NON-SURGICAL TREATMENT OF MUTILATED SEVERE SKELETAL CLASS II MALOCCLUSION WITH HYPERDIVERGENT GROWTH PATTERN - A CASE REPORT

Authors:
Dr. Seema Gupta, MDS
Assistant Professor, Department of Orthodontics, Manipal College of Dental Sciences, Manipal, Karnataka, India

Dr. Surendra Shetty, BDS, MDS
Professor and Dean, Department of Orthodontics, Manipal College of Dental Sciences, Mangalore, Karnataka, India.

Dr. Subraya Mogra, BDS, MDS
Professor and Head, Department of Orthodontics, Manipal College of Dental Sciences, Mangalore, Karnataka, India

Dr. Sandeep Kumar, MDS
Assistant Professor, Department of Prosthodontics and Maxillofacial Prosthetics, Manipal College of Dental Sciences, Manipal, Karnataka, India

Abstract
Malocclusion, with a superimposed vertical growth tendency, is often difficult to treat without a combined surgical orthodontic approach. Certain situations, however, may preclude surgery as a treatment option. The following case report demonstrates the use of orthodontic mechano-therapy alone in successfully treating a patient that exhibited a mutilated Angle's Class II Division 1 malocclusion, complicated by missing teeth, mandibular shift, anterior open bite, and a dolicofacial skeletal pattern.

Key Words
Skeletal Class II, Hyper divergence, Mutilated dentition, Mandibular Shift, Anterior open bite.

Introduction:
In the literature, 2 distinct types, or extremes, of facial form have been characterized: the skeletal deepbite and the skeletal open bite. Schudy¹ used the terms hypodivergent and hyperdivergent, respectively, to describe these facial patterns, the latter of which has also been referred to as long face syndrome. The cause of these skeletal discrepancies is usually related to positional and/or size variations of the maxilla, the mandible, and/or the cranial base.

The diagnosis and orthodontic correction of Class II, Division 1 malocclusions in patients with a dolicofacial skeletal pattern can prove to be very challenging for the clinical practitioner².³. The tendency for mandibular growth in an unfavorable direction and rotation of the mandible downward and backward in response to orthodontic forces of inappropriate magnitude or direction must be minimized. Treatment can be rendered even more difficult in patients with a mutilated dentition⁷,⁸ if teeth normally used for anchorage are missing. This type of malocclusion often exhibits teeth that are severely tipped or overerupted and can present space management problems that complicate treatment. This case report describes the treatment of a patient for whom an individualized treatment plan was of paramount importance because of the unique features of the malocclusion. These features included a dento-skeletal Class II Division 1 with a mutilated dentition, anterior open bite, increased overjet and mandibular shift with dolicofacial skeletal pattern.

History and etiology:
20 year old female came to the department with the chief complaint of forwardly placed upper teeth. She had an unremarkable medical history. Her dental history included presence of thumb-sucking habit till the age of 8 years, which was later stopped but replaced...
by simple anterior tongue thrust due to the presence of anterior open bite. She had undergone previous extraction of both mandibular first molars and the maxillary left first premolar as a result of caries, and poor oral hygiene—all with a history of infrequent dental check-up visits. No signs or symptoms of temporomandibular dysfunction were noted. The skeletal and dental disharmonies were believed to be hereditary in nature, but complicated by the environmental factors of active thumb sucking, tongue thrusting and poor oral hygiene, which resulted in the loss of permanent teeth.

Examination:
Extraoral examination (Fig 1) revealed a dolichocephalic head type, leptoprosopic face type with an oval facial form. The face was asymmetrical with mandible deviated towards right on closure due to functional interference in left side upper canine-lower first premolar region. The profile was convex with steep mandibular plane. The lips were incompetent and upper lip was short. Lower lip was everted & hypertrophied. Nasolabial angle was right angled with hyperactive mentalis muscle activity.

Intraoral examination (Fig 2) and study models (Fig 3) revealed Class I canine relationship on left side & Class II on right side. Both lower second molars were mesially & lingually tipped. Alveolar Ridges in the region of lower first molars were resorbed, particularly one on lower right side. There was incomplete overbite of 3mm with increased overjet of 8mm. The upper midline was coinciding with the facial midline but lower midline was shifted to right by 4mm due to functional shift of mandible. The upper arch was ‘V’ shaped with spacing of 6mm in the region of extracted left first premolar area and in lower arch; there was spacing of 16.5mm in the region of extracted first molars. The upper left first molar was extruded into lower first molar extraction space.

Panoramic radiographic examination (Fig. 4) revealed the missing teeth, and the mesial inclination of the mandibular second molars. Upper third molars were mesioangularly impacted. There was reduced bone height in the lower right extraction space.

Pre-treatment cephalogram (Fig 4) and analysis (Fig 5 and Table) indicated a Class II skeletal relationship (ANB 6°). Bimaxillary dental protrusion was noted with mandibular incisor to NB plane (30° and 10mm) and to A-Pog (6mm), an interincisal angle of 97°, maxillary incisor to NA plane (41° and 10mm) and to A-Pog 15mm. The upper and lower lip to esthetic plane was measured as 5 mm and 9 mm, respectively. The mandibular plane angle was high (FMA, 42°; Sn-GoGn, 50°).

Diagnosis:
Patient was diagnosed as skeletal Class II and Dental Class II Div 1 subdivision with hyperdivergent growth pattern.

Diagnostic problem list summary:
1. Class II skeletal and dental
2. Skeletal/dental anterior open bite and increased overjet.
3. Mandibular deviation to the right due to functional interference in left upper canine-lower premolar region.
4. Mutilated occlusion
5. Bimaxillary protrusion
6. Severe lip incompetence
7. Constricted maxillary arch
8. Advanced gingivitis with poor home care
9. Active tongue thrusting habit

Treatment plan:
The first objective was to improve the patient’s home care. She was referred to a general dentist for a complete periodontal/restorative evaluation and scheduled prophylaxis every 2 months until her gingivitis was resolved and her home care improved. The diagnostic records were then reviewed with an oral surgeon and a treatment plan proposed to use orthodontic treatment in conjunction with orthognathic surgery to alleviate the dental discrepancies and to correct the skeletal component. But patient refused for any surgical procedure and requested nonsurgical therapy. The limitations of a purely orthodontic approach were thoroughly reviewed with the patient and a secondary nonsurgical treatment was proposed. In general, it was designed to give the patient an improved facial appearance by reducing the bimaxillary protrusion, reducing lip incompetence.

The orthodontic treatment plan:
1. The extraction of the maxillary right first premolar and to use that space along with space of already extracted upper left first premolar for maxillary incisor retraction and anterior crowding elimination.
2. A fixed habit appliance along with tongue exercises to break the tongue thrusting habit.
3. Preadjusted appliances (0.022 inch Roth prescription) to improve arch alignment, overjet and overbite.

4. To upright the mesially tipped lower second molars and prosthetic replacement of lower first molars with three-unit bridge as alveolar ridges were resorbed and unsuitable for mesial movement of second molars.

5. To intrude the extruded upper left first molar.

6. To level and align both the arches, remove the functional interferences and thus treat centric occlusion and centric relation to coincidence.

The prognosis for achieving these objectives was fair to poor, considering the skeletal disharmony.

Treatment progress:
Fixed orthodontic treatment was started after thorough evaluation of patient oral hygiene and home care education. During the preorthodontic period, the patient underwent extraction of the maxillary right first premolar and upper third molars which were mesioangularly impacted, subgingival scaling, and home care education. The 0.022-inch straight wire preadjusted appliances was used in both the arches along with fixed maxillary habit appliance which was removed after 4 months as patient broke her tongue thrusting habit immediately on appliance placement. She was then given upper transpalatal arch with acrylic button kept 4 mm away from palate for first molar intrusion (Fig 6). Marked improvement in molar position was seen after 2 months. Initial arch wires were 0.014-inch nickel titanium for correction of rotations and initiation of leveling (Fig 7). There was improvement in mandibular shift after removal of occlusal interferences by arch alignment. After 6 months of treatment, upper canine retraction was started using sliding mechanics on maxillary 0.018-inch stainless steel wire. Meantime lower arch was leveled completely including uprighting of lower second molars and 0.019 x 0.025-inch stainless steel arch wire with closed coil spring in first molar extraction space was placed. After 11 months of treatment, upper arch wire was changed to 0.019 x 0.025 inch stainless steel wires with boot loop distal to lateral incisors to retract upper incisors (Fig 8). Loop mechanics were continued on rectangular arch wires in conjunction with vertical and long-term Class II elastics to idealize the occlusion. The lateral cephalogram taken before debonding showed good torque control of the incisors and the panoramic radiograph (Fig. 9) showed good root parallelism with minimal root resorption. Appliances were then removed after 18 months of treatment.

Retention:
A maxillary removable wraparound retainer was used to maintain space closure and reduce occlusal interferences in settling. A mandibular removable Hawley’s retainer with artificial first molar teeth was used for maintenance of extraction space till she was scheduled for fixed prosthesis.

Results achieved:
Active treatment produced an excellent correction of the initial problems. Facially, the upper incisor protrusion was reduced and a more favorable incisor to lip position was established at rest and on smiling (Fig 10). Dentally the patient’s home care improved tremendously. The incomplete overbite was eliminated, and complete space closure in the upper arch helped in achieving Class I canine relationship and normal overjet and overbite (Fig 11, 12). The post treatment cephalometric tracing (Fig 13; Table) showed reduction in FMA angle by 1°, the maxillary incisors were notably retracted (upper incisor to NA angle, 20°; maxillary incisor to NA distance, 5 mm). The mandibular incisors were uprighted and retracted (IMPA, 87°; mandibular incisor to NB distance, 7 mm; mandibular incisor to NB angle, 27°). The lips were competent in repose (upper lip to E-plane, -1 mm; lower lip to E-plane, +1 mm). The interincisal angle was improved to within the normal range (128°). The ANB angle decreased during treatment from 6° to 4°. Superimposition (Fig 14) showed significant retraction of the maxillary incisors, slight reduction in the mandibular plane angle and LAFH, and soft tissue improvements. Superimposition of pre and post treatment postero-anterior cephalograms shows correction of mandibular shift (Fig 15).

Discussion:
Malocclusions involving anterior open bite and overjet can, of course, occur in patients with low, normal, or high mandibular plane angles. Much has been written in the orthodontic and surgical literature about the diagnosis and treatment of skeletal open bites related to the “long-face syndrome” patient, with a dolichocephalic facial form, a high mandibular plane angle, a hyperdivergent or vertical growth pattern, clockwise rotation of the mandible, weak musculature, and an anterior open bite developing without interceptive and comprehensive treatment, or in spite of it. But a patient with mutilated dentition, severe vertical growth pattern, anterior open bite, anterior tongue thrust and mandibular shift is not much discussed in the literature. Although a surgical treatment option would have been best to correct her skeletal
discrepancy but both the patient and her parents preferred a nonsurgical approach. Therefore, it was decided to correct her problem within the limitations of orthodontic treatment alone. Whenever, treatment involving extraction and retraction of teeth is done in such patients, there is tendency for FMA angle to open up further. It is very difficult to maintain or reduce the FMA angle in such patients. In the present case, however FMA angle was reduced by 0.5°. In 1988, Gramling started working on what he called the Probability Index. Gramling’s clinical research determined that patients who had a high FMA, if they also had a retruded mandible and a high occlusal plane, were predisposed to treatment failure when conventional orthodontic treatment was undertaken. In 1989, Merrifield and Gebeck completed a study of successful and unsuccessful Class II correction. They found that in the successfully treated sample, the posterior facial height increased more than the anterior facial height. In other words, the FMA remained the same or closed during treatment. In the unsuccessfully treated sample, vertical dimension control was lost and anterior facial height increased more than posterior facial height.

Overall, the service provided to this patient, although not conventional, has produced a significantly improved facial appearance, a vastly improved occlusion and increased self-esteem. Both the upper first molars were intruded with the help of transpalatal arch having acrylic button placed away from palate. Upper incisor retraction was efficiently carried out with intrusion of the upper molars. In the process, FMA closed by 1° and SNA angle decreased by 1°, SNB increased by 1°, reducing ANB to 4°. The patient was satisfied with the treatment outcome. Follow up of the patient however, was not possible because contact with the patient was lost due to change of her residential place.

**Conclusion:**

This case report illustrated the treatment of the patient who had skeletal pattern characterized by excessive anterior facial height. The treatment of patient who has this skeletal pattern must be carefully planned before orthodontic mechanotherapy is initiated. The force systems used for the patient who has excessive anterior facial height are equally as important as the diagnosis. The forces used must control vertical extrusion. Loss of control can lead to poor esthetic results. Although most of these patients could best be treated with a combination of orthodontics and surgery, the “orthodontics only” approach must remain a viable option. Clinical orthodontists must have the knowledge and skill to effect a nonsurgical correction for patients with excess vertical dimension, because, like all orthodontic patients, these desire a result that is esthetic, healthy, functional, and stable.

**References:**


Legends:
Fig 1: Pretreatment extraoral photographs
Fig 2: Pretreatment intraoral photographs
Fig 3: Pretreatment photos of the study models
Fig 4: Pretreatment radiographs
Fig 5: Pretreatment cephalometric tracing
Fig 6: Transpalatal arch with acrylic button placed 4mm from the palate
Fig 7: Initial leveling 0.014inch nickel titanium arch wires
Fig 8: Upper incisor retraction on 0.019 x 0.025 inch stainless steel boot loop arch wire
Fig 9: OPG and lateral cephalogram before debonding
Fig 10: Posttreatment extaroral photographs
Fig 11: Posttreatment intraoral photographs
Fig 12: Posttreatment photos of study models
Fig 13: Posttreatment cephalometric tracing
Fig 14: Pre-treatment (black) and post-treatment (red) cephalometric tracings, superimposed on: (a) sella-nasion plane at sella; (b) palatal plane at ANS; (c) mandibular plane at menton
Fig 15: Superimposition of Pre (solid line) and post (dotted line) treatment antero-posterior cephalograms.

Table: Cephalometric analysis

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Normal</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
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<tbody>
<tr>
<td>SNA (°)</td>
<td>82 ± 2</td>
<td>81</td>
<td>80</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>80 ± 2</td>
<td>75 76</td>
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<tr>
<td>ANB (°)</td>
<td>2</td>
<td>6</td>
<td>4</td>
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<tr>
<td>Cant of occlusion (°)</td>
<td>9</td>
<td>Upper-11</td>
<td>16</td>
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<tr>
<td>FMA (°)</td>
<td>25</td>
<td>42</td>
<td>41</td>
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<tr>
<td>SN-GoGn (°)</td>
<td>32</td>
<td>50</td>
<td>49</td>
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<tr>
<td>Gonial angle (°)</td>
<td>128</td>
<td>143</td>
<td>141</td>
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<tr>
<td>IMPA (°)</td>
<td>90</td>
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<td>87</td>
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<tr>
<td>Interincisal angle (°)</td>
<td>132</td>
<td>97</td>
<td>128</td>
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<tr>
<td>LAFH (mm)</td>
<td>67.2 ± 4.7</td>
<td>76</td>
<td>74</td>
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<td>UI-NA (°)</td>
<td>22</td>
<td>41</td>
<td>20</td>
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<tr>
<td>UI-NA (mm)</td>
<td>4</td>
<td>10</td>
<td>5</td>
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<tr>
<td>UI- APog (mm)</td>
<td>-1 to +5</td>
<td>15</td>
<td>8</td>
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<tr>
<td>LI-NB (°)</td>
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<td>30</td>
<td>27</td>
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<tr>
<td>LI-NB (mm)</td>
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<td>7</td>
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<tr>
<td>LI- APog (mm)</td>
<td>1.2 ± 1.4</td>
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<tr>
<td>E line- U (mm)</td>
<td>-4</td>
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<td>-1</td>
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<tr>
<td>E line- L (mm)</td>
<td>-2</td>
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<td>+1</td>
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