

Distalisation of Complete Maxillary Arch in an Adult Patient: A Palatal Mini Implant Approach

To cite: Mishra K, Bhardwaj A, Thukral R. *In vitro* Distalisation of Complete Maxillary Arch in an Adult Patient: A Palatal Mini Implant Approach. Journal of Contemporary Orthodontics, February 2018, Vol 2, Issue 1, (page 30-39).

Received on:
16/01/2018

Accepted on:
20/02/2018

Source of Support: Nil

Conflict of Interest: None

Mishra K¹, Bhardwaj A², Thukral R³

¹Assistant Professor, Department of Orthodontics and Dentofacial Orthopaedics, Modern Dental College and Research Centre, Indore, Madhya Pradesh, India, kratikamishra1990@gmail.com

²Professor and Head, Department of Orthodontics and Dentofacial Orthopaedics, Modern Dental College and Research Centre, Indore, India, dramit2211@yahoo.in

³Professor, Department of Orthodontics and Dentofacial Orthopaedics, Modern Dental College and Research Centre, Indore, India, dr.rakeshthukral@yahoo.com

ABSTRACT

This article reports the successful use of two palatally placed mini-screws in the maxilla for correction of class II malocclusion by distalisation of complete maxillary arch in an adult patient who had a skeletal Class II malocclusion, vertical growth pattern with proclined anterior teeth, bilateral class II molar relationship, convex soft tissue profile, acute nasolabial angle and potentially competent lips. Temporary anchorage devices (TADs) in the posterior region between maxillary second premolar and maxillary first molar teeth on palatal side were used as anchorage for the retraction of whole maxillary arch. This technique requires minimal compliance and is particularly useful for correcting Class II malocclusion with protrusive maxillary front teeth without extraction.

Keywords: Class II malocclusion, Distalisation, Temporary anchorage devices.

INTRODUCTION

Dental implant anchorage has progressed from nonintegrated screws (1940s) to osseointegrated devices (1972 to present). The first clinical report of implant anchorage was presented in 1969 by Dr. Leonard Linkow. TADs have developed as important orthodontic adjuncts for expanding the scope of biomechanical therapy and enhancing clinical outcomes.¹⁻⁵ TADs such as the mini-implant have proven efficacy in providing “absolute anchorage” in orthodontics. Maxillary molar distal movement is often required to treat patients with Class II malocclusion. Several techniques have been proposed to move maxillary molars distally such as extraoral traction, Schwarz plate-type appliances, Wilson distalizing arches, removable spring appliances, distal jet appliances, intermaxillary elastics with sliding jigs and pendulum appliance. However, these conventional techniques often are accompanied by unwanted side effects of flaring or mesial movement of the anterior teeth. In contrast, the mini-screws provide sufficient anchorage for molar distalisation in Class II treatment without unwanted side effects. In this case report, we aim to introduce the treatment of a patient of Class II Division 1 malocclusion with use of palatal mini-screws for distalization of maxillary arch.

CASE REPORT

The patient, 26-year-old girl, had a convex profile and Angle's Class II div 1 malocclusion. Her chief complaint were forwardly and irregularly placed upper front teeth. The clinical examination revealed the skeletal Class II base with retrognathic mandible, proclined maxillary and mandibular anteriors, spacing in upper front teeth, increased overjet, accentuated deep curve of spee, protrusion of upper and lower lips and incompetent lips. The functional examination revealed incisal and canine guidance without prematurity and shift. The patient had no temporomandibular joint symptoms. No deviation and pain during the border movement of the mandible were detected.

The pretreatment extra-oral, intra-oral photographs (Fig. 1) and cephalogram and a panoramic radiograph (Fig. 2) were taken. The cephalometric analysis (Table 1) demonstrated a Class II skeletal relationship (ANB 5°). The A-point was in normal position (SNA 82°), and B-point was posteriorly placed (SNB 77°). The angle between the maxillary incisors and the S-N plane was 114°, and the IMPA was 99°, which indicated mandibular retrognathism and bidental proclination. Patient had a vertical growth pattern as indicated by increased FMA of 34°.

Treatment Objectives

Our treatment objectives included improving the patient's smile esthetics and facial profile along with a harmonious occlusion.

This included:

- Creating a normal overbite and overjet relationship
 - Improved facial profile
 - Correct proclination of upper and lower anteriors
 - Correct upper and lower crowding
 - Correction of canine relationship
 - Achieve lip competency.

Treatment Options

The treatment alternatives were presented to the patient.

1. Orthognathic surgery (BSSO Advancement).
2. Extraction treatment plan including extraction of maxillary first and mandibular second premolars.
3. *Non-extraction treatment:* Using TADs for distalisation of maxillary arch as patient's all third molars were absent.

All above mentioned plans were discussed with the patient and her parents but they opted for non-extraction, non surgical plan i.e. plan 3.

Treatment Plan

Non extraction treatment plan using palatal TADS for whole maxillary arch distalisation with 0.022 preadjusted edgewise [MBT] fixed mechanotherapy.

RETENTION PROTOCOL

Upper and lower removable Hawley's retainer to be worn full time for 1 year (Fig. 9).

Treatment Progress Summary

The appliance used for the patient was 0.022 × 0.028" pre adjusted edgewise [MBT] fixed appliance. The treatment was started with a 0.014" NiTi archwire in the upper and lower arch. The following sequence of wires was used: 0.016" NiTi,

Table 1

Represents cephalometric analysis

Parameters	Mean	Pretreatment	Post-treatment
Skeletal			
SNA	82	82	81
SNB	80.5	77	77
ANB	2	5	4
N Perp to point A	0 ± 2	−3	−3
N Perp to point pog	0 to −4	−7	−9
Go-Gn to SN	32	33	32
Y-axis	66	60	62
Sum of posterior angle's	396 ± 6	399	396
Dental			
U1 to NA angle	22	34	25
U1 to NA	4	8	6
U1 to SN angle	102	114	104
L1 to NB angle	32	26	29
L1 to A-Pog	1–2	4	7
L1 to mandibular plane angle	90	99	101
U ₆ –PT vertical	14.2	20.2	18.2
Inter-incisal angle	130	112	120
Soft tissue			
S Line to upper lip	−2	−5	−2
S Line to lower lip	0	3	−2
Naso labial angle	90–100	82	113



Figure 1 Pretreatment intra-oral and extra-oral photographs

0.016 × 0.022" NiTi, 0.017 × 0.025" NiTi, 0.019 × 0.025" SS and a 0.021 × 0.025" SS.

Two palatal micro implants were used to bring about the distalisation of the entire arch. Two implants were placed in the maxilla on the palatal side (1.3 × 10 mm). The palatal implants

were placed in the vertical palatal shelf just distal to the second premolar (Fig. 3). A bite raising composite resin was placed mid treatment to avoid locking of the upper molars occlusal to the lower molars during their distalisation. Crimpable hooks were crimped on 0.019 × 0.025" SS wire between upper lateral



Figure 2 Pretreatment lateral cephalogram and orthopantomogram



Figure 3 Intra oral picture of palatal implants with NITI closed coil springs



Figure 4 After space closure extra-oral photographs

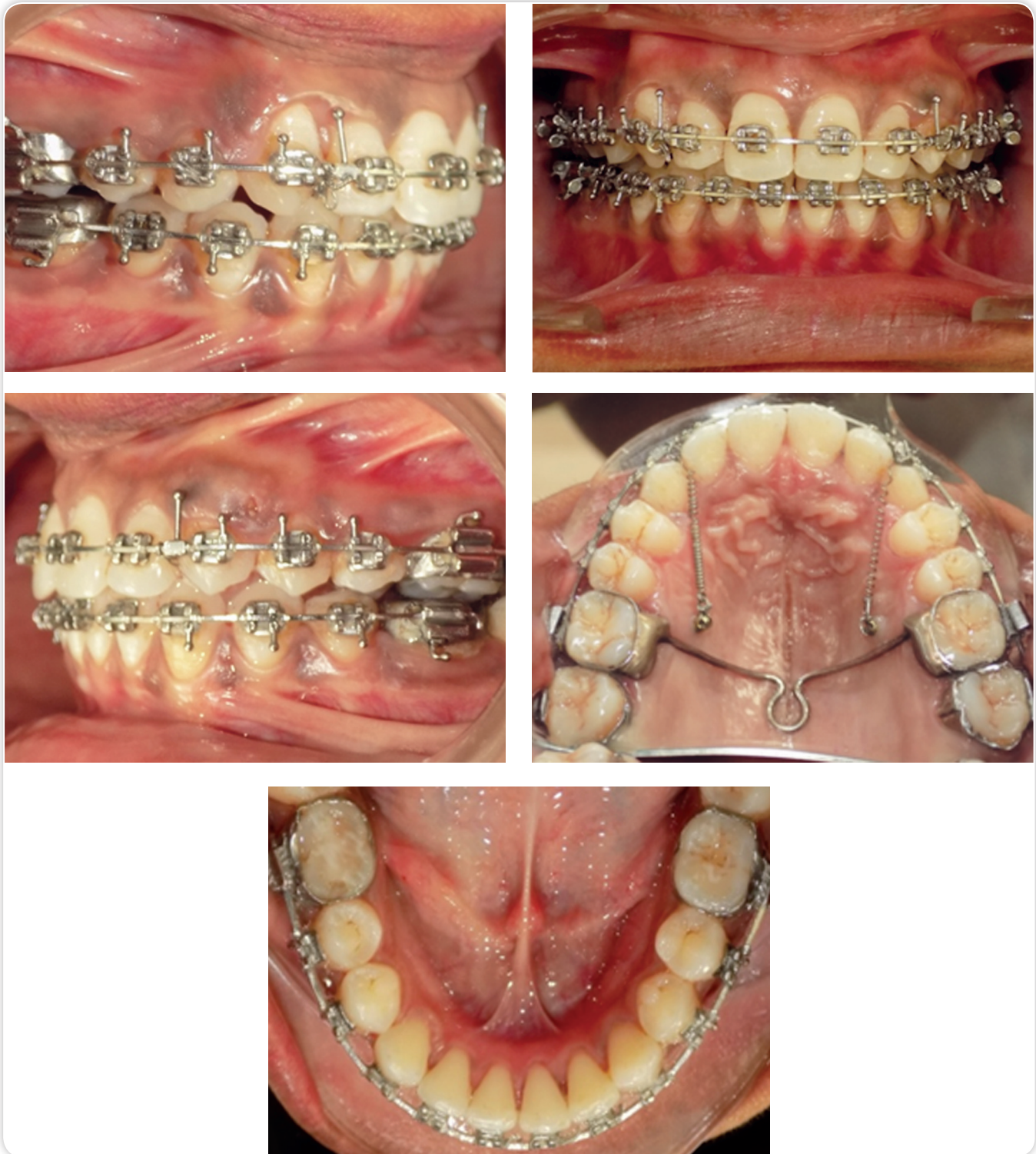


Figure 5 After space closure intra-oral photographs

incisor and canine labially to facilitate a point of attachment for the NITI closed coil springs placed from the implants to the teeth.

The force system brought about retractive force on the entire upper dentition and maxillary molars moved distally in Class I molar relationship. After space closure was completed, Hawley's retainers were delivered to the patient.



Figure 6 Extra oral photographs post debonding

Post-Treatment Assessment

Post-treatment records show a remarkable improvement in the patient's soft tissue profile. As the teeth were retracted the lips followed, and resulted in achievement of lip competency, a normal nasolabial angle and harmonious balance between the nose, lips and the chin. (Fig. 4 after space closure-extra oral photographs). The dental corrections showed a significant retraction of the upper and lower anteriors. The proclination of the upper and lower anteriors was corrected and an ideal overjet, overbite and coincident midlines were achieved (Fig. 5 after space closure intra-oral photos).

Pretreatment and post-treatment cephalometric changes can be appreciated in Table 1. Figures 6 and 7 show post treatment photographs and Figure 8 shows post-treatment radiographs and Figure 10 shows superimposition of pre- and post-treatment radiographs by various superimposition methods i.e. manual and by using dolphin software (Fig. 11).

The patient's smile esthetics and facial balance were improved at the end of treatment. The lips and chin appeared more esthetic (Fig. 6). Overall superimposition of cephalometric tracings showed superior movement of the maxillary dentition and posterosuperior movement of upper incisors with little skeletal change and mandibular counterclockwise rotation. Lower molar showed minimal vertical and anteroposterior change (Fig. 10). The post-treatment panoramic radiograph

showed overall parallelism of roots. No significant root resorption was noted (Fig. 8).

DISCUSSION

Maxillary molar distalisation with mini-screw anchorage is more comfortable for the patient than traditional reinforced anchorage systems such as multi-brackets appliance combined with intraoral or extraoral anchorage, because there is no requirement for the patient's cooperation. Nevertheless, the success rate is approximately 80–95%, and minimum invasion for placement surgery is necessary; the patients complained of little pain and discomfort after placement of the mini-screws.

Before the development and application of TADs, orthodontists' choices for distalisation of maxillary molars were limited to appliances such as pendulum, distal jet, headgears, Schwarz appliance, etc.⁸ These appliances have some disadvantages, such as their unesthetic appearance [e.g. Headgear], undesirable intermittent forces, and dependence on patient cooperation and adverse effect on anterior anchorage [e.g. pendulum appliance].

We used TADs between the maxillary second premolars and first molars combined with nickel-titanium closed-coil springs that could provide a continuous force directed near the center of resistance of the six anterior teeth.^{9,10} The force could be divided into two parts: a greater horizontal force for



Figure 7 Intraoral photographs post debonding

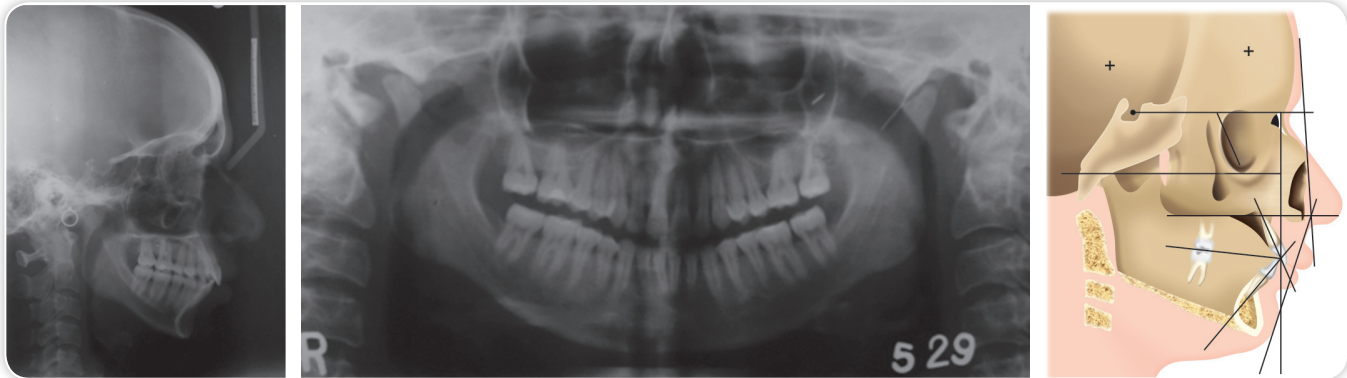


Figure 8 Post-treatment radiographs

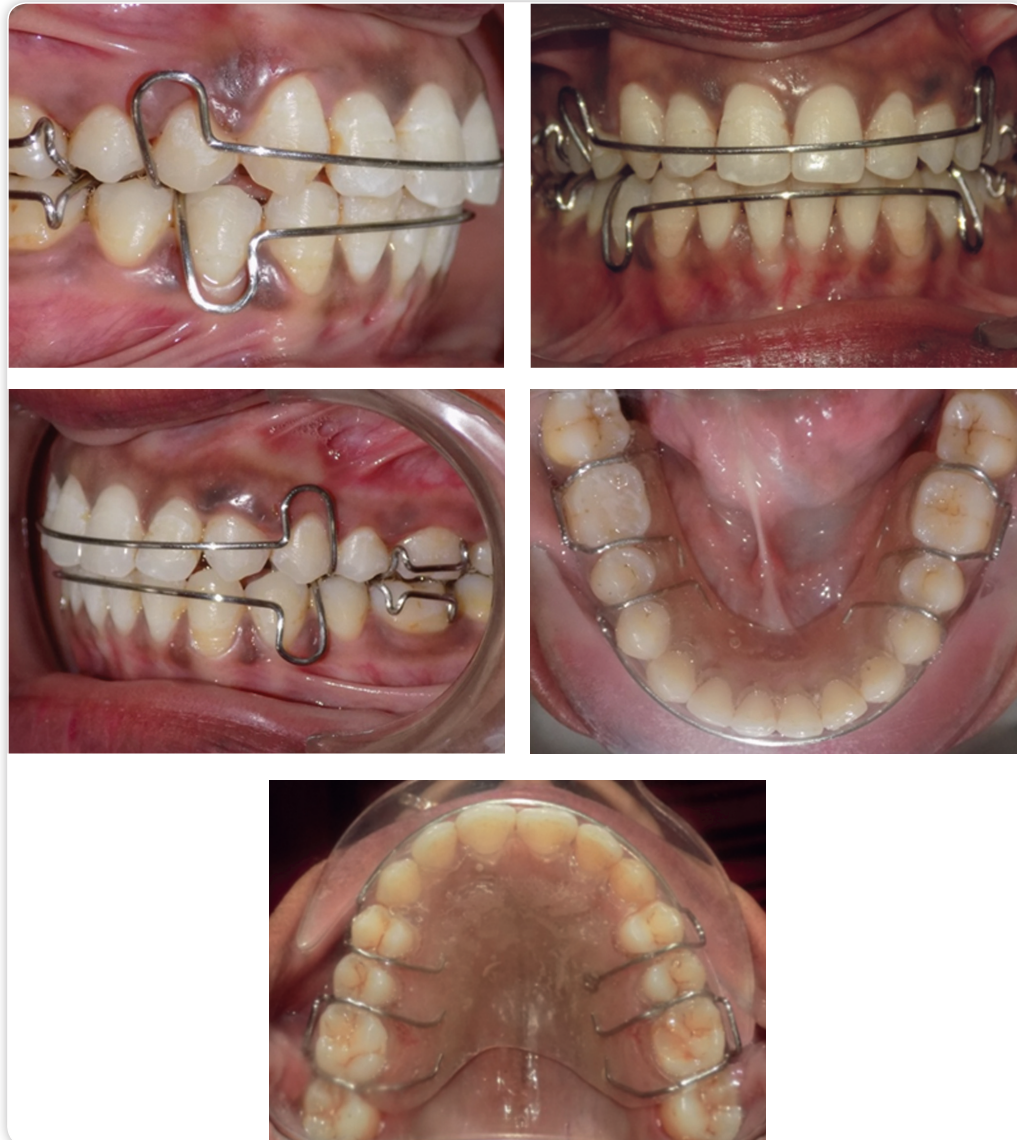


Figure 9 Retention phase

retraction of the protrusive anterior dentoalveolar complex and a smaller vertical force for intrusion of the anterior teeth.² To ensure maximal retraction and prevent excessive lingual tipping of the anterior teeth, we placed a compensatory curve in the maxillary archwire, which could counteract the deformation of archwire, provide torque control on the anterior teeth. Torque control of the anterior teeth also prevented the roots from approximating the labial cortical plate.^{1,2,7} In this case report, as there was no third molar present, so space distal to maxillary second molar was utilized for the distalization of the maxillary arch easily. After closure of spacing, contact between the canine and the first premolar was established. At this point, any further continuation of the retractive force resulted in its transmission to the posterior segment through the proximal contacts causing distalisation of upper molars.⁶

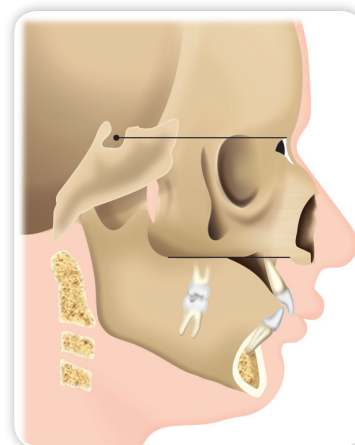


Figure 10 Superimposition by Bjork's superimposition method

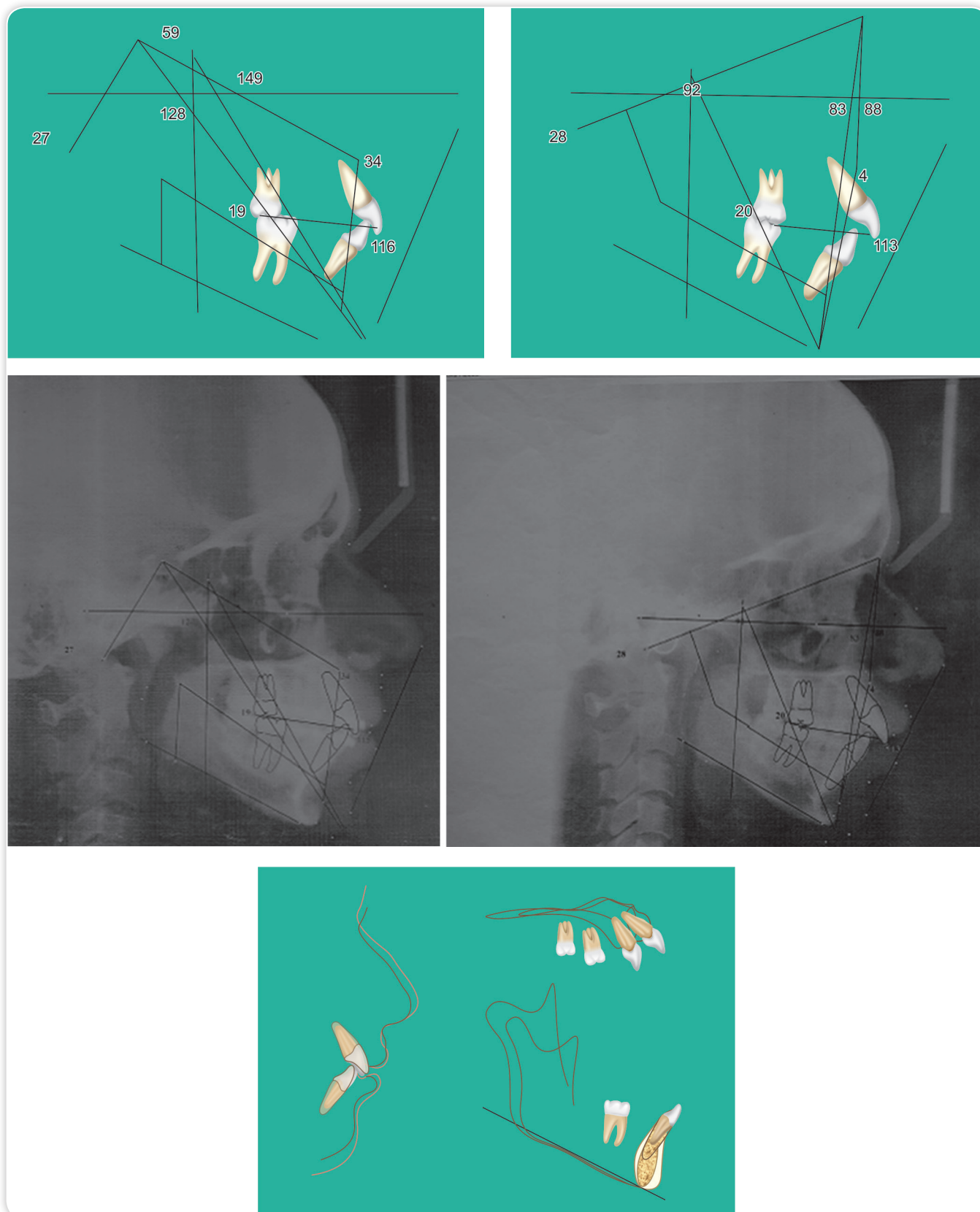


Figure 11 Digital imaging superimposition method

The coil springs were left in place for 2–3 months after space closure to obtain a tight contact of teeth and distalisation of molars. Park *et al.*⁵ previously reported that the maxillary first molars were moved to the distal by 1.64 mm with statistical significance in their study of group distal movement using mini-screw anchorage. In the present study, we quantified the treatment effects of interradicular mini-screw anchorage and confirmed the validity of its clinical usage for the distal movement of maxillary molars as in previous case study.^{1,12}

Sugawara *et al.*¹¹ reported that the maxillary first molars could be moved distally by approximately 4 mm at the crown level with miniplate anchorage. However, the disadvantage of this technique is the requirement of a mucoperiosteal incision or flap surgery when the plates are placed and removed.

The midpalatal area provides adequate retention for miniscrew implants due to good bone quality. Placement of miniscrew in posterior midpalatal area also reduces risk of damaging anatomical structures like nerves, blood vessels or tooth roots. The soft tissue thickness is also very less in this region. Thus, chances of implant failure in posterior palate are also less as compared to placement in more cancellous buccal bone in maxilla. We placed an implant of 1.3 mm diameter and 10mm length in posterior midpalatal area under local infiltration anesthesia, at the level between first and second molars. Unlike subperiosteal implants,¹³ miniscrews are more cost effective and allow immediate loading molar distalization is recommended for correction of Class II malocclusion without extraction in certain cases. The use of implants has made a major change in orthodontic treatment mechanics.¹⁰

CONCLUSION

A palatal implant system was used for distalisation of whole maxillary dentition in class II adult patient. The molars translated distally without tipping and upper anteriors were also retracted with minimum tipping. No cooperation was required, except good oral hygiene. Minimal invasive techniques eased the surgical procedure and reduced the operation time. The paramedian region could be a suitable implant site for orthodontic purposes. Further work needs to be done with an increased number of treated cases.

Address for Correspondence

Mishra K
Department of Orthodontics
Modern Dental College and Research Centre
Indore, Madhya Pradesh, India
e-mail: kratikamishra1990@gmail.com

REFERENCES

1. Joshi DD. Treatment of a Class II Division I malocclusion using miniscrews: A case report. *Journal of Dental Implants.* 2016;6(2):69.
2. Park HS, Kwon TG, Sung JH. Nonextraction treatment with microcrew implants. *Angle Orthod.* 2004;74:539-49. [PubMed]
3. Linkow LI, Chercheve R. Theories and techniques of oral implantology. St. Louis: Mosby;1970.
4. Janssens F, Swennen G, Dujardin T, Glineur R, Malevez C. Use of an implant as orthodontic anchorage. *Am J Orthod Dentofacial Orthop.* 2002;122:566-70.
5. Park HS, Lee SK, Kwon OW. Group distal movement of teeth using microcrew implant anchorage. *Angle Orthod.* 2005;75:602-9. [PubMed]
6. Tekale PD, Vakil KK, Vakil JK, Gore KA. Distalization of maxillary arch and correction of Class II with mini-implants: A report of two cases. *Contemporary clinical dentistry.* 2015;6(2):226.
7. Nanda R. Philadelphia: WB Saunders; 1997. Biomechanics in Clinical Orthodontics.
8. Lee JS, Kim JK, Park JS, Vanarsdall RS, Jr. Illinois: Quintessence; 2007. Application of the Orthodontic Mini-Implants.
9. Güray E, Orhan M. "En masse" retraction of maxillary anterior teeth with anterior headgear. *Am J Orthod Dentofacial Orthop.* 1997;112:473-9. [PubMed]
10. Gelgör IE, Büyükyılmaz T, Karaman AI, Dolanmaz D, Kalayci A. Intraosseous screw-supported upper molar distalization. *Angle Orthod.* 2004;74:838-50. [PubMed]
11. Sugawara J, Kanzaki R, Takahashi I, Nagasaka H, Nanda R. Distal movement of maxillary molars in nongrowing patients with the skeletal anchorage system. *Am J Orthod Dentofacial Orthop.* 2006;129:723-33. [PubMed]
12. Bechtold TE, Kim JW, Choi TH, Park YC, Lee KJ. Distalization pattern of the maxillary arch depending on the number of orthodontic miniscrews. *Angle Orthod.* 2013;83:266-73. [PubMed]
13. Sung SJ, Jang GW, Chun YS, Moon YS. Effective en-masse retraction design with orthodontic mini-implant anchorage: A finite element analysis. *Am J Orthod Dentofacial Orthop.* 2010;137:648-57. [PubMed]