II skeletal base with mildly decreased vertical facial proportions. The mandible was retrognathic, and the maxilla normal. The malocclusion was complicated by a horizontally impacted UR1. The upper central incisors was on the facial midline, and the lower center line was 2mm to the left of the upper. The molar relationship was full unit Class II on the left and ¼ unit Class II on the right. The upper and lower incisors were severely proclined, with the lower incisors in normal position relative to the APo line. Orthodontic camouflage for the underlying Class II skeletal discrepancy was carried out. On initial examination it was clear that the upper and lower incisors were proclined. Lower incisor proclination would indicate the amount of correction that can be attained by orthodontics only. For Case 1, the lower incisors were se- verely proclined, with no pres- ent crowding. Provided we did not procline the lower incisors much more, we would be able to attain an acceptable compromise orthodontic camouflage result.

Phase I treatment consisted of a hybrid TPA-tongue crib appliance with 2x4 upper pre-adjusted edgewise fixed appliances (0.022* x 0.028 slot) with MBT prescription. Surgical exposure of the UR1 via the open technique with bonding of a gold chain and orthodontic traction to the archwire was done to facilitate eruption. Retention via a bonded upper fixed retainer UR1 to UR1 was placed until Phase II treatment.

Phase II treatment consisted of growth modification via an Andrews Activator with full upper and lower pre-adjusted edgewise fixed appliances (0.022* x 0.028 slot) with MBT prescription. After the use of the Activator a cephalometric analysis was done to evaluate the incisor inclination and position. Although the incisors were proclined after the functional appliance phase, her profile accepted the increased inclinations, and we took advantage of the increased labial root torque values of the MBT prescription to decrease the proclination closer to pre-treatment values. As demonstrated by the super- imposition (Figure 10), most of the changes were dento-alveolar in nature, SNA decreased slightly, but this is likely to be due to remodeling of A point following upper incisor move- ment, rather than a true change in skeletal base relationship.

The upper incisors were retro- climed form their pre-treatment position, and with the increase in lower incisor inclination, this resulted in reduction of the Class II 1 incisor relationship, concomitantly improving the buccal segment relationship.

During treatment, we main- tained the lower archform and intercanine width, and it was possible to get good buc- cal segment interdigitation, which aid in maintenance of the sagittal correction. Furthermore we can expect that the incisor relationship will be maintained seeing as we did not procline the lower incisors excessively to become influence by the lower lip. Therefore stability can be expected to be good.

The patient is aware of the need for long-term retention.

Table 1 Case 1. Pre-treatment cephalometric analysis

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<th>Variable</th>
<th>Pre-treatment</th>
<th>Normal</th>
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<tr>
<td>SNA (°)</td>
<td>79.3</td>
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<tr>
<td>SNP (°)</td>
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<td>ANB (°)</td>
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<td>SN to maxillary plane (°)</td>
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<td>Wits appraisal (mm)</td>
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<td>Upper incisor to maxillary plane angle (°)</td>
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<td>106 (SD 10)</td>
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<td>Lower incisor to mandibular plane angle (°)</td>
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<td>92 (SD 5)</td>
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<td>Interincisal angle (°)</td>
<td>101.3**</td>
<td>133 (SD 10)</td>
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<td>Maxillary mandibular plane angle (°)</td>
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<td>27 (SD 5)</td>
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<tr>
<td>Upper anterior face height (mm)</td>
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<tr>
<td>Lower anterior face height (mm)</td>
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<td>Face height ratio (%)</td>
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<td>55</td>
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<td>Lower incisor to APo line (mm)</td>
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<td>0 (SD 2)</td>
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<tr>
<td>Lower lip to Ricketts E Plane (mm)</td>
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Table 2 Case 1. Post-treatment cephalometric analysis

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<td>Lower lip to Ricketts E Plane (mm)</td>
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<td>-2</td>
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Table 3 Case 1. Post-treatment cephalometric analysis

*Denotes values greater than 1 standard deviation from the average Caucasian values.
** Denotes values greater than 2 standard deviation from the average Caucasian values.
*** Denotes values greater than 3 standard deviation from the average Caucasian values.

*Denotes values greater than 1 standard deviation from the average Caucasian values.
** Denotes values greater than 2 standard deviation from the average Caucasian values.
*** Denotes values greater than 3 standard deviation from the average Caucasian values.

Figure 7 (a-c). Case 1. Upper and lower MBT pre-adjusted edgewise appliances with 0.016* heat activated nickel titanium archwires

Figure 8 (a-c). Case 1. Upper and lower 0.019 x 0.025 stainless steel archwires with closed elastomeric chain for space closure from UR6 to U11. Class II intermaxillary elastics bilaterally full time.

Figure 9 (a-c). Case 1. Post-treatment extra- and intra-oral photographs

Figure 10. Case 1. Mid-treatment to pre-finish superimposition.

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