A Case Report on Correction of Class II Division 2 Malocclusion using Molar-to-molar Appliance

Jeegar Ketan Vakil

INTRODUCTION

K. N, a 13 years 6 months male, reported with the chief complaint of irregularly placed teeth. Clinical examination and analysis of records showed that he had an Angle’s Class II molar relationship on a Class II skeletal base with retrognathic mandible and deep mentolabial sulcus. There was reduced vertical proportion. The incisor relation was class II division 2 with moderate crowding in the lower arch. Oral hygiene status was fair to poor. Lips were competent at rest.

Treatment involved orthodontic fixed appliance mechanotherapy using metal brackets with 0.018 × 0.025 MBT prescription. Correction of anteroposterior (A-P) skeletal discrepancy was done using fixed functional appliance (Advansync2). Optimal orthodontic and esthetic result was achieved by nonextraction treatment protocol.

SECTION 1: PRETREATMENT ASSESSMENT

- Patient’s initials: K. N
- Sex: Male
- Date of birth: March 23, 2002
- Age at pretreatment assessment: 13 years 6 months
- Age at start of treatment: 13 years 6 months
- Age at the completion of active treatment: 15 years 7 months
- Patient’s complaint: “Irregularly placed teeth”

Extraoral assessment

Skeletal assessment

- Transverse: Acceptable facial symmetry and balance on frontal examination
- A-P: Skeletal Class II pattern with convex profile
- Vertical: Reduced vertical proportion [Figure 1].

Soft-tissue assessment

- Upper and lower lips competent at rest
- Normally positioned lips in relation to Rickett’s E-line
- Nasolabial angle within normal limits.

Temporomandibular joint assessment

- No signs or symptoms of temporomandibular disorder.

Intraoral examination

Oral hygiene and dental health

Oral hygiene status was fair-to-poor with stains and deposits on labial and lingual surfaces.

Erupted teeth

<table>
<thead>
<tr>
<th>6</th>
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</table>

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Crowding/Spacing

Maxillary arch
- “U”-shaped squarish arch form
- Palatally placed central incisors, while labially tipped lateral incisors
- Right and left canines unerupted
- Right deciduous molar overretained.

Mandibular arch
- Ovoid arch form
- Mild anterior crowding present in the lower arch
- Left canine yet not erupted (inadequate space) and second premolar is partially erupted [Figure 2].

Occlusal features
- Incisor relationship: Class II
- Overjet (mm): -
- Overbite: 8 mm
- Center lines: Upper midline coincident to the facial midline
- Left buccal segment relationship: Molars: Full-unit Class II
- Right buccal segment relationship: Molars: Full-unit Class II
- Displacement: Maxillary central incisor palatally tipped. Lateral incisors are tipped labially. Right canine impacted. Left canine placed buccally
- Mandibular arch: Rotations present with right canine and left 1st premolar. Curve of Spee was deep [Figure 3].

General radiographic examination
- Unerupted teeth: Upper right and left canines, upper right second premolar. All third molars, lower left canine
- Partially erupted lower second molars and lower left second premolar
- Teeth absent: None [Figure 4].

Interpretation

Skeletal
The cephalometric analysis revealed Class II skeletal A-P relationship with an ANB of 9° and a Wits appraisal of 5 mm. The vertical proportions are in normal range as assessed by the SN-Go-Gn angle (29°) and FMA (25°) indicated. Face-height ratio is reduced.

Dental
Clinically and cephalometrically, retroclination was seen with upper central incisors (U1 to NA showed 10° and −4 mm). Lower incisors were also retroclined (L1 to NB showed 20°). The interincisal angle was increased (151°).

Soft tissue
Soft-tissue profile was full. Nasolabial angle (98°) was normal. Lower lip was forwardly placed relative to Rickett’s E-line. The thickness of the lower lip is increased and the position is everted [Table 1].
**Diagnostic summary**

K. N, a 13 years 6 months Indian male, presented with an Angle’s Class II molar relationship on a Class II skeletal base with reduced vertical proportions. The malocclusion was complicated due to retrognathic mandible and severe anterior deep overbite. Oral hygiene status was fair-to-poor with plaque deposits and stains.

The upper and lower lips were competent at rest. Lower anterior face height was reduced. Nasolabial angle was normal. Mentalabial sulcus was deep. The dental health component of the index of treatment need (IOTN) recorded as 4f and the esthetic component as 6.

**Problem list**

1. Skeletal Class II jaw base relation due to retrognathic mandible
2. Convex profile
3. Class II buccal segment
4. Anterior deep overbite
5. Irregularly placed upper and lower anteriors
6. Inadequate space for eruption of unerupted canines
7. Poor-to-fair oral hygiene.

**Aims and objectives of the treatment**

1. Correction of skeletal Class II jaw base relation
2. Improvement of facial profile
3. Correction of deep anterior bite
4. Correction of crowding of upper and lower anteriors
5. Create space to allow eruption of canines
6. Achieve Class I molar and Class I incisor relationship.
7. Retain corrected result
8. Oral prophylaxis and instructions for oral hygiene maintenance.

**Treatment plan**

**Appliance**

- Functional appliance to correct A-P skeletal discrepancy
- Upper and lower metal preadjusted edgewise fixed appliances (0.018” × 0.025” slot) with MBT prescription.

**Table 1: Pretreatment cephalometric analysis**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA</td>
<td>81</td>
</tr>
<tr>
<td>SNB</td>
<td>72</td>
</tr>
<tr>
<td>ANB</td>
<td>9</td>
</tr>
<tr>
<td>Wit’s appraisal (mm)</td>
<td>5</td>
</tr>
<tr>
<td>FMA</td>
<td>25</td>
</tr>
<tr>
<td>GoGn-Sn</td>
<td>29</td>
</tr>
<tr>
<td>Max-Mn plane angle</td>
<td>24</td>
</tr>
<tr>
<td>Upper anterior face height (mm)</td>
<td>38</td>
</tr>
<tr>
<td>Lower anterior face height (mm)</td>
<td>38</td>
</tr>
<tr>
<td>Face height ratio (%)</td>
<td>50</td>
</tr>
<tr>
<td>U1-NA (°)</td>
<td>10</td>
</tr>
<tr>
<td>U1-NA (mm)</td>
<td>10</td>
</tr>
<tr>
<td>U1-SN (°)</td>
<td>93</td>
</tr>
<tr>
<td>L1-NB (°)</td>
<td>20</td>
</tr>
<tr>
<td>L1-NB (mm)</td>
<td>3</td>
</tr>
<tr>
<td>L1-Apog (mm)</td>
<td>-1</td>
</tr>
<tr>
<td>IMPA</td>
<td>92</td>
</tr>
<tr>
<td>Interincisal angle</td>
<td>15</td>
</tr>
<tr>
<td>Soft tissue</td>
<td></td>
</tr>
<tr>
<td>Rickett’s E-line (mm)</td>
<td>3</td>
</tr>
<tr>
<td>Nasolabial angle</td>
<td>98</td>
</tr>
</tbody>
</table>

**Table 2: Key stages in treatment progress**

<table>
<thead>
<tr>
<th>Date</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 28, 2015</td>
<td>Pretreatment records, diagnosis and treatment planning, case discussion and oral prophylaxis</td>
</tr>
<tr>
<td>October 4, 2015</td>
<td>Removable twin block delivered. Z springs placed to correct the position of central incisors</td>
</tr>
<tr>
<td>February 27, 2016</td>
<td>Reported after 5 months. Upper central incisors bonded, molars banded. Protractive utility arch placed with 0.017×0.025 TMA</td>
</tr>
<tr>
<td>April 18, 2016</td>
<td>Upper laterals and premolars bonded. 0.014 NiTi placed. Lower arch bonded. 0.014 NiTi placed</td>
</tr>
<tr>
<td>May 16, 2016</td>
<td>Lower 0.016 Aust. SS wire with open coil-spring to open space for left canine</td>
</tr>
<tr>
<td>July 17, 2016</td>
<td>Upper and lower canines bonded</td>
</tr>
<tr>
<td>October 22, 2016</td>
<td>U/L-0.016×0.022 NiTi wire placed</td>
</tr>
<tr>
<td>November 18, 2016</td>
<td>Mid-treatment records taken. Fixed functional appliance (AdvanSync2) placed. Activation of approximately 4 mm done from upper distal to lower mesial casing [Figure 5]</td>
</tr>
<tr>
<td>January 4, 2017</td>
<td>Reactivation of the appliance done. Upper distal to lower distal casing. 0.016×0.022 SS placed in upper and lower arches. [Figure 6]</td>
</tr>
<tr>
<td>February 22, 2017</td>
<td>1 mm spacers placed on both the sides to enable the patient to close in normal overjet and overbite</td>
</tr>
<tr>
<td>July 15, 2017</td>
<td>AdvanSync2 removed. Second molars bonded. 0.016 NiTi placed</td>
</tr>
<tr>
<td>August 8, 2017</td>
<td>0.016×0.022 NiTi placed in upper and lower arches</td>
</tr>
<tr>
<td>September 4, 2017</td>
<td>0.017×0.025 SS placed in upper and lower arches</td>
</tr>
<tr>
<td>September 29, 2017</td>
<td>Bonded retainers given</td>
</tr>
<tr>
<td></td>
<td>Wire sectioned distal to canines and settling elastics started</td>
</tr>
<tr>
<td>October 10, 2017</td>
<td>Debonding of brackets done. Upper removable retainer delivered on the same day. Posttreatment records taken</td>
</tr>
</tbody>
</table>
Additional dental treatment
• Oral prophylaxis and maintenance.

Steps in treatment
1. Leveling and alignment of upper arch and deep bite correction
2. Leveling and alignment of lower arch, create space for the left canine to erupt
3. Correction of skeletal Class II jaw base relation using functional appliance
4. Leveling and alignment of second molars when they erupt adequately
5. Finishing and detailing
6. Retention of corrected result.

Proposed retention strategy
1. Upper arch-bonded retainer (lateral incisor to lateral incisor)
2. Lower arch-bonded retainer (canine to canine).

The reason for placing bonded retainers in upper and lower arches is due to the presence of moderate crowding and rotations in upper and lower arches, respectively.

An anterior inclined plane was incorporated in the upper thermoplastic retainer. Patient was instructed to wear it day and night for at least a year followed by night time wear. Following this, a reduced regimen will be recommended on a long-term basis.

Prognosis for stability
Provided that the teeth were effectively decrowded, derotated, properly torqued, good occlusal interdigitation was achieved, and general arch form was maintained, the long-term stability of treatment changes will be good. Skeletal basal relation was more conducive for harmonious growth of maxillo–mandibular complex.

To maximize stability of corrected crowding, rotations and tipping upper and lower bonded retainers were considered appropriate. A-P correction was retained by giving anterior inclined plane in the upper Essix retainer.

Section 2: Treatment
Treatment progress [Table 2]
• Start of active treatment: September 2015
• Age at start of active treatment: 13 years 6 months
• End of active treatment: October 2017
• Age at the end of active treatment: 15 years 7 months
• End of retention: Ongoing
• Total active treatment: 25 months.

Section 3: Posttreatment Assessment
Post-Treatment photographs are shown in Figures 8 and 9. Post-Treatment study models in Figure 10.

Occlusal features [Table 3]
• Incisor relationship: Class I
• Overjet (mm): 2 mm
• Overbite: 3 mm
• Centrelines: Coincident with each other and facial midline
• Left buccal segment relationship: Molars: Class I
• Canines: Class I
• Right buccal segment relationship: Molars: Class I
• Canines: Class I
• Crossbites: None
• Displacements: None
• Functional occlusal features: Mutually protected occlusion
• Canine guidance on left and right lateral excursions with no working or nonworking side interferences

<table>
<thead>
<tr>
<th>Table 3: Occlusal indices</th>
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<tbody>
<tr>
<td>Index</td>
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<td>IOTN</td>
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<tr>
<td>Dental health component</td>
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<td></td>
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<tr>
<td>Esthetic component</td>
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<tr>
<td>IOTN: Index of treatment need</td>
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</tbody>
</table>

Figure 5: Placement of AdvanSync2 (upper distal and lower mesial casing)

Figure 6: Reactivation of AdvanSync2 (Upper distal and lower distal casing)
• Anterior guidance on protrusion with posterior disclusion
• Other occlusal features: None.

Complications encountered during the treatment
Oral hygiene maintenance was compromised and the patient had to be motivated continuously. Fluoridated mouthwash and toothpaste were prescribed.

Breakages of brackets of lower right and left premolars caused problems. Decementation of the appliance delayed the treatment progress.

Radiographs taken toward the end of treatment
• Radiographs taken: Lateral cephalogram and orthopantomogram [Figure 7]
• Date: October 10, 2017
• Relevant findings
  • No obvious pathology
  • No change in root length of upper incisors.

Interpretation of cephalometric changes
Skeletal
There was favorable A-P change which was evident from reduction of ANB angle from 9° to 5° and improvement in Wit’s appraisal from 5 to 2 mm. This was possible as the patient was still growing. Correction of inclination of upper central and lateral incisors also attributed to favorable mandibular growth. Mandibular growth was enhanced by the use of fixed functional appliance. These two factors contributed to skeletal Class II correction by improving SNB and thus reducing the ANB angle. The vertical component was improved. This is also depicted by face-height ratio which slightly increased.

<table>
<thead>
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</tr>
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<tr>
<td>Lower anterior face height (mm)</td>
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<tr>
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<tr>
<td>U1-NA (°)</td>
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<td>21</td>
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<tr>
<td>U1-NA (mm)</td>
<td>−4</td>
<td>3</td>
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<tr>
<td>U1-SN (°)</td>
<td>93</td>
<td>101</td>
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<td>Interincisal angle</td>
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<td>4</td>
</tr>
<tr>
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<td>98</td>
<td>101</td>
</tr>
</tbody>
</table>
Dental
The inclination of upper incisors improved which was
depicted by two readings (U1-NA changed by 11° from 10°
to 21° and U1-SN also changed by 8° (from 93° to 101°)).
The angulation and position of lower incisors almost
remained constant in reference to N-B line.

As a result of these changes, the interincisal angle
improved from 151° to 126°.

Soft tissue
Nasolabial angle was within the normal range. The
balance of soft tissues improved considerably. Lower lip
position is forward in relation to Rickett’s E-line, due to
everted and increased thickness [Table 4].

Section 4: Rationale for Treatment
The cephalometric changes can be noted by the
individual and overall superimpositions [Figure 11].

Rationale for treatment
Treatment justification
An IOTN score of 4f on the dental health component
and 6 on the esthetic component suggested a “great”
need for treatment. K. N demonstrated a high level of
perceived need for treatment and notably complained of
irregular upper front teeth. Due to crowding, oral hygiene
maintenance was difficult apart from an unaesthetic smile.

Orthodontic treatment mechanics
Functional appliance
AdvanSync2 molar-to-molar Class II corrector was given.
Justification for the use of fixed functional appliance
AdvanSync2 molar-to-molar Class II corrector was used
to achieve skeletal correction. AdvanSync2 is a less
bulky modified banded Herbst-like appliance with a
short telescope [Figure 5].

Figure 11: Superimposition of pre- and post-treatment lateral
cephalograms. (a) Maxillary changes, (b) mandibular changes, (c) overall
skeletal and dental changes

The advantages are as follows:
1. Noncompliant Class II corrector
2. Achieve Class II correction in Class I time
3. Allows freedom of mechanics mesial to molar
4. Ease of activation [Figure 6]
5. Gradual activation allows more of skeletal change
and less dental effect (proclination of lower
anteriors).

Bracket prescription
The MBT bracket prescription (0.018 × 0.025), with
increased labial root torque in the lower labial segment,
helped maintain lower incisor inclination. Increased
lingual root torque in upper anterior brackets helped in
achieving proper torque in the upper anterior region.

Critical appraisal
K. N was successfully treated by orthodontic treatment over
25 months. The original treatment aims were accomplished
and the patient’s chief complaint was addressed. K. N.
was notably pleased with the treatment outcome. A good
occlusal and esthetic result was achieved and this was
reflected in the IOTN score and esthetic component.

Records
Pretreatment records (photographs and study models)
should have been better.

Skeletal
As the patient was within the growth potential
(cervical vertebral maturational index and secondary
sexual features), skeletal changes were expected.
Improvement in the convex profile is observed. There
has been a notable improvement in ANB angle by 4°
and Wit’s by 3 mm, respectively.

Dental
Marginal ridge relation of first and second molars on
the lower right and upper left should have been better
[Figures 9 and 10]. Good intercuspation is achieved in
the buccal segment. However, still better vertical settling
is desired on the left side. Occlusal settling of upper left
second premolar needs to be better.

Radiographically, the roots of lower laterals and right canine
should have been divergent. The root of upper left second
premolar should have been parallel to the adjacent teeth.

Soft tissue
Facial profile was improved and well balanced at the
end of the treatment [Figure 8]. Reduction in depth of
mentolabial sulcus is seen.

Iatrogenic
Clinically, no areas of decalcification were noticed on
any of the teeth surface.

Radiographically, no root resorption was observed.
CONCLUSION
Considering the severity of the case to begin with, desired result was attained. Harmonious skeletal, dental, and soft-tissue balance was achieved.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal and for the extraoral picture to be published on the cover page.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.