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Severe Bimaxillary Dento-Alveolar Proclination with Hyperdivergent Jaw Bases Treated with Temporary Anchorage Devices: A Case Report

Abstract: The article describes the orthodontic treatment of a 19-year-old female with severe bimaxillary dento-alveolar proclination and severely hyperdivergent jaw bases. Clinical and cephalometric analyses denoted it to be a critical anchorage case. Accordingly, with the aim of providing absolute anchorage, temporary anchorage devices (TADs) were placed in all four quadrants in the inter-radicular area of the second premolar and first molar, following extraction of all first premolars. Facial aesthetics improved considerably, fullness of the upper and lower lip reduced and incompetency of the lips was eliminated. The application of TADs not only reduced the antero-posterior discrepancy, but also addressed the vertical problem.

Clinical Relevance: The treatment of critical anchorage, hyperdivergent cases with conventional orthodontics has always remained a challenge, with a greater chance of an unsatisfactory treatment outcome. The use of TADs has changed the scenario with the concept of absolute anchorage coming closer to reality.

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Conservation of anchorage is a decisive constituent of *en masse* retraction.¹ Utmost importance is placed on Newton's third law – the law of action and reaction. Orthodontists are sentient of the fact that, for any force applied on the teeth, there will be an equal and opposite reaction.^{2–4} Poor patient compliance can only skew the 'vector equation' towards greater

anchorage loss and hence unsatisfactory treatment results; these factors have led to the greater exercise of intra-osseous anchorage.⁵ Use of implants have become more practical as far as conservation of anchorage is concerned.^{6–13} The mechanics of force application can be simple or complicated, depending on the level of anchorage control necessary. The use of TADs reduces the number of teeth

requiring bands or brackets, especially second molars, hence reducing the risk of damage to the periodontium or enamel surfaces.¹⁴

Diagnosis

A 19-year-old female attended the orthodontic clinic complaining of forwardly placed upper and lower front teeth, spacing in between the upper front

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Figure 1. (a–d) Pre-treatment extra-oral photographs.

two teeth and difficulty in lip closure. Her medical history was non-relevant and temporomandibular joint function was normal.

Extra-oral examination revealed a convex profile, incompetent lips with reduced philtrum length and increased lower anterior face height. On smiling, the patient exhibited a consonant smile arc (Figure 1). In Sarver's classification of smile lines, this means that the lower lip vermilion border follows the incisal edges of the upper teeth in a frontal smile.

Intra-oral examination showed a bilateral Angle's Class I molar and canine relationship with a midline diastema in the upper arch and moderate crowding in the lower arch with a 90° rotation of the lower left second premolar. The overjet and overbite measured 1.2 mm and 2 mm, respectively. The skeletal midline matched the dental midline (Figure 2).

The panoramic radiograph

revealed a full complement of teeth except for the third molars (Figure 3).

Cephalometric analysis (Table 1) (Figure 4) showed a severe bimaxillary dento-alveolar proclination and severely protrusive incisors.

The patient was diagnosed as Angle's Class I malocclusion with severe bimaxillary dento-alveolar proclination and severely hyperdivergent jaw bases.

Rationale for treatment plan

Taking into consideration the convex profile and the severe space discrepancy in the upper and lower arches, an extraction treatment protocol was followed along with placement of TADs in all the quadrants for conservation of anchorage.

Treatment objectives

- In the maxillary and mandibular arches, to obtain space by extraction of

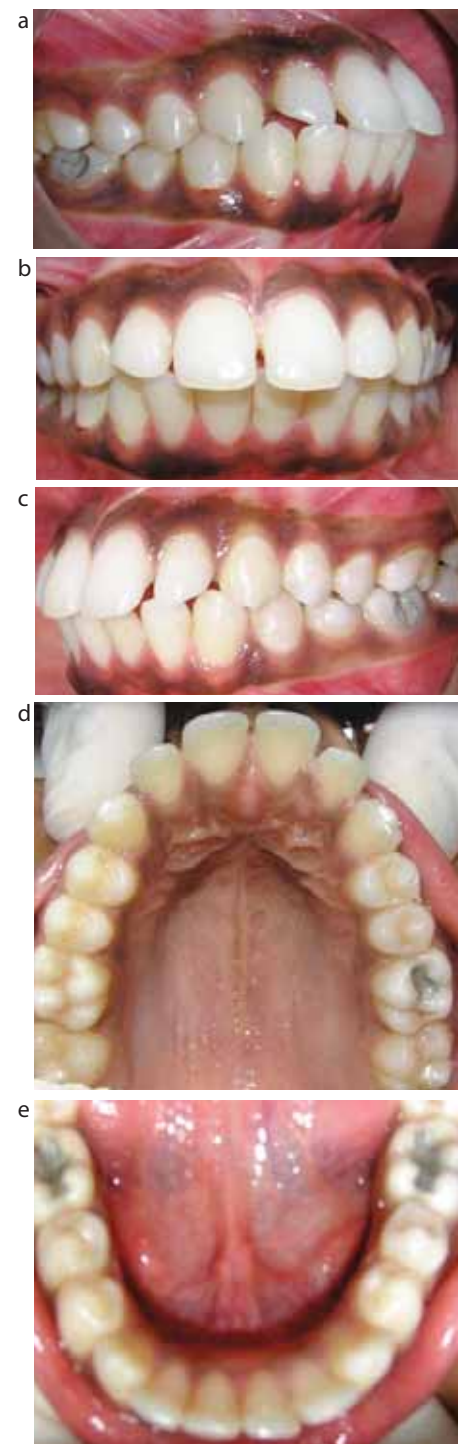


Figure 2. (a–e) Pre-treatment intra-oral photographs.

all first premolars and utilize for *en masse* retraction of the anterior segment and for decrowding the lower anterior segment;

- Obtaining correct overjet and overbite;
- Correction of the convex facial profile to rather straighter;
- Eliminating the lip strain along with attainment of the proper lip balance;
- Achieve a stable, functional occlusion with a pleasing smile.

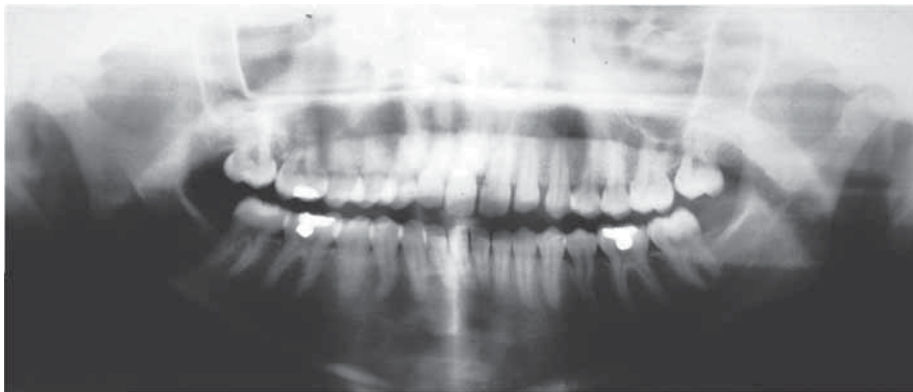


Figure 3. Pre-treatment panoramic film.

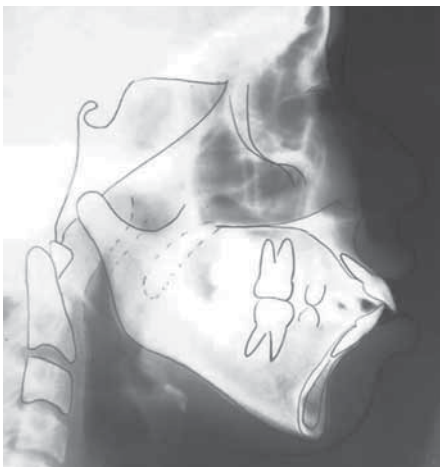


Figure 4. Pre-treatment cephalometric radiograph.

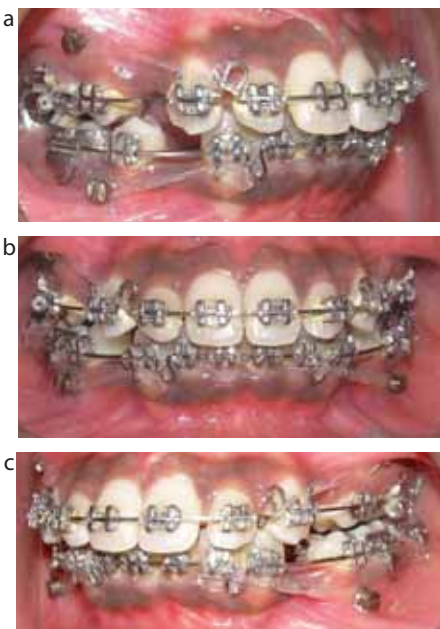


Figure 5. (a-c) TADs placed in the inter-radicular area of first molar and second premolar in all the quadrants.

Treatment alternatives

■ Extraction of all four first premolars and use of high pull headgear with TransPalatal

Arch (TPA). High pull headgear is used for two reasons. First, to conserve anchorage, secondly to attain vertical control, as the patient has hyperdivergent jaw bases. However, the patient was reluctant to use the headgear.

■ A surgical line of treatment was also formulated, consisting of a bimaxillary dento-alveolar setback with advancement genioplasty to address the bimaxillary dento-alveolar proclination and recessive chin, respectively, after appropriate orthodontic decompensation. The patient was not enthusiastic about this line of treatment.

■ The third treatment plan would be to extract all first premolars and the use of TADs placed in the inter-radicular area between the second premolar and first molar in all the four quadrants. The use of TADs will not only conserve anchorage but will also assist vertical molar control.

Treatment progress

After the formal consent of the patient was obtained, all first premolars were extracted under local anaesthesia. The first molars were banded and the remaining teeth were bonded with a 0.022" Pre-Adjusted Edgewise Appliance (MBT prescription, 3M Unitek, Monrovia, California, USA). Initial levelling in both arches was accomplished with 0.016" NiTi (Orthoforce G4- Nickel Titanium G&H Wire Company, Hanover, Germany) archwires. The severely rotated lower left second premolar was addressed individually by placement of a couple force to correct the rotation. As soon as the rotation was corrected, 0.018" SS wires were placed in the upper and lower arches. No active retraction was undertaken during the levelling and aligning stage. Once levelling and aligning was achieved, however, 0.021" x 0.025" SS wires were placed in the upper and lower arches with cuspid

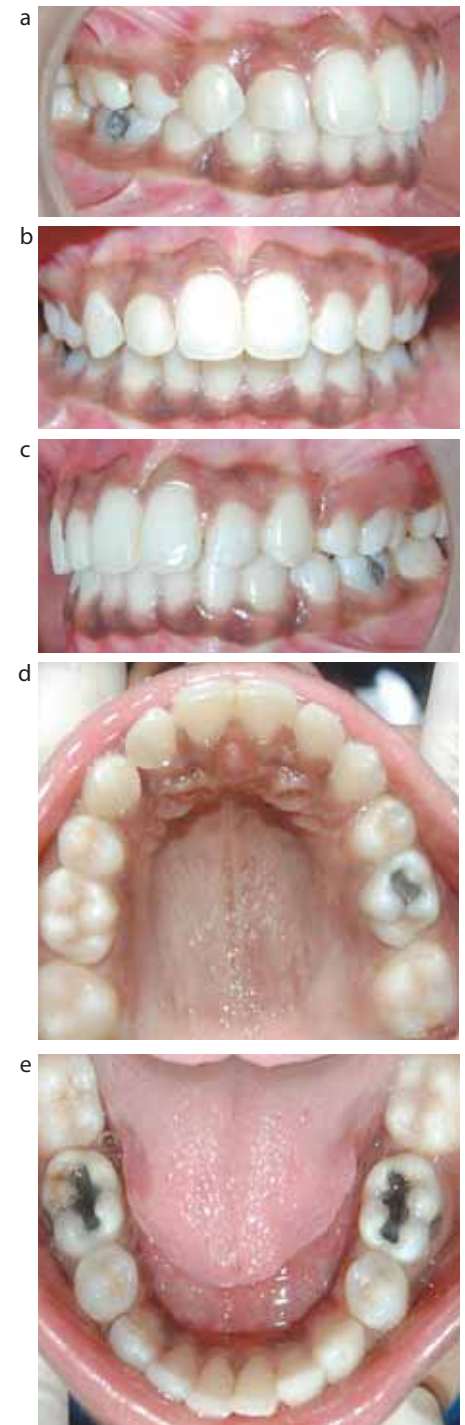


Figure 6. Post-treatment intra-oral photographs. Note the upper right lateral incisor was built up with composite to match the space discrepancy.

hooks. TADs, 1.2 x 8 mm in dimension (SK Surgical's®, Pune, India), were placed in the inter-radicular area of second premolar and first molars in all the four quadrants under a topical anaesthetic (Figure 5). Implants were loaded immediately without a waiting period. Using power chains, approximately 200 gm of force was applied, running from the hooks on the continuous archwires to the head

SKELETAL ANTERO-POSTERIOR	PRE-TREATMENT	POST-TREATMENT
ANB (°)	8	2
A [⊥] -B [⊥] (mm)	9	3
Wits (mm)	4	2
NA-Pog (mm)	10	3.5
Harvolds (mm)	24	24
VERTICAL		
SN-GoGn (°)	40	36
FH-GoMe (°)	38	32
MM Plane (°)	36	28
Jarabak ratio (%)	58.65	62
Y-axis (°)	75	71
MAXILLARY		
SNA (°)	84	82
A [⊥] -N [⊥] (mm)	3	2
A [⊥] -Ptm [⊥] (mm)	48	48
S [⊥] -Ptm (mm)	20	20
MANDIBULAR		
SNB (°)	74	76
B [⊥] -N [⊥] (mm)	10	6
Go-Pog (mm)	77	77
DENTAL		
U1-SN (°)	122	98
U1-NA (°/mm)	34/12	15/7
U1-APog (°/mm)	51/13	22/6
L1-MP (°)	104	92
L1-NB (°/mm)	43/14	22/3
LI-APog (°/mm)	34/11	23/3
U1-L1 (°)	95	128
SOFT TISSUE		
E-Line (mm)	U*-2 L [†] -9	U-2 L-2
H-Line (mm)	L-7	L-1
S-Line (mm)	U-5 L-5	U-1 L-1
Nasolabial Angle (°)	83	112

Table 1. Comparison of pre-treatment and post-treatment cephalometric readings. *U–Upper; †L–Lower.

mesial to the upper right canine as the upper right lateral incisor was smaller in size than the norm. After debonding the appliance, the lateral incisor was built up with hybrid Bis-GMA composite resin to match the contralateral lateral incisor.

Thirteen months after the initial bracket placement, the promulgated objectives seemed to be achieved. A good Class I molar relationship was maintained along with a Class I canine relationship with the correct overjet and overbite (Figure 6). Extra-oral photographs showed a pleasing profile (Figure 7). Cephalometric analysis and superimposition (Figure 8) revealed that the hyperdivergency of the jaw bases improved from SN-GoGn 40° to 36°; FH-GoMe, 38° to 32°, MM angle from 36° to 28°, Jarabak ratio from 58.65% to 62% (Figure 9). A post-treatment panoramic radiograph confirmed complete space closure in the premolar and canine areas (Figure 10).

The retention regime of the patient was implemented by instructing the patient to wear a maxillary and mandibular full wraparound Begg retainer for 24 hours a day for 2 years, followed by night-time only for another 6 months (Figure 11).

Discussion

The utilization of implant anchorage has proved to have many striking features and advantages:¹⁵

- The ability to provide treatment possibilities and alternatives that were not previously viable;
- 'Absolute' anchorage leads to a more reliable treatment plan and enables a reduction in the treatment time as a consequence of avoiding round tripping;
- This anchorage system obviates the need for patient compliance. Extra-oral anchoring devices, such as headgear, could be replaced by this method unless the utopia of absolute patient co-operation could be consistently obtained.

In the present case, high pull headgear with TPA was one of the alternate treatment options; the motive for using high pull headgear was to conserve anchorage and also to intrude the molars, however, the patient refused this option. The second alternative was to submit the patient to orthognathic surgery with the associated morbidity. The patient refused the second alternative treatment option as well. Therefore, TADs offered the best non-compliant, minimally invasive, cost-benefit effective treatment alternative and offered an effective therapy for

of the implant. After seven months of active *en masse* retraction, settling of the occlusion was completed using 0.016" SS

archwires in the upper and lower arches, with settling elastics, for a period of three months. Some space was maintained



Figure 7. (a–d) Post-treatment extra-oral photographs.

the severe bimaxillary protrusion and hyperdivergence.

The patient's complaints, which included forwardly placed upper and lower front teeth and difficulty of lip closure, were addressed very well by this treatment modality. Since the bimaxillary proclination was corrected by complete retraction of the upper and lower anterior teeth, the upper lip assumed a more relaxed inferior position. Along with the abovementioned correction, TADs also brought about good vertical molar control.

Conclusion

In conclusion, an adult critical anchorage case of severe bimaxillary protrusion was successfully treated utilizing TADs for anchorage. TADs were used as an alternative treatment to headgear or orthognathic surgery, resulting in good occlusion with a Class

I molar and canine relationship. The present case indicated that the skeletal anchorage is of great importance in achieving formulated objectives in the hitherto complex maximum anchorage scenario.

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Figure 8. Post-treatment lateral cephalogram.

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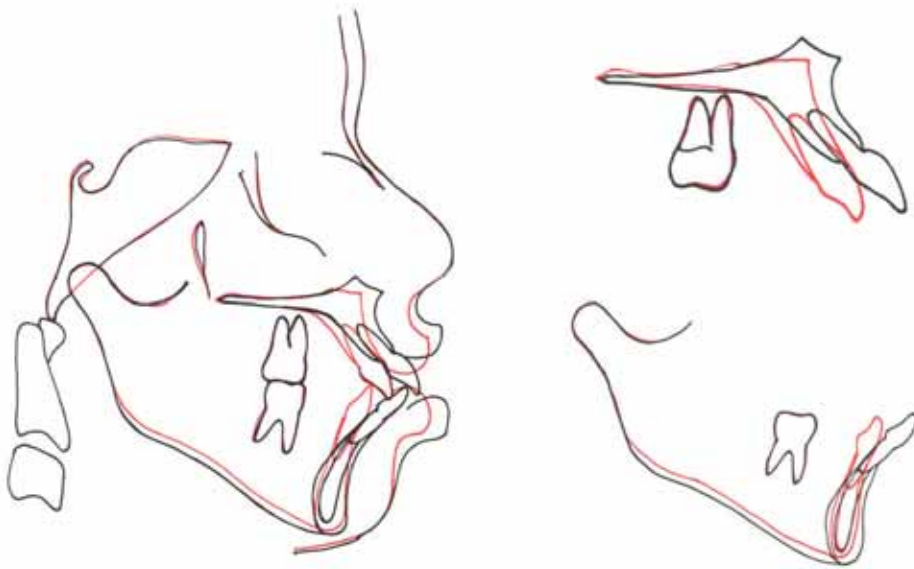


Figure 9. Superimposition of cephalometric radiographs.

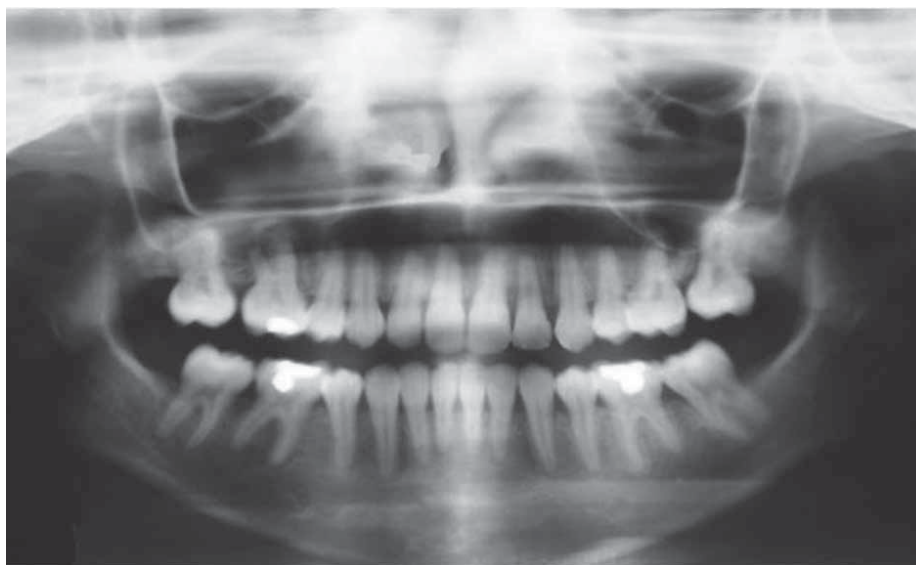


Figure 10. Post-treatment panoramic film.

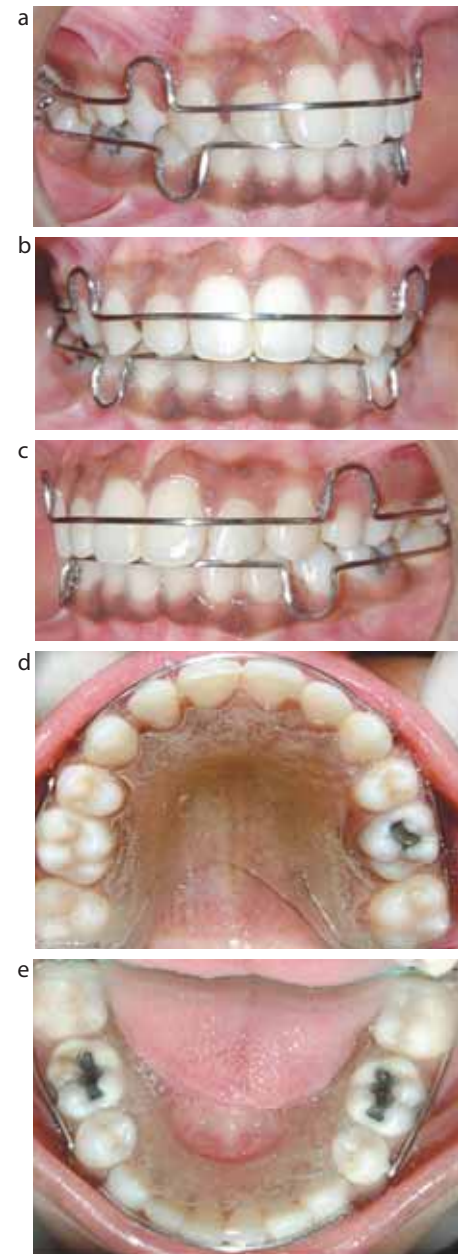


Figure 11. (a–e) Intra-oral photograph showing post-treatment occlusion with Hawley retainers.