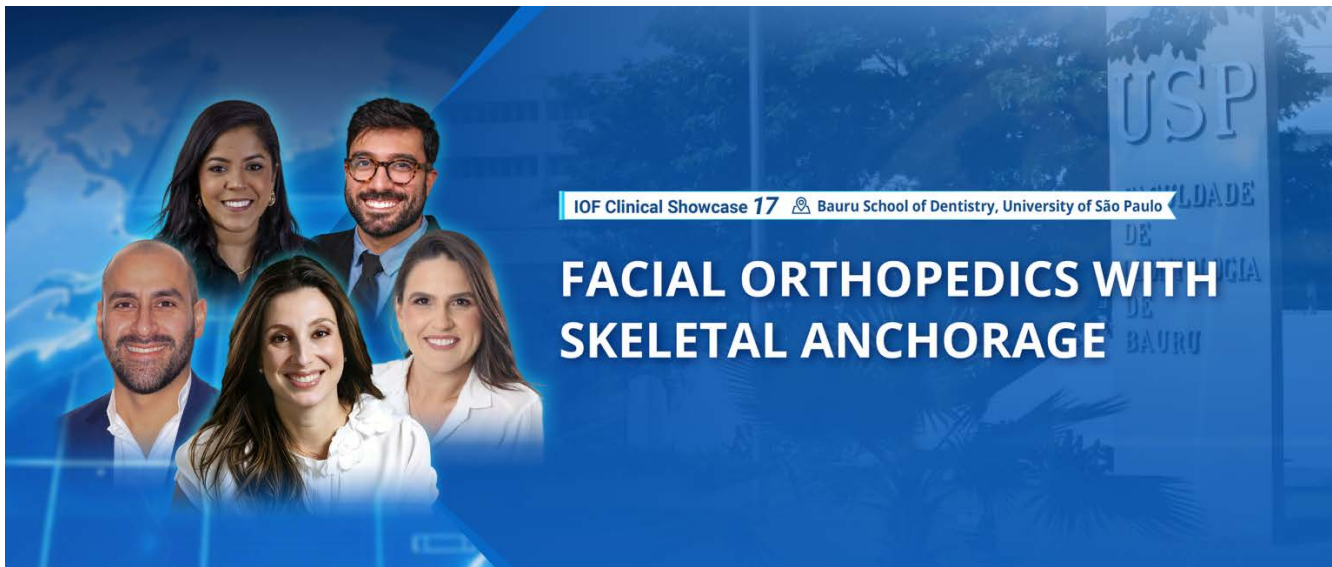




This course offers an in-depth exploration of contemporary orthodontic orthopedics, with a focus on skeletal anchorage for treating growing patients with severe transverse and sagittal discrepancies. Through two carefully documented clinical cases, the program demonstrates maxillary protraction and rapid maxillary expansion in growing patients, highlighting key treatment strategies, clinical decision-making, and long-term outcomes.

The first part of the program focuses on sagittal correction through maxillary protraction, presenting the treatment of an adolescent Class III patient using a miniscrew-anchored maxillary protraction (MAMP) protocol. You will learn how a hybrid expander combined with mini-screws and Class III elastics can achieve significant midface advancement, correct anterior crossbite, and produce favorable skeletal changes—even in patients beyond the ideal age for facemask therapy.

The second part shifts to transverse correction through rapid maxillary expansion, showcasing the management of a 15-year-old patient with bilateral posterior crossbite using a hybrid Hyrax expander with two palatal mini-screws. You will learn how bone-borne expanders minimize unwanted dental side effects, maximize skeletal effects, and provide a less invasive alternative to tooth-borne devices in late adolescence.



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Case 1

Effects of miniscrew-anchored maxillary protraction in a growing patient with Class III malocclusion

Speaker: Dr. Felicia Miranda

01 Basic Case Information

The patient was an 11-year-old male who presented to the Department of Orthodontics.

Chief complaint: Anterior crossbite

Medical history: No unexpected finding

Clinical Examination

Extraoral analyses



Pretreatment extraoral photographs

The patient presented with a skeletal Class III skeletal pattern, concave facial profile, hypodivergent, symmetrical face, and competent lip closure.





Pretreatment intraoral photographs. CO-CR shift. Edge-to-edge position in CR

Intraoral analyses

The patient was in late mixed dentition stage. He presented with bilateral Angle Class I molar relationships and anterior crossbite. The maxillary dentition presented with moderate crowding, resulting in insufficient eruption space for the bilateral maxillary canines. The mandibular dentition was relatively aligned. The patient presented with a CO-CR shift. The mandible could be guided posteriorly to an edge-to-edge incisal relationship.

Radiographic findings



Pretreatment Panoramic Radiograph

No unexpected findings were observed on the pretreatment panoramic radiograph. The patient was in the late mixed dentition stage. The maxillary canines were erupting, and all four third molars were developing.



Measurement	Value
SNA	84.2°
SNB	84.1°
Wits	-4.2 mm
SN-GoGn	31°
Mx1-PP	118.1°
IMPA	91.4°
Overjet	-3.8 mm

Pretreatment Cephalometric analysis

The cephalometric analysis showed the Wits appraisal was -4.2 mm and hypodivergent. The maxillary incisors had a relatively normal inclination, while the mandibular incisors were slightly proclined.



Pretreatment Hand-Wrist Radiograph

The hand-wrist radiograph indicated that the patient was in the pre-peak stage of the adolescence growth spurt.

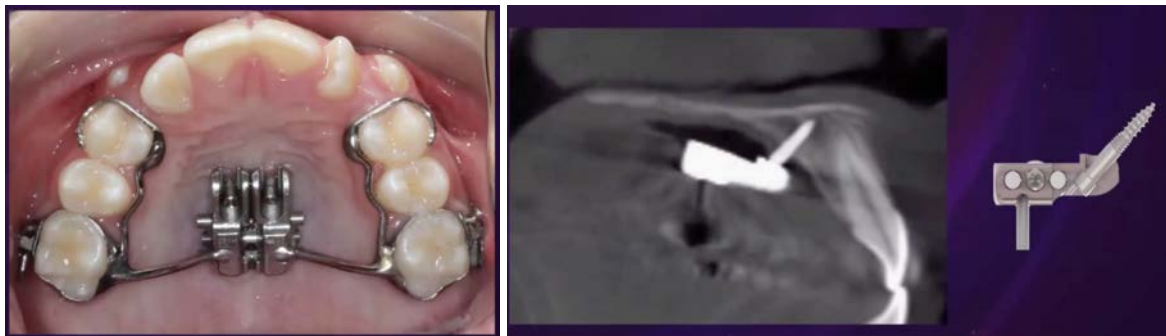
02 Treatment Plan

Considering that the patient still had remaining growth potential, the presenter considered maxillary protraction to be the preferred treatment option. After taking into account the patient's age, the expected dental and skeletal effects, the invasiveness of the procedure, and the associated cost, the presenter decided to use miniscrew-anchored maxillary protraction, or MAMP.

03 Treatment Progress

The presenter first delivered a hybrid expander. The anterior border of the expander was designed to be positioned posterior to the third palatal rugae, and bands were cemented on the maxillary first molars.

Subsequently, under local anesthesia, two miniscrews were inserted with a maximum insertion torque of 35 N·cm at a speed of 30 rpm. The miniscrews were 1.8 mm in diameter and 7 mm in length, with a 4 mm transmucosal collar. The insertion path followed the prefabricated holes in the expander, with the miniscrews placed at approximately a 45-degree angle to the occlusal plane.



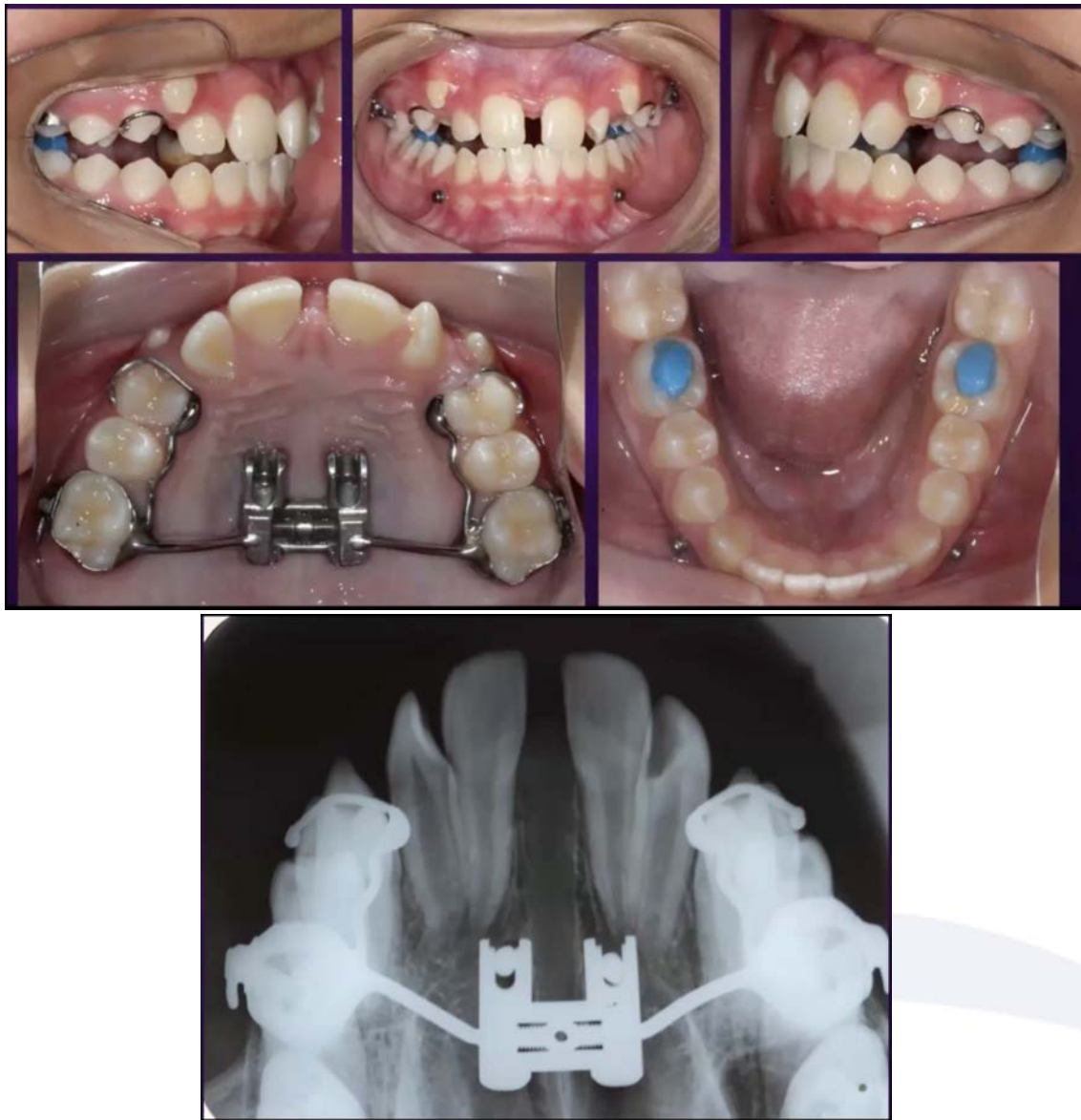
Hybrid Expander Design and Palatal Miniscrew Placement

In the mandible, the presenter selected two miniscrews measuring 1.6 mm in diameter and 6 mm in length, with a 1 mm transmucosal collar. These miniscrews were placed buccally between the mandibular canine and first premolar. The vertical position of insertion was determined based on the mucogingival junction. Because the mandibular miniscrews require specific insertion sites, it is important to confirm that the patient is in the late mixed dentition stage, that the bilateral mandibular permanent canines have fully erupted, and that there is adequate space between the mandibular canines and first premolars for miniscrew placement.

After maxillary and mandibular anchorage preparation was completed, the patient was instructed to activate the expander twice daily. Each activation produced 0.2 mm of expansion, with an anticipated total expansion of 5.6 mm after 14 days.

During treatment, the presenter recommended maintaining good oral hygiene. The patient was also advised to apply 2% chlorhexidine gel on the miniscrew placement sites twice daily throughout the treatment period.





Extraoral and intraoral photographs after expansion. A occlusal radiograph confirmed successful opening of the midpalatal suture.

After expansion, a large diastema was observed between the maxillary central incisors. Some sagittal improvement was also noted, and the anterior dental relationship improved to an edge-to-edge position. A post-expansion occlusal radiograph confirmed successful opening of the midpalatal suture.

The patient then began bilateral Class III elastics. He was instructed to wear the elastics from maxillary first molars to the ipsilateral mandibular miniscrews full time. The elastics were changed twice daily. During the first month, 150 g elastics were used. Starting from the second month, 250 g elastics were used until a normal overjet was achieved. The maxillary protraction phase lasted a total of 6 months.



Extraoral and intraoral photographs after MAMP



Comparison of Pretreatment, Post-Expansion, and Post-MAMP Records

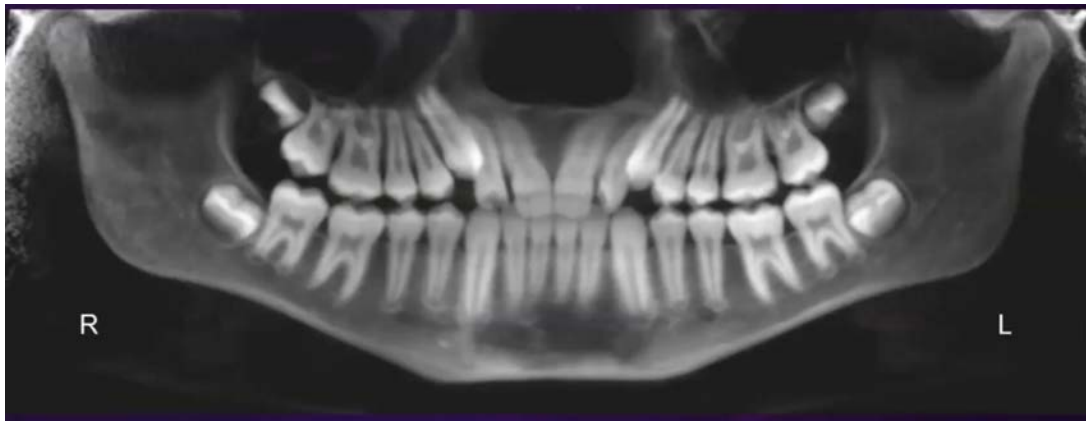


Six months after completion of MAMP, the patient's extraoral and intraoral photographs were taken. At that time, the expander and miniscrews had been removed.

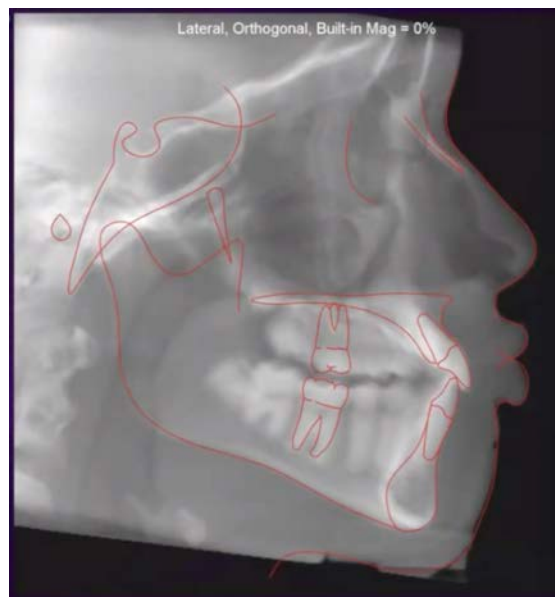


The patient wore a chin cup at night for retention.

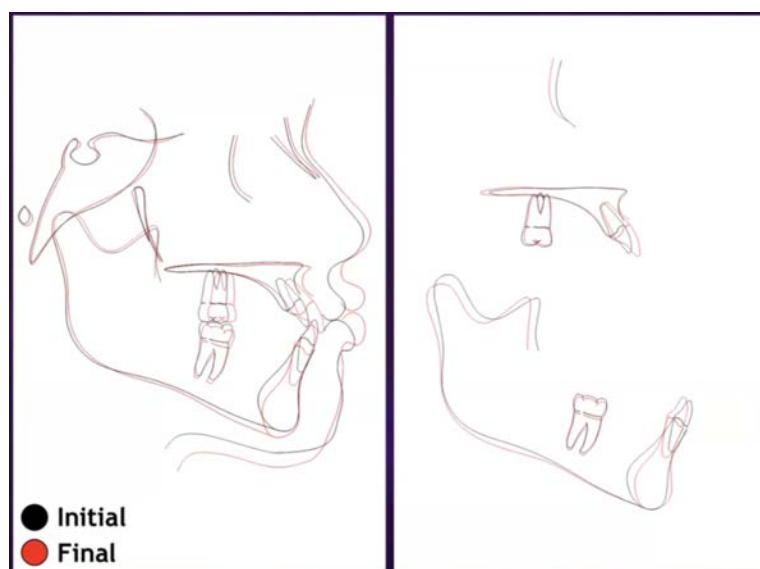
After MAMP treatment, the sagittal relationship had improved significantly. The patient showed a Class I facial pattern, with a marked improvement in facial profile, particularly in the midface region. After treatment, the bilateral molar relationships became Class II, and the anterior crossbite was completely corrected. The speaker instructed the patient to wear a chin cup at night for active retention purpose.



Panoramic Radiograph After MAMP



Cephalometric Analysis After MAMP



Measurement	Pretreatment	Posttreatment	Difference
SNA	84.2°	85.9°	1.7°
SNB	84.1°	82.9°	-1.2°
Wits	-4.2 mm	-0.6 mm	3.6 mm
SN-GoGn	31°	30.8°	-0.2°
Mx1-PP	118.1°	128.5°	10.4°
IMPA	91.4°	87.9°	-3.5°
Overjet	-3.8 mm	3.5 mm	7.3 mm

Cephalometric Superimposition and Data Comparison Before and After MAMP

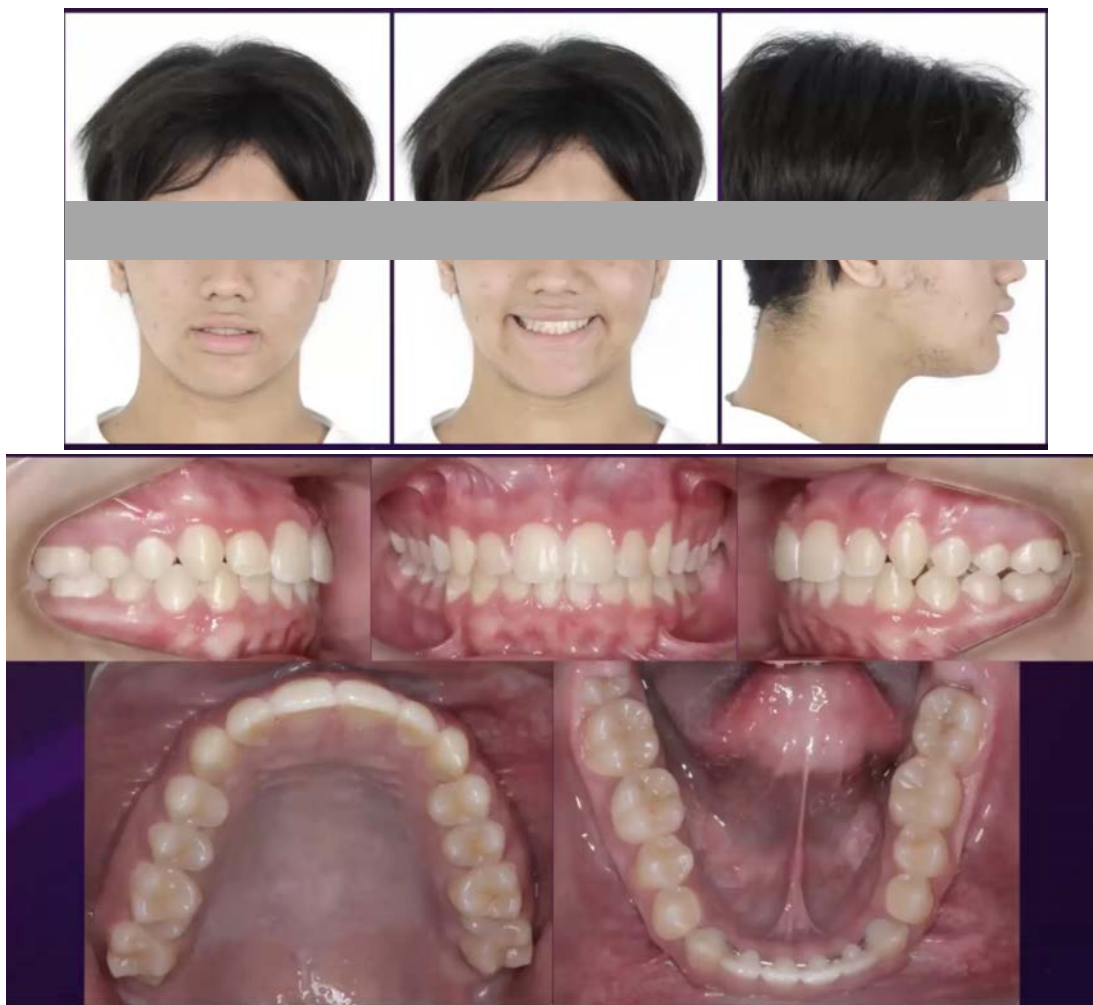
Cephalometric analysis showed anterior displacement of the maxilla after treatment. The Wits value increased by 3.6 mm, and the overjet increased by 7.3 mm. The maxillary incisors showed a slight increase in proclination, while the mandibular incisors showed mild retroclination.

Because the maxillary dentition was crowded and the bilateral maxillary canines lacked sufficient eruption space, the presenter decided to proceed with comprehensive orthodontic treatment. To avoid potential side effects, the presenter placed palatal miniscrews again and used them as anchorage for molar distalization in order to gain space for the maxillary canines. Once adequate space was obtained, fixed appliances were bonded, and leveling and alignment of both arches were initiated.



Comprehensive Orthodontic Treatment in Progress

04 Orthodontic Treatment Outcomes



Posttreatment Extraoral and Intraoral Photographs

The total treatment duration was 2.4 years. At the end of treatment, the patient was 16 years old. He presented with good occlusion, stable overjet, and a favorable sagittal relationship.



5.7 years of follow-up

Follow-Up intraoral and extraoral photographs 5.7 Years After Treatment

The presenter was able to follow the patient throughout the entire growth period. Approximately 6 years after treatment completion, the patient maintained a good facial profile. The orthopedic effect and occlusion remained stable.

05 Discussion

For skeletal Class III patients with maxillary deficiency, facemask maxillary protraction is the most commonly used orthopedic treatment. Studies have shown that facemask maxillary protraction produces more favorable craniofacial changes in patients in the primary dentition and early mixed dentition stages. Therefore, it is more suitable for patients younger than 10 years of age.

To overcome the limited effectiveness of facemask maxillary protraction in older patients, Dr. De Clerck introduced the concept of bone-anchored maxillary protraction, or BAMP, in 2009. This approach uses titanium miniplates and Class III elastics to protract the maxilla in adolescent patients. Bone-anchored maxillary protraction requires placement of titanium miniplates bilaterally in the maxillary zygomatic buttress region and in the mandible between the canine and lateral incisor regions. Class III elastics are then attached between the maxillary and mandibular miniplates. Previous studies have shown that BAMP can produce favorable skeletal effects in adolescent patients. However, this approach also has limitations. For example, miniplate placement and removal are relatively complex, and the treatment cost is relatively high.

For this reason, in 2011, Wilmes proposed a new design to simplify bone-anchored maxillary protraction. This design used a maxillary hybrid expander instead of maxillary miniplates, together with a modified mandibular mentoplate. Class III elastics were applied between the maxillary and mandibular anchorage units to protract the maxilla.

Compared with miniplates, miniscrews offer the advantages of lower invasiveness and better cost-effectiveness. In addition, miniplate placement usually requires the involvement of an oral and maxillofacial surgeon, whereas miniscrew placement can be performed independently by the orthodontist. Therefore, the presenter's team proposed miniscrew-anchored maxillary protraction, replacing the miniplates used in previous protocols with miniscrews. Because miniscrew placement is relatively simple, the complexity and cost of treatment can be reduced.

The indications for miniscrew-anchored maxillary protraction may include Class III facial pattern, skeletal Class III malocclusion, and patients older than 10 years of age. The patient must have remaining growth potential, so this treatment is best indicated during the prepubertal or pubertal growth spurt period. Because of the mandibular miniscrew insertion sites, the mandibular permanent canines must be fully erupted. Therefore, the patient should ideally be in the late mixed dentition or early permanent dentition stage.

The miniscrew-anchored maxillary protraction protocol developed by the presenter's team uses a hybrid expander rather than a conventional expander. A study conducted by the presenter's team analyzed and explained the rationale for this design. For adolescent Class III patients, a hybrid expander appears to provide more favorable outcomes. In the hybrid expander group, anterior overjet correction was achieved in 94% of patients, compared with 71% in the conventional expander group. In addition, the hybrid expander group showed greater improvement in SNA, greater anterior displacement of the maxilla, and greater increase in nasal cavity width. The hybrid expander also produced fewer dental side effects, with less mesial movement of the posterior teeth compared with the conventional expander group.

Regarding case selection for miniscrew-anchored maxillary protraction, the presenter proposed five factors to consider.

The first factor is the Wits appraisal. The Wits value should be at least -1 mm, because the patient must be diagnosed with skeletal Class III malocclusion in order to be a potential candidate for miniscrew-anchored maxillary protraction. However, the Wits value should not be excessively negative. The presenter's team found that after treatment, the maxilla typically advances by approximately 2 to 3 mm. Therefore, in patients with very severe sagittal skeletal discrepancies, this treatment approach should be considered cautiously.

The second factor is patient compliance. Although this technique is primarily intraoral, the patient still needs to wear Class III elastics full time. Patients with better compliance are more likely to achieve correction, demonstrate greater treatment changes, and obtain better outcomes.

The third factor is growth status. The patient should be in the prepubertal or pubertal growth spurt period. If the patient has already passed the pubertal growth spurt, the expected effects would be minimal. The speaker might not recommend miniscrew-anchored maxillary protraction for such patients.

The fourth factor is dental development. As discussed in the case presentation, because of the required miniscrew insertion sites, the bilateral mandibular permanent canines must be fully erupted. If the patient is too young, miniscrew placement may be difficult. The speaker prefers to begin miniscrew-anchored maxillary protraction when the patient is in the late mixed dentition stage.

The final factor is the patient's growth pattern. Although the hybrid expander may provide some degree of vertical control, patients with a horizontal growth pattern generally have better treatment effects and more favorable long-term prognosis than patients with a vertical growth pattern.

However, miniscrew-anchored maxillary protraction may not be suitable for patients with cleft lip and palate. These patients may not have sufficient palatal bone for miniscrew placement, so miniscrew placement could be challenging, and hybrid expander may not be an option. In addition, posttreatment stability may be less favorable for these patients. Bone-anchored maxillary protraction allows miniplates to remain in place during growth, enabling the patient to wear Class III elastics at night for active retention purpose, which could be difficult for patients with miniscrews.

In summary, miniscrew-anchored maxillary protraction offers the advantages of lower invasiveness, lower cost, and relatively simple clinical procedures. It may serve as a treatment option for growing adolescent skeletal Class III patients with maxillary deficiency. Because Class III patients have a relatively high risk of relapse, the presenter recommends regular follow-up until the completion of growth, regardless of the maxillary protraction method used.

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Case 2

Miniscrew-Supported Rapid Maxillary Expansion in Late Adolescence

Speaker: Dr. Ivan Silva

01 Case Information

The patient was a male who first presented at 15 years of age. His date of birth was February 2009.

Medical history: No unexpected finding

Clinical examination

Extraoral analyses



Pretreatment extraoral photographs

The patient had normodivergent pattern, passive lip seal, mild facial asymmetry with a chin deviation. During smiling, both the maxillary and mandibular incisors were adequately displayed, with adequate gingival display. The patient presented with increased buccal corridors, and the maxillary dental midline coincided with the facial midline.

The patient had a Class III facial pattern, concave profile, maxillary deficiency, a slightly obtuse nasolabial angle, a mild mentolabial fold, and a slightly increased cervicomental angle.

Intraoral analyses



Pretreatment Intraoral photographs

In the sagittal dimension, the patient presented with bilateral Angle Class III molar relationships and a positive overjet, suggesting dental and dentoalveolar compensation. The mandibular dental midline was deviated to the left, and the mandibular dentition showed moderate crowding.

In the transverse dimension, the patient had bilateral posterior crossbite, indicating maxillary arch constriction.

In the vertical dimension, the patient had a moderate curve of Spee. The anterior overbite was shallow, especially in the lateral incisor region.

Radiographic findings



Pretreatment Panoramic Radiograph

No unexpected findings were observed on the pretreatment panoramic radiograph. The patient was already in the permanent dentition stage.



Pretreatment Hand-Wrist Radiograph

The pretreatment hand-wrist radiograph indicated that the patient had passed the pubertal growth peak but still had some remaining growth potential.



Measurement	Value
SNA	81.5°
SNB	83.5°
Wits	-5.4 mm
SN-GoGn	28.4°
Mx1-PP	119.5°
IMPA	79.5°

Pretreatment cephalometric analysis

The pretreatment cephalometric analysis showed an SNB angle of 83.5°, indicating mandibular prognathism. The Wits appraisal was -5.4 mm, indicating skeletal Class III malocclusion. The mandibular plane angle, SN-GoGn, was 28.4°, suggesting an average growth pattern. The maxillary incisor inclination was 119.5°, and the mandibular incisor inclination was 79.5°, indicating lingual compensation of the mandibular incisors.

The initial diagnosis was skeletal Class III malocclusion, Angle Class III malocclusion, bilateral posterior crossbite, mandibular dentition crowding, and mandibular midline deviation.

02 Treatment Plan

The presenter's team proposed three treatment options:

1. Conventional rapid maxillary expansion combined with comprehensive orthodontic treatment
2. Miniscrew-assisted rapid palatal expansion, or MARPE, combined with comprehensive orthodontic treatment
3. Maxillary expansion using a hybrid hyrax expander, combined with comprehensive orthodontic treatment

The speaker emphasized that MARPE uses four palatal miniscrews, while the hybrid expander uses only two palatal miniscrews.

After comprehensive consideration, the speaker decided to treat the patient with a hybrid expander.

03 Orthodontic Treatment Progress

The speaker selected a prefabricated hybrid expander. Bands were placed on the first molars, and two miniscrews were inserted in the anterior palate. The miniscrews measured 1.8 mm in diameter and 7 mm in length, with a 4 mm transmucosal collar. They were inserted after the expander was placed, with an insertion torque of 30 N·cm.

The insertion sites were located bilaterally in the anterior palate, adjacent to the midline. The miniscrews were inserted into the palate at a 60-degree angle to the occlusal plane, in the first third of the descent part of the palate.



Intraoral Photographs After Expander Placement

The patient was instructed to activate the expander twice daily for 14 days, with an expected total expansion of 10 mm.



Extraoral and Intraoral Photographs After Expansion



A periapical radiograph confirmed opening of the midpalatal suture.

After expansion, a large diastema was observed between the maxillary central incisors, indicating that the expansion process had progressed successfully. The presenter also took a periapical radiograph to confirm the opening of the suture.

The expander was left in place for retention purpose. The retention phase lasted 6 months. During this period, the anterior overbite improved, the diastema between the maxillary central incisors decreased, and multiple generalized spaces were observed in the anterior region.



Extraoral and Intraoral Photographs 6 Months After Expansion and After Expander Removal

The presenter evaluated the 3D expansion outcomes using intraoral scans, three-dimensional facial photographs, and CBCT imaging.

In the sagittal dimension, the maxilla advanced by 1 mm, the ANS advanced by 3.42 mm, and the maxillary first molar showed approximately 1 mm of mesial movement. In the transverse dimension, the zygomatic region moved laterally by 4.59 mm, the nasal cavity width increased by 3.05 mm, and the maxilla moved laterally by 5.82 mm. The dental arch width also increased. Dental buccal movement of 4.61 mm, 5.43 mm, and 4.3 mm was observed in the canine, premolar, and molar regions, respectively. The bilateral molars also showed varying degrees of buccal tipping, which was confirmed by intraoral scan data. In the vertical dimension, the maxilla moved downward. The ANS moved inferiorly by approximately 1.58 mm, and the maxillary body moved inferiorly by approximately 2.04 mm. At the same time, the bilateral molars showed varying degrees of intrusion.

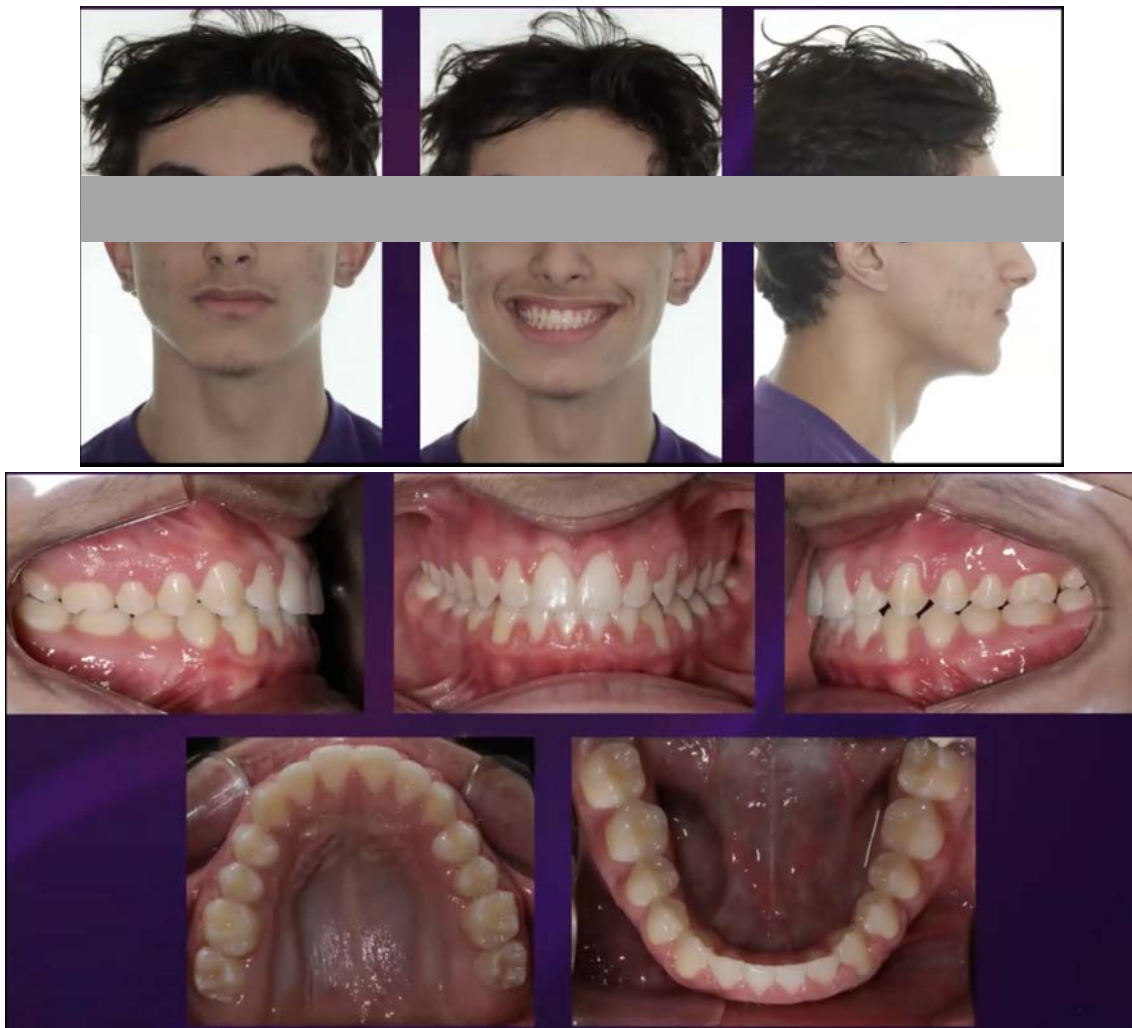
Compared with the right side, the left side showed 4.5 mm more lateral displacement in the zygomatic region, 1.58 mm more leftward displacement of ANS, and 3.82 mm more leftward displacement of the maxilla.

Facial measurements showed that the intercanthal distance increased by 0.03 mm, the nasal base width increased by 0.21 mm, and the intercommisural distance increased by 4.1 mm.

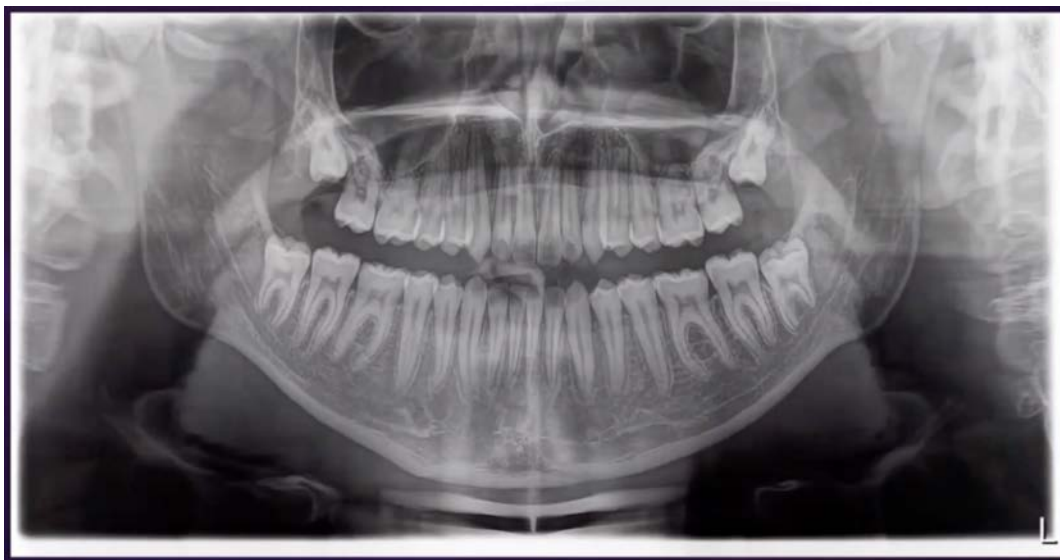
After expansion, the presenter proceeded with comprehensive orthodontic treatment. The main treatment objectives were to maintain a positive overjet and correct the Class III relationship through appropriate dental and dentoalveolar compensation. The bracket prescription selected by the presenter was Capellozza Class III. This prescription can help control the inclination of the mandibular canines while maintaining a certain degree of maxillary incisor proclination, thereby facilitating camouflage orthodontic treatment.

The presenter bonded brackets on all maxillary teeth and all mandibular teeth except the four incisors. A sectional arch technique was used in the mandible. The purpose was to maintain the existing overjet and avoid proclination of the mandibular incisors. The patient was also instructed to begin Class III elastics early and wear them continuously to assist with sagittal dental movement. In addition, to gain space and reduce the tendency for mandibular incisor proclination, the presenter performed a certain amount of interproximal reduction. Once sufficient space had been obtained, the mandibular incisors were incorporated into the orthodontic appliance system.

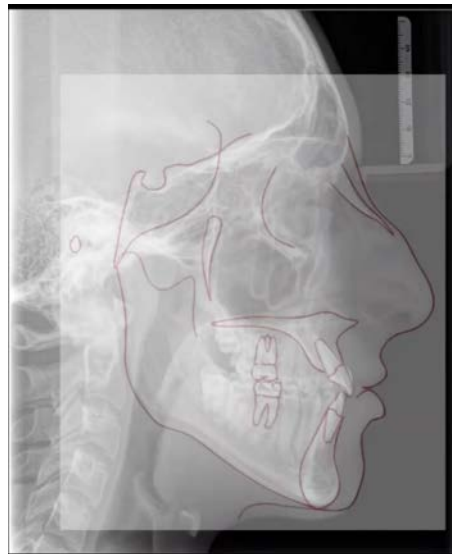
04 Orthodontic Treatment Outcomes



Posttreatment Extraoral and Intraoral Photographs



Posttreatment Panoramic Radiograph



Measurement	Pretreatment	Posttreatment	Difference
SNA	81.5°	81.8°	0.3°
SNB	83.5°	83.9°	0.4°
Wits	-5.4 mm	-5.2 mm	0.2 mm
SN-GoGn	28.4°	28.9°	0.5°
Mx1-PP	119.5°	118.9°	-0.6°
IMPA	79.5°	78.3°	-1.2°

Posttreatment Cephalometric Analysis and Comparison of Pretreatment and Posttreatment measurements

The patient was very satisfied with the treatment outcome. However, because oral hygiene was not ideal during orthodontic treatment, the patient's periodontal condition was compromised. The panoramic radiograph showed good root positioning. Because the patient was treated with camouflage orthodontics, the cephalometric changes were mainly attributed to changes in the inclination of the maxillary and mandibular incisors.

05 Discussion

Rapid maxillary expansion is one of the primary clinical approaches for correcting transverse discrepancies. Conventional maxillary expanders typically use the teeth as anchorage for expansion. In 2007, Wilmes proposed the design of the hybrid expander. The original concept was to concentrate the expansion force on the maxilla, rather than relying solely on dental anchorage, when performing maxillary expansion in growing patients.

Current evidence suggests that, compared with conventional expanders, bone-supported expanders may be more suitable for late adolescent patients because they can reduce associated dental side effects. In a

recently published expert consensus, experts agreed that skeletal anchorage expanders can reduce posterior buccal tipping compared with tooth-borne expanders. However, no consensus was reached regarding whether skeletal anchorage expanders can produce greater skeletal expansion than tooth-borne expanders.

Regarding pain and discomfort during expansion, there is no significant difference between hybrid expanders and conventional expanders. The presenter stated that during miniscrew placement under local anesthesia, patients usually do not complain of pain. However, they may report an unusual sensation near the nasal floor, which may be related to the proximity of the miniscrew insertion sites to the nasal floor.

For case selection, the speaker used hand-wrist radiographs to assess the patient's growth status. The speaker also attempted to analyze the maturation stage of the midpalatal suture using CBCT, but found that this was not always clinically straightforward. In his opinion, midpalatal suture maturation staging is more of a predictive tool than a diagnostic tool. The maturation stage of the midpalatal suture is not strongly correlated with whether rapid maxillary expansion can be successfully achieved. The speaker noted that some reports have shown successful rapid maxillary expansion with miniscrew-supported expanders even in relatively older patients with stage E midpalatal sutures. Therefore, midpalatal suture staging may be more appropriate for predicting treatment outcomes rather than screening whether a patient is eligible for rapid maxillary expansion.

During expansion, the stability of miniscrews as an anchorage source is critical. The presenter recommended placing miniscrews in the anterior palate because this region has relatively thick bone. Stability is also related to the patient's oral hygiene. If inflammation or infection occurs around the miniscrew insertion sites, the miniscrews may lose stability, become mobile, or even fail.

The speaker recommended emphasizing the importance of oral hygiene to patients and monitoring them closely. Orthodontists should instruct patients on how to clean around the miniscrews and expander during daily oral hygiene procedures. The speaker stated that he instructs patients to use two different types of toothbrushes, a soft-bristled toothbrush and an interdental brush, for daily cleaning. If patients have difficulty maintaining adequate hygiene, they may also use mouth rinse or apply chlorhexidine gel around the miniscrew insertion sites.

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