Case Report

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Dentistry Section

En-masse Distalisation of Mandibular Dentition with Ramal Miniplate for Correction of Class III Malocclusion: A Case Report

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ABSTRACT

Mandibular arch distalisation is a non extraction camouflage treatment modality for class III malocclusion, and the introduction of skeletal anchorage devices has enabled its use with minimal patient compliance and reciprocal side effects. The aim of the present case report was to show the efficacy of the retromolar fossa as a suitable skeletal anchorage site for mandibular dentition distalisation. Inter-radicular mini screws are the most commonly used forms of skeletal anchorage; however, they are often problematic in the mandible because of their high failure rate in the posterior region. In order to avoid these issues, some clinicians place mini screws extraradicularly in the buccal shelf area or in the retromolar area. This approach is demonstrated through a case report of an 18-years-old male patient with a chief complaint of extra teeth and spacing in the upper front teeth. The diagnosis formulated was a Class III skeletal pattern, anterior divergence, Angle's Class III malocclusion with an edge-to-edge bite and presence of mesiodens in the premaxillary region. The treatment approach was to use skeletal anchorage to distalise the mandibular arch with ramal plates after extraction of the mandibular third molars, since the patient refused the surgical treatment. At one year follow-up appointment, there was no noticeable relapse or signs or symptoms of adverse effects like gingival recession, mobility and bone loss.

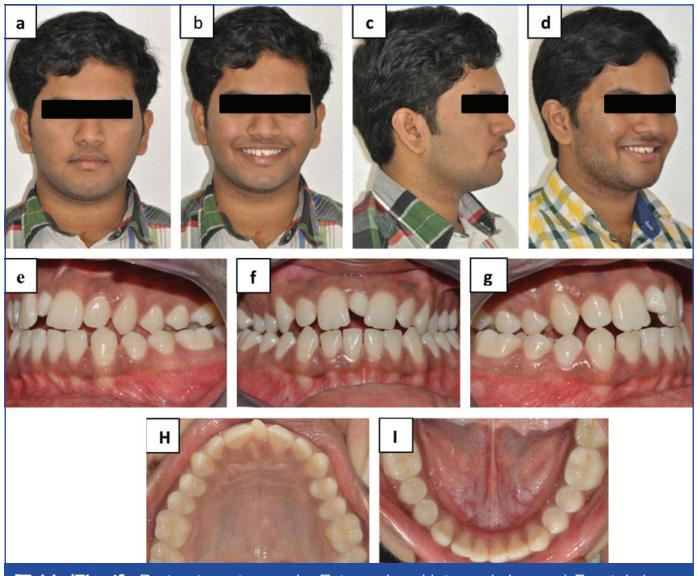
Keywords: Mandibular ramus, Miniplates, Skeletal anchorage

CASE REPORT

A 18-year-old male patient reported to the Department of Orthodontics, with the chief complaint of extra teeth in the upper front region since childhood. The patient gave no significant medical history, genetic predilection or syndromes.

Extraoral examination showed a straight profile, anterior divergence and competent lips at rest. Intraorally patient had an edge to edge incisor bite, presence of mesiodens between upper central incisors and a bilateral Angle's class III molar relation [Table/Fig-1].

The cephalometric analysis indicated a Class III skeletal base due to mandibular prognathism with horizontal growth pattern [Table/Fig-2]. Orthopantomogram (OPG) revealed the presence of two mesiodens in the premaxillary region [Table/Fig-2].



[Table/Fig-1]: Pretreatment records: Extraoral and intraoral views: a) Frontal view; b) Frontal smile view; c) Lateral view; d) Oblique view; e) Left lateral view; f) Frontal view; g) Right lateral view; h) Upper occlusal view; i) Lower occlusal view.

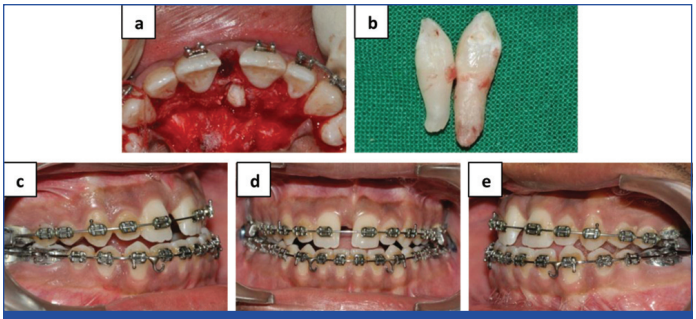
[Table/Fig-2]: Pretreatment radiographs: Lateral cephalograph and OPG.

The diagnosis formulated was that the patient presented with a straight profile, anterior divergence, with Class III skeletal pattern, with horizontal growth pattern, Angle's Class III malocclusion with an edge-to-edge bite and presence of mesiodens in the premaxillary region.

The following treatment objectives were established: (1) correct the jaw discrepancies of the maxilla, (2) establish correct overbite and overjet, (3) establish a stable Class I molar and canine relationship, and (4) and improve facial and dental aesthetics.

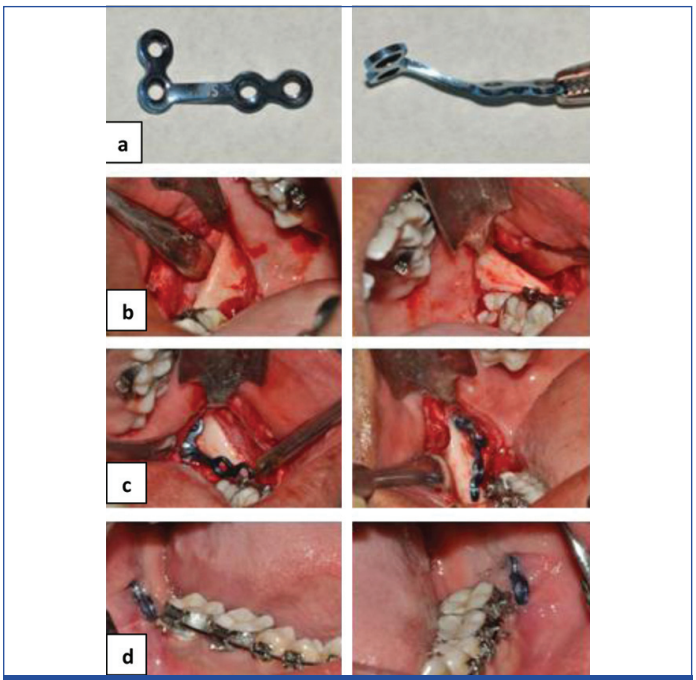
The ideal treatment plan required is performing bi-jaw surgery to correct the patient's skeletal discrepancies. Since, the patient was apprehensive about surgery, the alternative treatment approach was to use skeletal anchorage to distalise the mandibular arch with ramal plates after extraction of the mandibular third molars. The patient agreed to the alternate treatment plan proposed.

It was decided to maintain the mesiodens in the anterior maxillary region till stiffer wires were reached, to reduce the chances of arch collapse. The patient was bonded with 0.022"×0.028" preadjusted edgewise fixed orthodontic appliance on the maxillary and mandibular dentition with an initial wire of 0.016" nickel-titanium. The initial leveling and aligning was achieved with 0.016" NiTi, 0.016×0.022" NiTi, 0.017×0.025" Stainless Steel (SS) followed by 0.019×0.025" SS in nine months. The mesiodens were then extracted at this stage to aid in the closure of midline diastema with en-masse maxillary arch mesialisation towards the midline [Table/Fig-3]. The diastema was closed with the help of full arch e-chain and Class III interarch elastics.

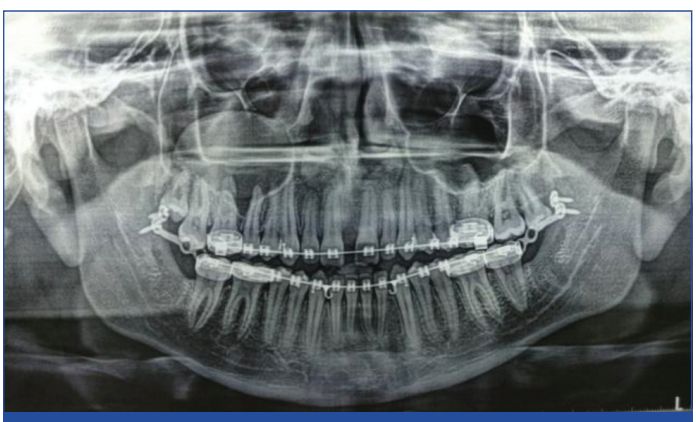


[Table/Fig-3]: a,b) Mesiodense removal; c-e) Closure of diastema using MBT.

Patient was then prepared for the miniplate placement for mandibular distalisation [Table/Fig-4,5]. A full-thickness flap was reflected in the retromolar area, the L-plate (SK Surgicals, India; length of the short arm, 10 mm; length of the long arm, 15.5 mm; diameter, 2.5 mm) was modified to fit the bone surface. The mandibular third molars were extracted during the procedure. The anterior head of the plate was extended into the oral cavity and positioned horizontally to lie 3 mm lateral to the buccal surface of the second molar, and between the buccal groove of the second molar and its distal surface, anteroposteriorly. The plates were fixed with the help of two mini screws (2 mm in diameter, 5 mm in length). The flap was sutured back over the plate. Patient was prescribed analgesics for a period of three days after the procedure to alleviate the postoperative pain. An elastic chain was engaged to the extended head of the plate to the soldered hooks on the mandibular archwire.



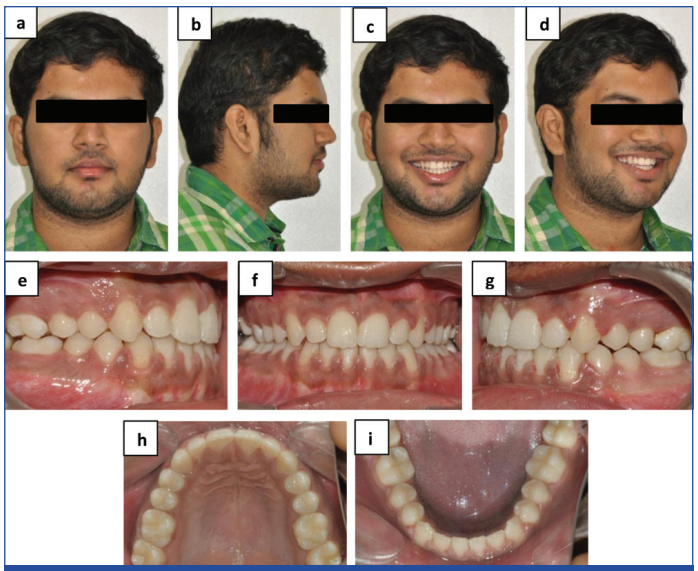
[Table/Fig-4]: Placement procedure: a): Plate selection and recontouring; b): Incision, flap reflection showing retromolar fossa; c): Plate fixation; d): After placement of the ramal plate.



[Table/Fig-5]: Post miniplate insertion radiographs.

Distalisation was continued for six months. Panoramic images were taken prior to and after distalisation showing the amount of molar distalisation. The appliances were removed 27 months after the initial bracket placement. Maxillary and mandibular fixed retainers were bonded from canine to canine and Begg's removable retainers were given. An Angle's Class I molar and canine relationship was established. Normal overbite and overjet was achieved. The maxillary third molars were advised for extraction.

Post-treatment records showed a pleasing straight profile with stable class I occlusion achieved with the help of conservative treatment approach with significant improvement of the soft tissue profile and lip protrusion. A positive overjet and overbite were also achieved. The lower incisor were retroclined slightly at the end of the treatment [Table/Fig-6,7]. Comparison between cephalometric values is given in [Table/Fig-8]. The cephalometric superimposition shows there was significant mandibular molar distalisation achieved, with slight opening of the mandibular plane [Table/Fig-9]. At one year follow-up appointment, there was no noticeable relapse or signs of any adverse effects like teeth mobility, gingival recession or bone loss.



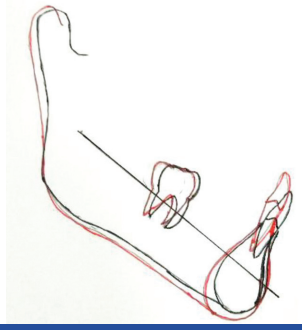
[Table/Fig-6]: Post-treatment records: Extraoral and intraoral views: a) Frontal view; b) Frontal smile view; c) Lateral view; d) Oblique view; e) Left lateral view; f) Frontal view; g) Right lateral view; h) Upper occlusal view; i) Lower occlusal view.

[Table/Fig-7]: Post-treatment radiographs (27 months from start of treatment): Lateral cephalograph and OPG.

Parameters	Ideal	Pretreatment	Post-treatment
Horizontal skeletal pattern			
SNA	82°	85°	86°
SNB	80°	87°	85°
ANB	2°	-2°	1°
Point A perpendicular to N (mm)	0 to 1 mm	-4 mm	1 mm
Point POG perpendicular to N (mm)	0 to -4 mm	0 mm	4 mm
Vertical skeletal pattern			
SN to Go-Gn	32°	27°	30°
Dental analysis			
U1 to SN	102°	113°	114°

IMPA	90°	86°	88°
Soft tissue analysis			
S line to UL	-2 mm	-3 mm	1.5 mm
S line to LL	0 mm	-4 mm	2 mm

[Table/Fig-8]: Cephalometric analysis.



[Table/Fig-9]: Cephalometric superimposition shows there was significant mandibular molar distalisation.
Black: Pretreatment; Red: Post-treatment

DISCUSSION

Class III malocclusion has been demonstrated within the interval of 0-26.7% of the general population with three times more prevalence in Asians [1]. Though easy to detect, it is one of the most difficult malocclusions to treat. The aetiology of a skeletal class III malocclusion is given in [Table/Fig-10].

Cause for class III malocclusion	Percentage
Maxillary skeletal retrusion	25%
Mandibular prognathism	20%
Combination	20%
Excessive lower anterior facial height	40%

[Table/Fig-10]: Aetiology of patients with class III malocclusion [1].

The 20th century has seen a shift in trend towards more conservative treatment approaches, due to increased cost, duration and patient apprehension towards elective surgical procedures under general anesthesia with the introduction of Temporary skeletal Anchorage Devices (TADs) [1].

Distalisation of the mandibular molars with TADs allows retraction of incisors to achieve a positive overjet. Literature evidence shows upto 4-5 mm of mandibular molar distalisation using mini screws in the retromolar area [2]. Other studies have reported successful mandibular dentition distalisation using TADs placed in the buccal shelf [3]. But anchorage obtained from a single screw, has some disadvantages like relatively early failure, and only limited movement is possible.

Sugawara J et al., introduced the concept of skeletal anchorage with the help of mini-plates, which are supported by 2 to 3 mini screws [4]. Miniplates could endure higher forces essential to distalise the whole dentition, unlike mini screws. They placed the miniplates on the mandibular body for mandibular distalisation.

Kook YA et al., reported the use of a ramal plate medial to the anterior border of the ramus as the force vector is more parallel to the functional occlusal plane [5]. Class III malocclusion presents with increased challenges during treatment planning. Recent introduction of TADs to cause distalisation of the mandibular molars have widened the envelope of nonsurgical treatment options [6]. With the application of interradicular mini screws, it was difficult to distalise more than 2 to 3 mm because of limited range of movement and required repositioning of mini screws [7]. However, with the introduction of ramal plates, the relocation of the mini screws during distalisation was no longer required. Several studies have reported lower failure rates for miniplates than for mini screws [8,9]. A systematic review showed that the failure rate of miniplates was 7.3%, whereas that of mini screws was 16.4% with a greater risk of failure when used in mandible [9]. The force with a mandibular ramal plate is directed parallel to the functional occlusal plane, the lateral force vector is minimal, therefore the rotation of the occlusal plane is minimal when compared to mini screws [10]. The height of the hook and the vector of force from the ramal plate can be adjusted to determine the overall control on the occlusal plane [11]. Also, mini screws placed in the buccal shelf may act to increase the intercanine width due to the lateral component of force and this can influence the stability after treatment completion. They may also cause occlusal plane rotation, increasing the vertical dimension based on the relationship between the force vector and the centre of resistance of the entire arch [12].

In the present case report, the successful application of a ramal plate for en-masse distalisation of mandibular dentition is demonstrated. When the hook of the plate was expose through the retromolar region, irritation is less than when it is through the vestibular mucosa, a movable tissue. Force was applied anteroposteriorly between the buccal groove of the second molar and its distal surface, allowing a longer range of action. Thus, during en masse distalisation using a ramal plate, the resultant vectors were produced by application of a force parallel to the functional occlusal plane which resulted in counter-clockwise rotation, as well as translation of the mandibular occlusal plane around a point apical to the centre of resistance of the entire mandibular dentition. This produces en-masse dental distalisation along with extrusion of the anterior teeth and intrusion of the posterior teeth.

Contrary to the reports of excessive distal tipping with mini screw, the distalisation with distal tipping ratio was minimum with the ramal plates [13].

Attention should be given to the mandibular anterior teeth during distalisation, and the status of the roots. The force vector passes above the centre of resistance of these anterior teeth and leads to counter-clockwise rotation with uncontrolled tipping. It can be counter acted by placing a third-order bend at the anterior section of the archwire. Mild interproximal reduction was undertaken in the lower anteriors to reduce the appearance of black triangles. At one year follow up appointment, there was no noticeable relapse or symptoms of adverse effects like tooth mobility, gingival recession and bone loss.

Though an efficient alternative to surgery, the procedure does have drawbacks. There might be anatomic limitation if retromolar foramen is located too close to the area of placement. As well as, the requirement of two flap procedures for insertion and removal is considered to be a major drawback, in contrast to mini screws.

The present case report showed the efficient use of ramal plates to extend the envelope of discrepancy and correct skeletal malocclusion in adult patient with a less invasive approach. With future readings in the field, the effects on the skeletal, dental, and soft tissue changes can be assessed more appropriately.

CONCLUSION(S)

Class III patients often go untreated because of the fear of an invasive surgery. With the advent of skeletal anchorage, ramal plates have become a viable treatment option for mandibular total arch distalisation in class III patients who are reluctant to have orthognathic surgery. The ramal plates placed in the retromolar fossa offer the advantage of the resultant force vectors to be parallel to the occlusal plane, leading to efficient molar distalisation and offers an anatomically suitable placement site for skeletal anchorage with minimal soft tissue irritation.

REFERENCES

[1] Zere E, Chaudhari PK, Sharan J, Dhingra K, Tiwari N. Developing class III malocclusions: Challenges and solutions. Clin Cosmet Investig Dent. 2018;10:99-116.

[2] Agarwal S, Shah N, Yadav S, Nanda R. Mandibular arch retraction with retromolar skeletal anchorage in a Class III open-bite patient. J Clin Orthod 2014;48(12):775-82.
[3] Jing Y, Han X, Guo Y, Li J, Bai D. Nonsurgical correction of a Class III malocclusion in an adult by miniscrew-assisted mandibular dentition distalization. Am J Orthod Dentofacial Orthop. 2013;143(6):877-87.
[4] Sugawara J, Daimaruya T, Umemori M, Nagasaka H, Takahashi I, Kawamura H, et al. Distal movement of mandibular molars in adult patients with the skeletal anchorage system. Am J Orthod Dentofacial Orthop. 2004;125(2):130-38.
[5] Kook YA, Park JH, Bayome M, Kim S, Han E, Kim CH. Distalization of the mandibular dentition with a ramal plate for skeletal Class III malocclusion correction. Am J Orthod Dentofacial Orthop. 2016;150(2):364-77.
[6] Park J, Cho HJ. Three-dimensional evaluation of interradicular spaces and cortical bone thickness for the placement and initial stability of microimplants in adults. Am J Orthod Dentofacial Orthop. 2009;136(3):314.e1-12.
[7] Yu J, Park JH, Bayome M, Kim S, Kook Y, Kim Y, et al. Treatment effects of mandibular total arch distalization using a ramal plate. Korean J Orthod. 2016;46(4):212-19.
[8] Yao CJ, Chang H, Chang JZ, Lai H, Lu S, Chen Y. Revisiting the stability of mini-implants used for orthodontic anchorage. J Formos Med Assoc. 2015;114(11):1122-28.
[9] Alharbi F, Almuzian M, Bearn D. Miniscrews failure rate in orthodontics: Systematic review and meta-analysis. Eur J Orthod. 2018;40(5):519-30.
[10] Ludwig B, Glasl B, Kinzinger GS, Lietz T, Lisson JA. Anatomical guidelines for miniscrew insertion: vestibular interradicular sites. J Clin Orthod. 2011;45(3):165-73.
[11] Shetty SK, Kumar YM, Vijeyan LG, Madhur VK. Advanced methods of total arch distalization in orthodontics: A literature review. International Journal of Science and Research (IJSR). 2019;8(3):714-17.
[12] Schatzle M, Mannchen R, Zwahlen M, Lang NP. Survival and failure rates of orthodontic temporary anchorage devices: A systematic review. Clin Oral Implants Res. 2009;20(12):1351-59.
[13] Lee YB, Park N, Kim J, Kim J, Kook S, Yoon-Ah. Comparison of treatment effects after total mandibular arch distalization with miniscrews vs ramal plates in patients with Class III malocclusion. Am J Orthod Dentofacial Orthop. 2021;161(4):529-36.

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