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CASE REPORT

OPTIMIZING CORRECTION OF CLASS II MALOCCLUSION WITH MINIPLATE-ASSISTED EN-MASSE MAXILLARY ARCH DISTALIZATION: A CASE REPORT

Optimización de la corrección de la maloclusión de clase II con distalización masiva del arco maxilar asistida por miniplacas: Reporte de un Caso

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ABSTRACT

Objetive: In the management of Class II malocclusion, distalization of maxillary teeth has proven to be an effective and established method, offering an alternative to extraction-based treatment modalities. Traditional en-masse maxillary arch distalization approaches have evolved, giving way to more sophisticated and aesthetically pleasing methods that prioritize patient comfort. Temporary Skeletal Anchorage Devices (TSADs) have become instrumental in this paradigm shift, with miniplates emerging as a particularly advantageous choice.

Case Report: This case report outlines the successful treatment of a Class II malocclusion in an adult female patient, wherein bilateral miniplates were strategically employed for total maxillary arch distalization.

Results: The utilization of miniplates demonstrated superiority over other TSADs, showcasing enhanced stability, effectiveness, and predictability in achieving optimal treatment outcomes. In the pursuit of not only correcting the malocclusion but also preserving facial profiles, the described method proved to be adept at achieving functional and aesthetic goals.

Conclusions: The present reported contemporary approach to orthodontic intervention underscores the continual refinement and advancement in orthodontic techniques, ultimately contributing to a more patient-centric and esthetically conscious field of practice.

Keywords: *Angle Class II malocclusion; En-masse Distalization; Miniplates; Temporary Skeletal Anchorage Devices; Orthodontic Anchorage Procedures; Malocclusion.*

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RESUMEN

Objetivos: En el manejo de la maloclusión de Clase II, la distalización de los dientes maxilares ha demostrado ser un método eficaz y consolidado, ofreciendo una alternativa a las modalidades de tratamiento basadas en extracciones. Los enfoques tradicionales de distalización masiva del arco maxilar han evolucionado, dando paso a métodos más sofisticados y estéticos que priorizan la comodidad del paciente. Los Dispositivos de Anclaje Esquelético Temporal (DSAT) han sido fundamentales en este cambio de paradigma, y las miniplacas se han convertido en una opción particularmente ventajosa.

Reporte de Caso: Este reporte de caso describe el tratamiento exitoso de una maloclusión de Clase II en una paciente adulta, en la que se emplearon estratégicamente miniplacas bilaterales para la distalización total del arco maxilar.

Resultados: El uso de miniplacas demostró superioridad sobre otros DSAT, mostrando mayor estabilidad, efectividad y previsibilidad para lograr resultados óptimos del tratamiento. Con el objetivo no solo de corregir la maloclusión, sino también de preservar los perfiles faciales, el método descrito demostró ser eficaz para lograr objetivos funcionales y estéticos.

Conclusiones: Este enfoque contemporáneo de la intervención ortodóncica subraya el continuo perfeccionamiento y avance de las técnicas ortodóncicas, contribuyendo así a una práctica más centrada en el paciente y con mayor conciencia estética.

Palabras clave: *Maloclusión Clase II de Angle; Distalización; Miniplacas; Dispositivos de Anclaje Esquelético Temporal; Métodos de Anclaje en Ortodoncia; Maloclusión.*

INTRODUCTION

Management of Class II malocclusion without resorting to tooth extractions involves the movement of upper and lower dentition, either individually or in combination. Total arch distalization of maxillary dentition is one of the commonly used approaches to correct a disto-occlusion and numerous orthodontic devices have been developed to achieve this, yielding positive clinical outcomes.[1]

However, it's important to note that these appliances either require patient cooperation or have complicated designs and may also result in unintended reciprocal effects, such as proclination of anterior teeth, premolar extrusion, tipping of molars, increase of lower anterior facial height with clockwise rotation of mandible.[2] Furthermore, the overall posterior movement of the molars achieved through these devices tends to be limited by the conclusion of orthodontic treatment.[3] In the ever-evolving field of orthodontics, innovative approaches continue to redefine the boundaries of what is achievable in terms of correcting dental and skeletal anomalies.

Among these advancements, the use of temporary skeletal anchorage devices (TSADs) as skeletal anchors has emerged as a transformative technique, offering orthodontists a powerful tool to address complex malocclusions and facial discrepancies especially when the patient does not agree for a surgical line of treatment.

En-masse distalization of maxillary arch using skeletal anchorage devices has enabled

its use with minimal patient compliance and reciprocal side effects. Miniscrews are the most commonly used forms of skeletal anchorage; however, they are often problematic because of their high failure rates with increased fracture during placement, loosening under loading, and impingement on roots either during placement or tooth movement. Miniscrews also require repositioning later during treatment to allow all intended tooth movements to be accomplished.

These benefits collectively make mini-plate-assisted distalization a compelling choice for orthodontic cases requiring complex tooth movements, ultimately leading to more effectual and patient-friendly treatment outcomes. Despite these promising benefits, limited information is available regarding this type of TSAD, and there are even fewer resources discussing the various clinical implications of their use.

In this case report, we present a compelling narrative of a patient who underwent enmasse distalization of maxillary teeth using miniplates as anchorage devices. Through this case study, we aim to contribute to the growing body of evidence supporting the use of miniplates in orthodontics and showcase its potential in achieving remarkable results for patients seeking orthodontic correction.

CASE REPORT

Diagnosis and Etiology

A 19-year-old female patient visited Department of Orthodontics and Dentofacial Orthopedics with the chief complaint of forwardly placed upper front teeth and wished to get them corrected. Upon questioning her medical history was non-contributory.

On extra-oral examination she presented with a mesofacial form, convex profile, straight divergence, horizontal growth pattern, potentially incompetent lips and acute nasolabial angle. Intra-oral examination revealed satisfactory oral hygiene status with adequate width of attached gingiva. Patient presented with end-on molar relation on right and Class II on left with end-on canine relation bilaterally. Incisor relation was Class II Division 1 with overjet of 9 mm and deep overbite of 7 mm (Figure 1).

The arch length discrepancies were 1.4 mm in the upper arch and 3.8 mm in the lower arch. Panoramic radiograph indicated that maxillary right and left third molars were absent, and all other teeth were present with healthy periodontal condition. Analysis of the lateral cephalometric radiograph (Table 1) revealed a skeletal Class I relation with ANB of 3°, reduced Frankfort mandibular plane angle, proclined and forwardly placed maxillary and mandibular incisors with protruded upper and lower lips (Figure 2).

Treatment objectives

Orthodontic treatment objectives for this patient included leveling and alignment of both the dental arches with retraction of upper and lower incisors to achieve optimum overjet and overbite, achievement of Class I canine and molar relationship on both the sides and retraction of upper and lower lips to improve facial profile and balance.

Treatment alternatives

The following treatment options were considered for this patient to achieve the planned treatment objectives:

1. Extraction of all first premolars or maxillary first premolars and mandibular second

premolars to achieve dental Class I molar and canine relationship along with normal overjet. However, the primary issue in this instance pertained to the vertical dimension, given that the patient exhibited deepbite condition along with a horizontal growth pattern.

Extraction and retraction of teeth would potentially exacerbate the intensification of the vertical occlusal discrepancy. Moreover, a further deepening of the bite could possibly mar patient's impeccably harmonized facial contour that already possessed a state of equilibrium with good soft tissue compensation.

2. Non-extraction therapy with en-masse distalization of the upper arch for the correction of molar and canine relationships using skeletal anchorage system with 'Y' shaped miniplates in the zygomatic buttress region of maxilla. The second option was pursued due to above discussed impending drawbacks of extraction therapy and the enhanced safety of skeletal anchorage in achieving the intended adjustment, ultimately culminating in the restoration of natural dentition and a harmonious occlusal relationship. Moreover, the patient expressed a preference that her profile should not be flattened much and desired strong inclination towards a treatment method devoid of any tooth extraction.

Treatment progress

Both the upper and lower arches were bonded with 0.022" X 0.028" MBT prescription brackets. Following the preliminary process of leveling and aligning, full thickness mucoperiosteal flaps were elevated, and 'Y'-shaped mini-plates were positioned within the bilateral zygomatic buttress region of the maxilla (Figure 3).

The plates were fixed using three monocortical screws, each of 2.0 mm in diameter and 5.0 mm in length. The surgical flap was reoriented and sutured with resorbable sutures with only the head portion of the mini-plates exposed in the oral cavity. After

Table 1.

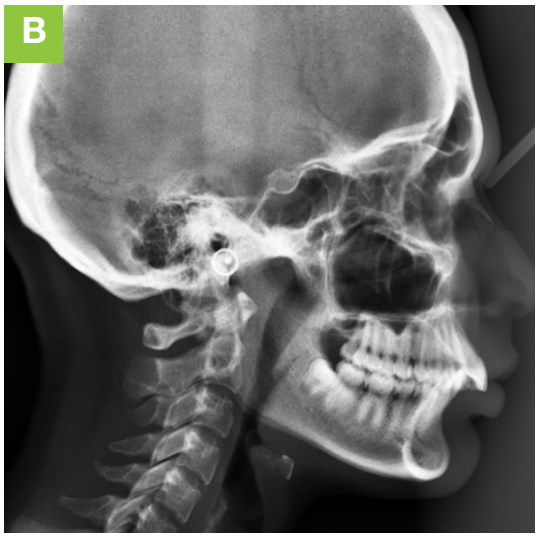
Cephalometric changes between Pre- and Post-treatment records. At the end of the treatment there were no skeletal changes observed with opening of the facial axis suggesting downward and backward rotation of the mandible. Upper incisors were significantly retracted and retroclined with minimal proclination of lower incisors.

Variables	Norm	Pre-treatment	Post-treatment
SNA (°)	82°	83°	83°
SNB (°)	80°	80°	80°
ANB (°)	2°	3°	3°
GoGn – SN (°)	32°	20°	22°
LAFH (mm)	-	69mm	71mm
Facial axis (°)	0°	+3°	+4°
U1 – NA (°)	22°	30°	23°
U1 – NA (mm)	4mm	10mm	6mm
U1 – SN (°)	102°	111°	107°
L1 – NB (°)	25°	30°	32°
L1 – NB (mm)	4mm	6mm	7mm
IMPA (°)	90°	108°	110°
S line – UL (mm)	-2mm	3mm	1mm
S line – LL (mm)	0mm	3mm	3mm

Figure 1.
Pre-treatment photographs.

A-C: Extra-oral.
D-H: Intra-oral.

Figure 2.
Pre-treatment radiographs



A: Panoramic radiograph. **B:** Lateral cephalogram.

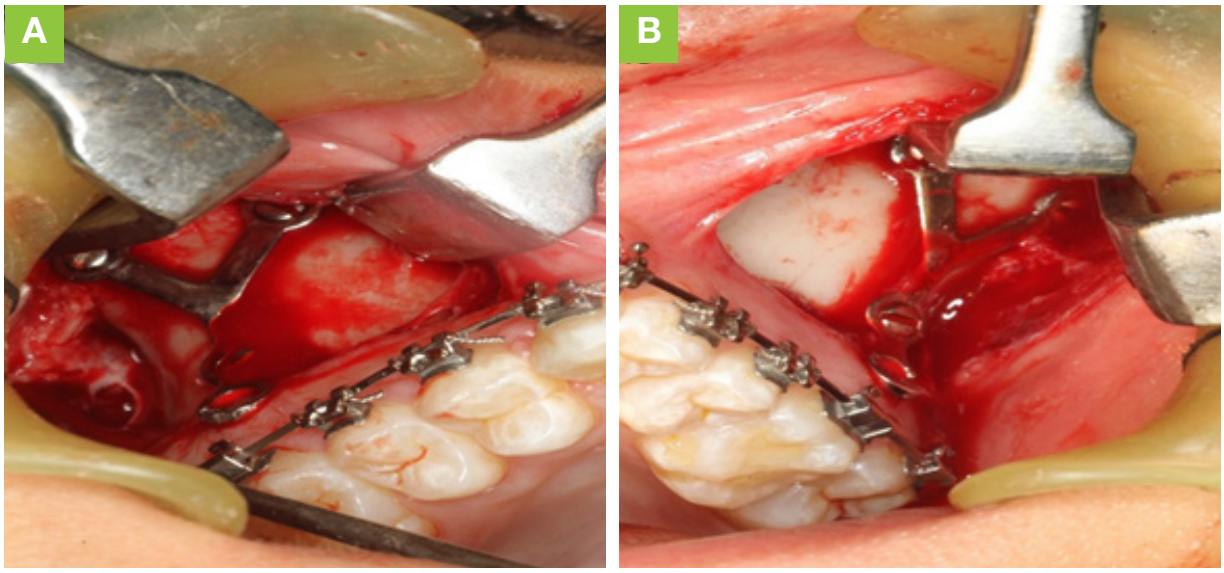
healing of the surgical site, with 0.017" X 0.025" posted stainless steel archwire in place distalizing forces were applied to the upper arch using closed coil NiTi springs from the mini-plate hooks (Figure 4).

The force on each side was measured to be 200 gm. Hence, a total force of 400 gm was applied to carry out the distalization of whole maxillary dentition. Reactivation of spring was done once in every 6 weeks and at every review visit the miniplate sites were examined for stability and soft tissue proliferation.

After 8 months of distalization, Class I molar and canine relationships were achieved bilaterally with normal overjet and overbite. During the final phase of the treatment, patient wore bilateral short Class II settling elastics.

Following an active treatment duration of 17 months, appliances were debonded with fixed retainers placed in the lower arch alongside full-time wear of clear retainers for the first 6 months followed by nocturnal wear to ensure the enduring preservation of treatment outcomes.

Figure 3.
'Y'-shaped mini-plates placed in the zygomatic buttress region of the maxilla.



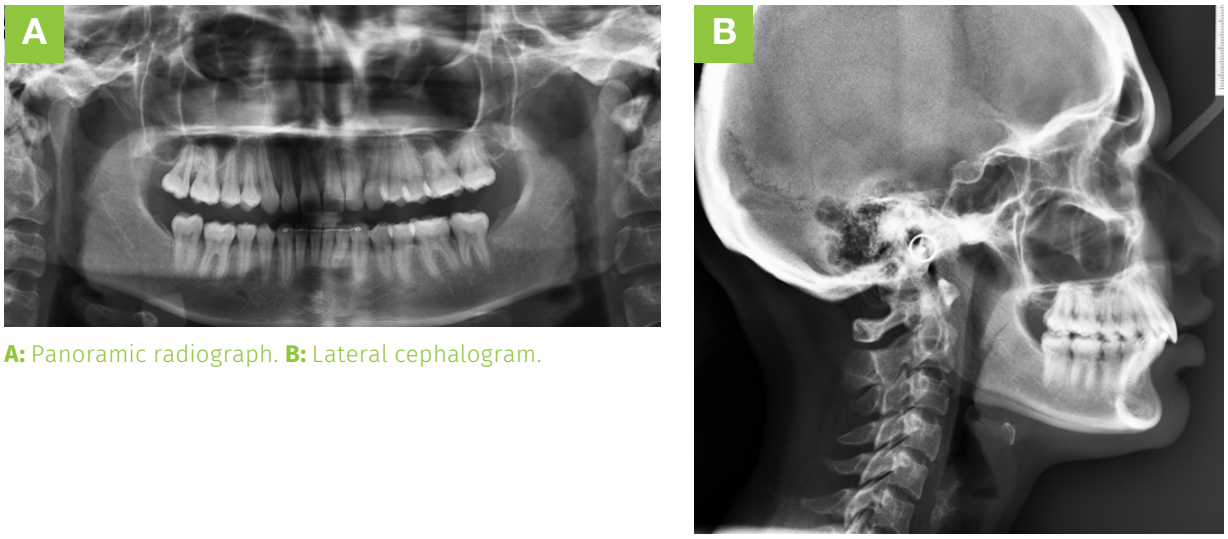
A: Right side. **B:** Left side.

Figure 4.
A, B and C, 0.017" X 0.025" posted stainless steel archwire with distalizing forces using closed coil NiTi springs from the mini-plate hooks.

Figure 5.
Post-treatment photographs.

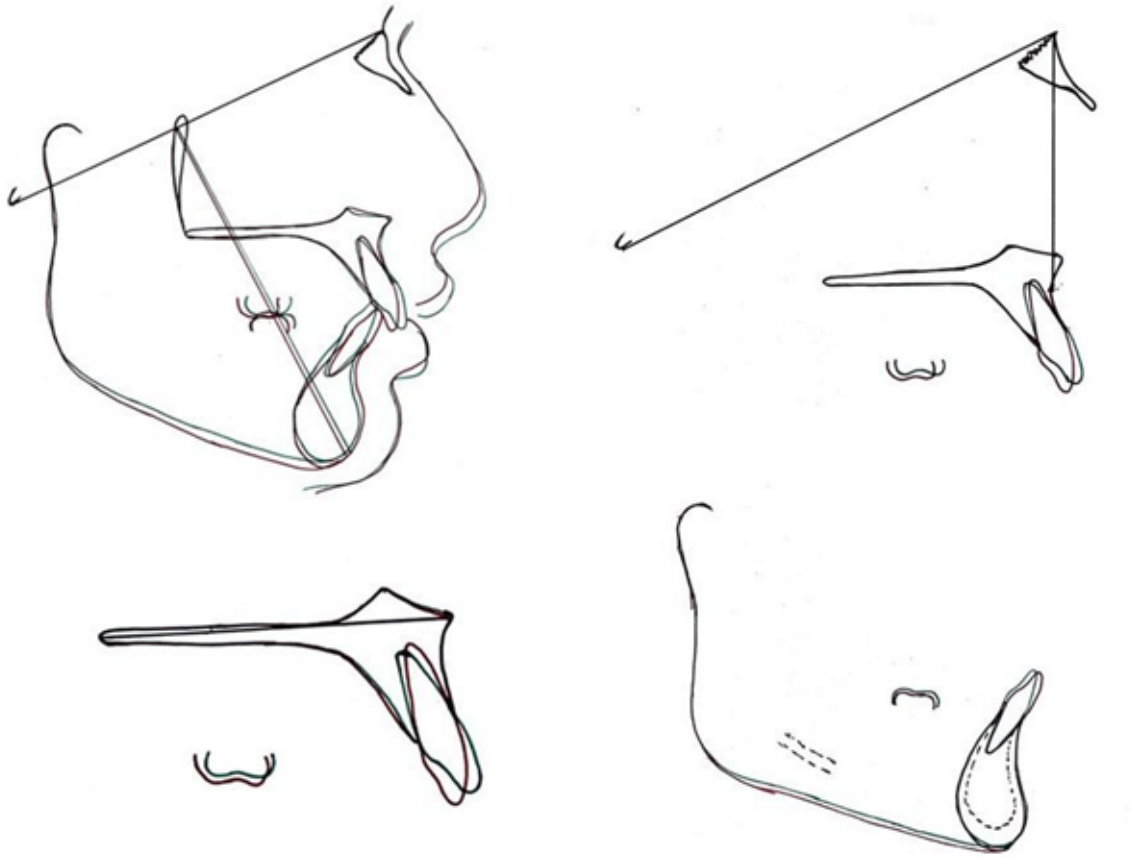
A-C: Extra-oral.
D-H: Intra-oral.

Figure 6.
Post-treatment radiographs.



A: Panoramic radiograph. **B:** Lateral cephalogram.

Figure 7.
Pre-treatment and Post-treatment lateral cephalometric tracing superimposition using Ricketts method.



RESULTS

Treatment results

At the end of orthodontic treatment, the profile of the patient had markedly improved with reduced midfacial convexity and attainment of lip competence subsequent to reduction in dental protrusion. Optimum overjet and overbite were achieved with Class I canine and molar relationship bilaterally.

The upper and lower dental midlines were coincident with good interdigitations. Precise incisor and canine guidance in protrusive and lateral excursions was established without any occlusal interferences (Figure 5 and Figure 6).

Superimposition of the pre- and post-treatment lateral cephalogram suggested that the maxillary incisors were uprighted from 111° to 107° and retracted by 3mm whereas, the mandibular incisors were proclined from 108° to 110° (Table 1 and Figure 7).

The mandibular plane angle increased by 2° with the opening of the facial axis. Maxillary first molars were distalized by a total of 4.3 mm. The distance of the upper and lower lips to the E-line was reduced by 2.2 mm and 0.8 mm, respectively.

DISCUSSION

In the realm of contemporary orthodontic practice, Class II malocclusion is considered as one of the most prevalent types of malocclusion, with occurrence of 38% to 50% among patients.[5] These individuals have facial and dental esthetic concerns that are empirically associated with diminished subjective assessments affecting their overall quality of life and self-esteem.[6]

Use of extra-oral appliances, functional jaw orthopedics, conventional fixed mechanotherapy with or without extraction of teeth are few of the many therapeutic options available for the correction of Class II malocclusion that have been proven to be effective; however, these options require substantial cooperation from patients to accomplish the planned treatment objectives.[5] While the integration of temporary skeletal anchorage into conventional orthodontic treatment planning is a relatively recent development, the concept itself has historical roots.

The advent of orthodontic implants for anchorage purposes prompted extensive exploration of various implant devices and application methodologies. In 1999, Umemori *et al.*,[7] introduced a pivotal modification to a rigid fixation plate conventionally employed for fracture stabilization.

This milestone marked the inception of a rapid evolution in the dominion of temporary skeletal anchorage techniques, facilitating the orthodontist's ability to effectuate multi-dimensional spatial movements with reliable skeletal anchorage.[5] The miniplate system comprises the utilization of both titanium miniplates and monocortical screws, which are diminutive, implantable devices serving as anchors for orthodontic movements. They provide a stable point of attachment for orthodontic appliances, reducing the need for patient cooperation and minimizing unwanted dental side effects.[1]

The presented case report delves into the utility of orthodontic miniplates as an intervention strategy for the management of Class II malocclusion. Along with the objective of correcting the existing malocclusion of the patient, we report the efficacy and viability of miniplates as TSADs in facilitating en-masse distalization of the maxillary teeth, with a particular focus on achieving therapeutic success, patient compliance, and the nuanced intricacies of this orthodontic approach whilst still maintaining patient's facial esthetics and overall dental health.

In our case, we placed miniplates in the infrazygomatic crest region to maximize their effectiveness in anchoring the maxillary dentition during the distalization process. Stability of the treatment outcome is a crucial consideration in orthodontic cases.

In this instance, we followed miniplate-assisted distalization with comprehensive orthodontic finishing and detailing to fine-tune the patient's bite and make any necessary adjustments. Our observations indicate that the use of miniplates for en-masse distalization of the maxillary teeth can be successful. The treatment effectively moved the maxillary teeth backward to correct the Class II malocclusion. By distalizing the entire maxillary dental arch, we were able to achieve our treatment goals without resorting to extractions.

Moreover, this approach preserved the patient's overall facial appearance and en-

sured a more balanced occlusion. Recently, many reports can be found in the literature showing the use of miniscrews placed in extra-radicular regions to facilitate en-masse distalization of the maxillary teeth.
However, studies by Liou *et al.*,[8] and Kinzinger *et al.*,[9] found that maintaining their positions under constant pressure is challenging. This predicament is compounded by the inherent difficulty in identifying a suitable anatomical site, consequently amplifying the probability of failure.

To navigate this challenge innovatively, miniplates emerge as a compelling alternative, offering a creative avenue for unilaterally or bilaterally distalizing the complete maxillary arch.[1] Patients' comfort and compliance are also important factors in orthodontic treatment. The use of miniplates reduces the reliance on patients to maintain compliance and eliminates the need for cumbersome extraoral appliances like headgear.[10]

Patient in this case reported minimal discomfort and inconvenience, making this treatment approach more appealing to those who may be averse to traditional orthodontic methods. Extraction of premolars for the retraction of anterior teeth and correction of molar relation was deemed unsuitable in this case. This decision was based on the observation that the required space for incisal retraction was relatively small compared to the size of the premolars. Such an approach could have resulted in the improper utilization of extraction space and potentially led to the development of a dished-in profile for the patient.[11]

It is essential to recognize that not all the cases of Class II malocclusion are suitable for miniplate-assisted distalization. Proper patient selection, precise miniplate placement, and the skill of the orthodontist are critical for the success of this approach.[4] Additionally, the surgical procedure for implanting miniplates carries inherent risks, including infection, pain, swelling and discomfort.
After the purpose of miniplates is served, an extra surgical procedure is required to remove them. These risks should be carefully weighed against the potential benefits before planning the treatment.[12,13] Long-term studies and further research will help solidify the effectiveness and stability of this treatment method in various clinical scenarios.

CONCLUSIONS

In conclusion of our report, we support the use of miniplates for en-masse distalization as an effective treatment option for correction of dental Class II malocclusion. This approach delivers effective outcomes within a manageable treatment duration, in addition to increased patient comfort and satisfaction. The success achieved reinforces the importance of precise biomechanical planning and personalized care in modern orthodontics. However, the decision to use miniplates should be based on a thorough evaluation of each patient's unique needs and characteristics.

CONFLICT OF INTERESTS

The authors declare that there are no conflicting interests.

ETHICS APPROVAL

Informed consent was provided by the patient for the publication of this case report.

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AUTHORS' CONTRIBUTIONS

Nikunj Maniyar: Conceptualization, Investigation, Methodology, Validation, Visualization, Writing – Original Draft & Editing.

A.T. Prakash: Conceptualization, Data Curation, Project Administration, Supervision, Validation, Writing – Review.

H.C. Kiran Kumar: Conceptualization, Supervision, Writing – Review.

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