

Pseudo-Class III Malocclusion with Anterior Crossbite and Bilateral Upper Transalveolar Impacted Canines: Four Premolar Extraction, Aligners, and Segmented Fixed Appliances

Abstract

History: An 18yr-11mo-old female presented with chief complaints of anterior crossbite, multiple missing teeth, and a protrusive chin.

Diagnosis: The patient was diagnosed with bimaxillary protrusion combined with an anterior crossbite, bilateral upper impacted canines, unerupted UR8, and missing UR7. The Discrepancy Index (DI) was 21.

Treatment: Four first premolars were extracted prior to Invisalign® treatment. The upper extraction spaces were maintained to allow the impacted canines to erupt. The lower extraction spaces were closed with aligners and segmental braces. The impacted UR3 erupted spontaneously, but the impacted UL3 and UR8 did not. Following surgical exposure, they were aligned using aligners, buttons, power chains (PCs), and elastics.

Results: After 43 months of active treatment, this malocclusion, with a Discrepancy Index of 21 points, was treated to a Cast-Radiograph Evaluation (CRE) score of 20 points and a Pink and White esthetic score of 2 points. The impacted canines were successfully aligned, with the impacted UR8 recovered and substituted for the missing UR7. The patient was pleased with the treatment outcome.

Conclusions: Careful treatment planning and clinical monitoring are prerequisites for treating challenging patients. Hybrid mechanics combining the strengths of segmented fixed appliances and clear aligner therapy are effective in correcting anterior crossbite, multiple impactions, and protrusive chin. (*J Digital Orthod* 2024;75:4-26)

Key words:

Clear aligner therapy (CAT), fixed appliance (FA), segmental fixed appliances, clear aligner, bimaxillary protrusion, four premolars extraction, anterior crossbite, functional shift, impacted canine, U8 for U7 substitution, Invisalign®, pseudo-Class III

The dental nomenclature for this paper is a modified Palmer notation with four oral quadrants: upper right (UR), upper left (UL), lower (LR) and lower left (LL). From the midline the permanent teeth are numbered 1-8.

Introduction

In 1997, two Stanford University students named Zia Chishti and Kelsey Wirth founded the company Align Technology.¹ Two years later, Align Technology introduced the first commercial clear aligner system called Invisalign. This system was initially only available to orthodontists, and was subsequently

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accessible to general dentists. The indication was originally limited to minor alignment problems. Due to advancement in technology and materials, these removable appliances can now be applied to complex malocclusions. In 2017, Grünheid et al.² compared the differences between the predicted

and achieved tooth positions for patients who received aligner treatment. The study found that although some planned tooth movements could not be entirely achieved, Invisalign was able to achieve predicted tooth positions with high accuracy in non-extraction patients.



■ **Fig. 1:** Pre-treatment facial and intraoral photographs

Invisalign has sparked a worldwide trend with an increasing number of patients choosing to use them. Compared to traditional braces, there are numerous advantages such as esthetics, comfort, easy maintenance, high patient acceptance,³ and less risk of developing white spot lesions.⁴

However, the drawbacks include high costs and an increased level of patient cooperation. Moreover, more challenging tooth movements are difficult to achieve with this system alone. Challenging teeth movements include mesiodistal tipping,⁵ extrusion,⁶ rotation of canines⁷ and extraction space closure.⁸

The aim of this study is to present a complex treatment for bilateral upper impacted canines, anterior crossbite, and pseudo-Class III malocclusion that was treated with a combined hybrid approach.

History and Etiology

An 18-year-old female sought orthodontic consultation for multiple missing teeth and a protrusive chin. No contributing medical or dental histories were reported. Her facial profile was

unesthetic due to mandibular prognathism. Clinical examination revealed a concave facial profile, lower lip protrusion, an acute nasolabial angle, and anterior crossbite (Fig. 1). An intraoral examination revealed that the UR7 was missing, and UR3, UL3, and UR8 were impacted. The overjet was -2 mm, and the overbite was 2 mm in centric occlusion (C_0). Buccal segments were Class I on the right and Class III on the left. An edge-to-edge incisal relationship was noted when the mandible was guided to the centric relation (C_R) position (Fig. 2). Panoramic radiography (Fig. 3) revealed that two upper canines were high impactions. The UR3 was positioned at the apex of UR4, whereas the UL3 was near the apex of the UL2. Lateral cephalometric radiographs indicated decreased inclination of the incisors in both arches and a relatively straight profile when the patient occluded in C_R (Fig. 4). The increased SNB angle indicated mandibular prognathism. If clockwise rotation of the mandible is achieved during orthodontic treatment, the SNB and mandibular plane angle and anterior crossbite would be improved.



■ Fig. 2: In C_R , an edge-to-edge relationship and 3 mm midline discrepancy was noted, indicating a functional shift.

Diagnosis

Facial:

- Facial Convexity: *Within normal limits (WNL)* (G-Sn-Pg', 13°)



■ Fig. 3: Pre-treatment panoramic radiograph

- Lip Protrusion: *Protrusive lower lip*

Skeletal:

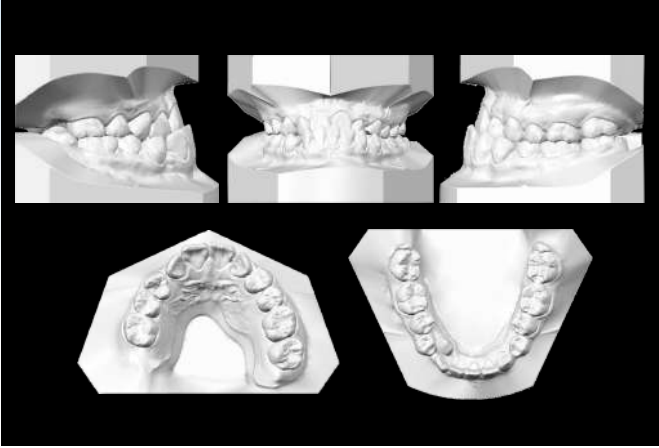
- Sagittal Relationship:
 - Class III tendency at C₀ position (SNA, 85°; SNB, 86°; ANB, -1°)
 - Mandibular plane angle: *Low angle* (SN-MP, 27°; FMA, 20°)

Dental:

- Occlusion: *Right Class III, left Class I molar relationship* (Fig. 5)
- Overjet: -2 mm
- Upper and Lower incisors: WNL



■ Fig. 4: Cephalometric radiograph in the C₀ (left) and C_R (right) positions. See text for details.



■ **Fig. 5:** Pre-treatment digital dental models (casts)

- Crossbite: *Upper and lower anterior teeth*
- Impaction: *The UL3 crown was transposed and impinging on the UL2 root. The UR3 was transposed impinging on the UR4 root.*

American Board of Orthodontics (ABO) Discrepancy Index (DI): 21.

Treatment Objectives

1. Level and align both arches.
2. Open the bite, and rotate the mandible posteriorly.
3. Maintain the upper incisors and retract the lower incisors to correct the anterior crossbite with aligners and anterior bite turbos.
4. Maintain the spaces for upper impacted canines to erupt.

Treatment Plan

The overall objectives were to correct the pseudo-Class III malocclusion, maintain the upper incisor positions sagittally, retract the lower arch and restore the missing UR7, impacted UR3, and UL3. Four treatment options were considered (Fig. 6).

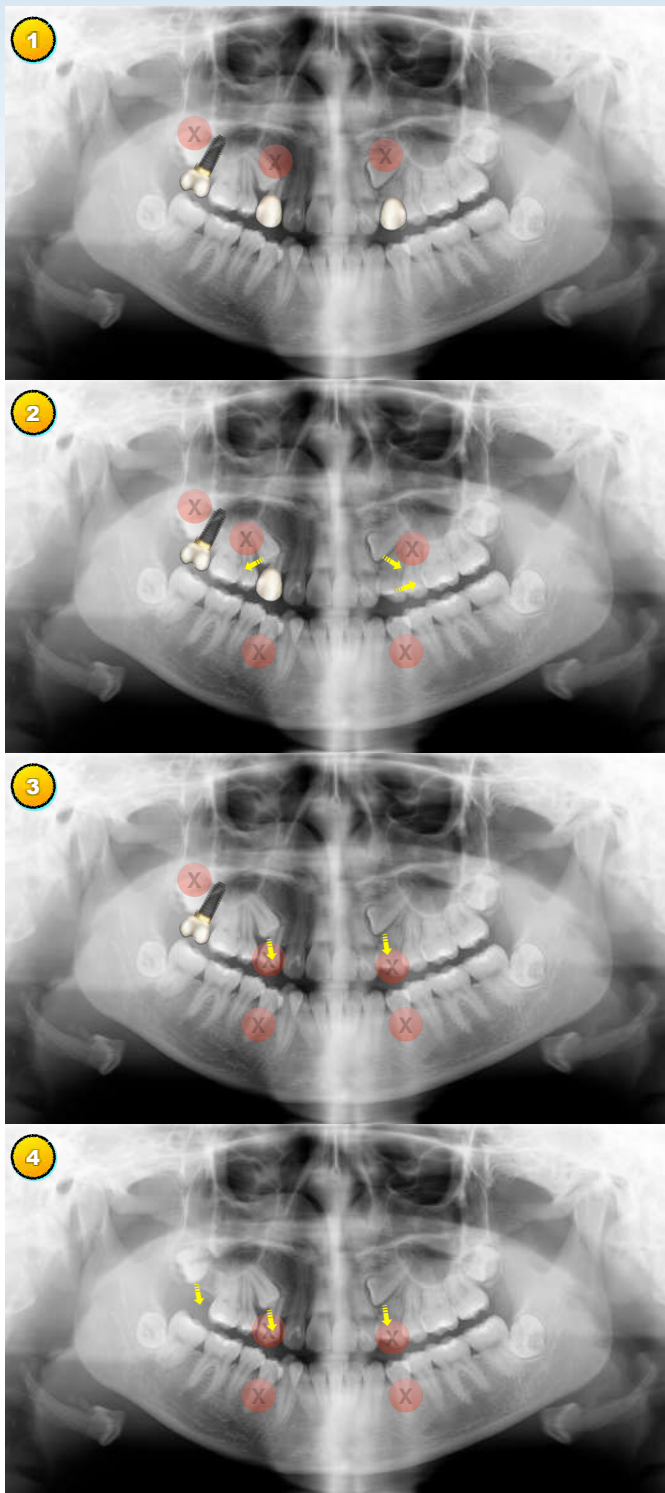
Option 1: Remove the impacted UR8, UR3, and UL3, and substitute them with the adjacent first premolars. Then, proceed with Lefort I surgery combined with bilateral intramural vertical ramus osteotomies.

Option 2: Extract bilateral upper second premolars and lower first premolars. Retain the upper extraction spaces for the impacted canines to erupt into. Perform surgical exposure if necessary. Place one implant-supported prosthesis in the UR7 area.

Option 3: Extract four first premolars. Retain the upper extraction spaces for the impacted canines to erupt into. Perform surgical exposure if necessary, and place one implant-supported prosthesis in the UR7 area.

Option 4: Extract four first premolars. Retain the upper extraction spaces for the eruption of the impacted canines. Perform surgical exposure procedure if necessary, and substitute the missing UR7 with the impacted UR8.

The benefits of the first option are easier process for the aligner technician and less treatment time. However, this option is undesirable because (1) more surgical intervention; (2) surgical correction of the jaws complicates orthodontic finishing; and (3) substituting the premolars with the impacted



■ Fig. 6: Treatment option 1-4. See text for details.

canines would result in an unesthetic outcome and a functional compromise.

The second option proposes extraction U5s instead of U4s, which would be efficient for anterior crossbite management. However, retaining U4s may cause a barrier for the impaction.

As for the third option, extracting bilateral upper first premolars may facilitate eruption of the impacted canines, but subsequent correction of the anterior crossbite would be more time-consuming.

Compared to the third option, the fourth option reduces the patient's cost because no implant

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA° (82°)	85°	85°	0°
SNB° (80°)	86°	84°	2°
ANB° (2°)	-1°	1°	2°
SN-MP° (32°)	27°	31°	4°
FMA° (27°)	20°	24°	4°
DENTAL ANALYSIS			
U1 TO NA mm (4mm)	3	4	1
U1 TO SN° (104°)	107°	108°	1°
L1 TO NB mm (4mm)	5	2.5	2.5
L1 TO MP° (90°)	91°	85°	6°
FACIAL ANALYSIS			
E-LINE UL (-1mm)	-2	-2	0
E-LINE LL (0 mm)	0	0.5	0.5
%FH: Na-ANS-Gn (56%)	52%	56%	4%
Convexity: G-Sn-Pg (13°)	13°	4°	9°

■ Table 1: Cephalometric Summary

would be necessary. But this option is the most difficult clinically. All three impacted teeth will be uncovered and aligned into the occlusion.

After discussing the four options with the patient and her parents, the fourth option was chosen because it was most likely to achieve a near ideal dentofacial result in a minimally invasive manner.

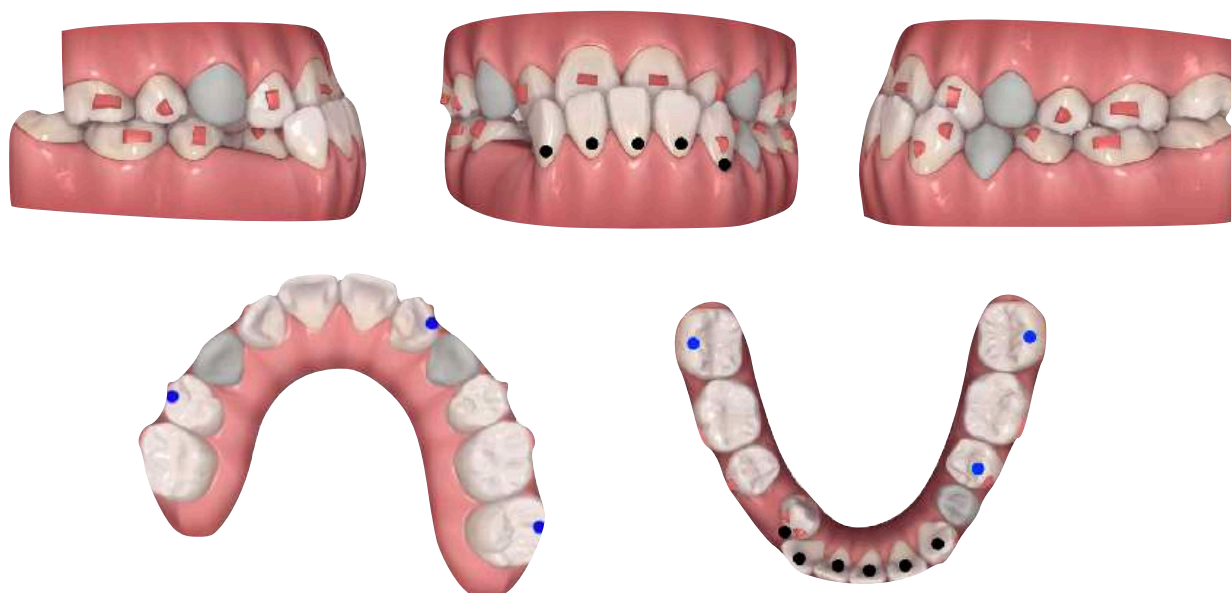
Treatment Progress

iTero Element® intraoral scan (Align Technology, Inc., San Jose, CA, USA) provides a 3D dataset. The ClinCheck® (Align Technology, Inc., San Jose, CA, USA) system was used to plan the treatment and project the outcome. Both optimized and conventional attachments were applied in sequential staging (Fig. 7). The treatment was

conducted in two phases: initial and refinement. Oral hygiene and aligner fit were monitored at monthly intervals.

Initial phase

The major goals of the initial treatment were to correct the anterior crossbite⁹ and keep the upper extraction spaces for the impacted canines to erupt into (Fig. 8). Four first premolars were extracted before the aligner treatment started. A total of 59 sets of aligners were used over 17 months. The first 19 sets of aligners were changed every 10 days. Optimized root control attachments were used on the lower canines. Gingival bevel attachments were applied to the upper incisors. Meanwhile, no power ridges were applied to the lower incisors (Fig. 7). Conventional rectangular and



■ **Fig. 7:**

ClinCheck® treatment plan and prescribed attachments are shown for the initial phase of treatment. Blue dots indicate variably predictable tooth movement (2.5-3 mm intrusion for lower incisors; 4-6 mm root movement for LR5). Black dots indicate less predictable tooth movement (>3 mm intrusion for upper incisors; >6 mm root movement for UR3). See text for details.

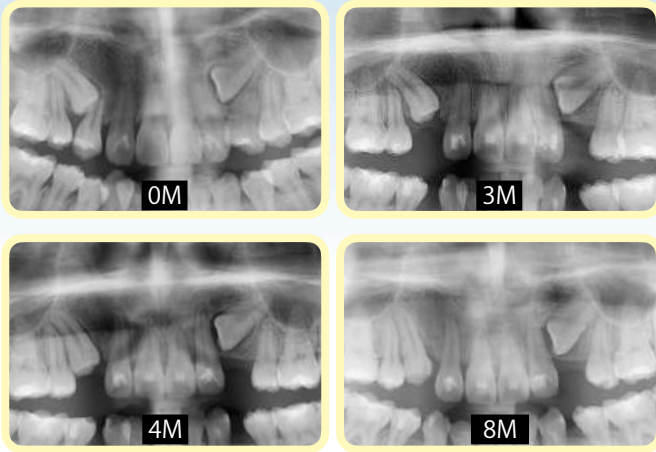


Fig. 8:
Upper right canine erupted gradually after the impinging first premolar was removed. The upper left canine did not erupt. Hence, surgical exposure was performed to facilitate eruption.



Fig. 9:
Wooden tongue depressor was bitten three times a day for two minutes each from aligner 7 (A7) onward.⁹ The lower anterior bite turbo was bonded from aligners 53 (A53).

optimized anchorage attachments were provided for the posterior teeth. SmartStage® technology was also used for the lower posterior teeth to minimize any unwanted tipping.

In order to correct the anterior crossbite, the patient was instructed to bite on a wooden tongue depressor three times a day from aligner 7 onward (Fig. 9).¹⁰ According to the Clincheck design, the anterior crossbite should have been corrected after aligner 40. However, the crossbite remained even after aligner 53. Therefore, a lower anterior bite turbo was bonded, and the patient continued to use the depressor. The anterior crossbite was corrected within three months. No Class III elastics were used during the initial phase.

The treatment progress is documented from the maxillary occlusal, mandibular occlusal, right lateral, and left lateral views, respectively (Figs. 10-13).

Following premolar extractions, the impacted upper right canine erupted spontaneously after six months (Figs. 8 and 10). Unfortunately the upper left canine failed to erupt. This was likely due to the lateral incisor blocking the pathway. Therefore, in the tenth month (aligner 32), surgical exposure of UL3 and UR8 was performed. UR3 eruption was inhibited so cross-arch elastics were applied for de-rotation and alignment (Fig. 12).

The lower extraction spaces were closed at the end of the first phase of aligners (Fig. 11). However, the lower left molars tilted mesially. Brackets were bonded on LL5-7, and a segmented archwire uprighted the molars in two months (Fig. 13).

Refinement phase

Two rounds of refinement (finishing), with 39 and 23 additional aligners respectively, were conducted to close the residual spaces and align the upper left canine. The Class III molar relationship on the right was corrected by lower

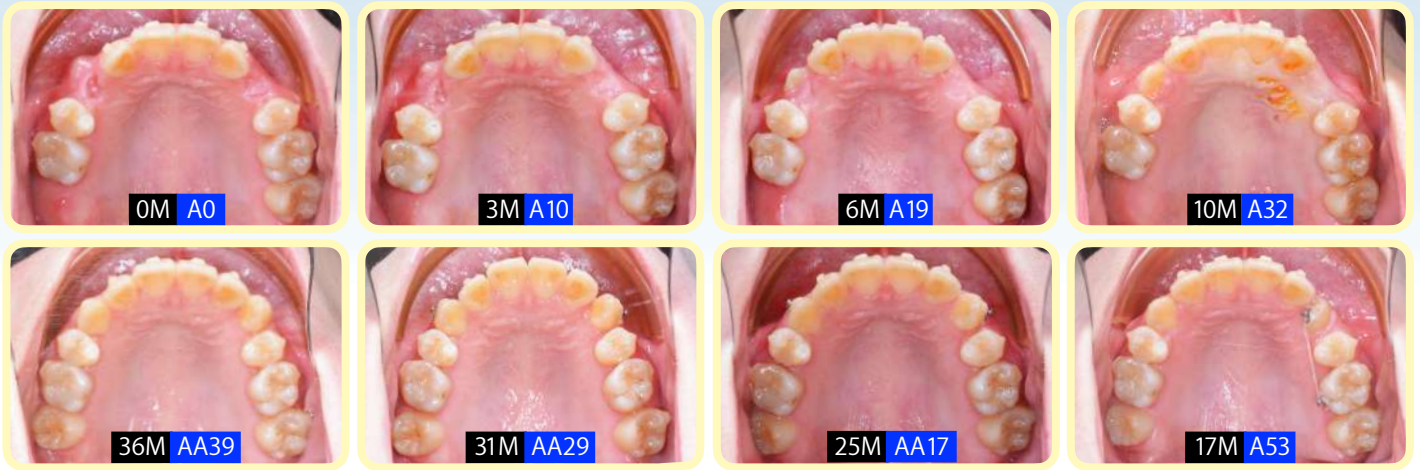


Fig. 10:
Treatment progress from the maxillary occlusal view and aligner progression are shown from the start of treatment (0M) to thirty-six months (36M) in a clockwise order.

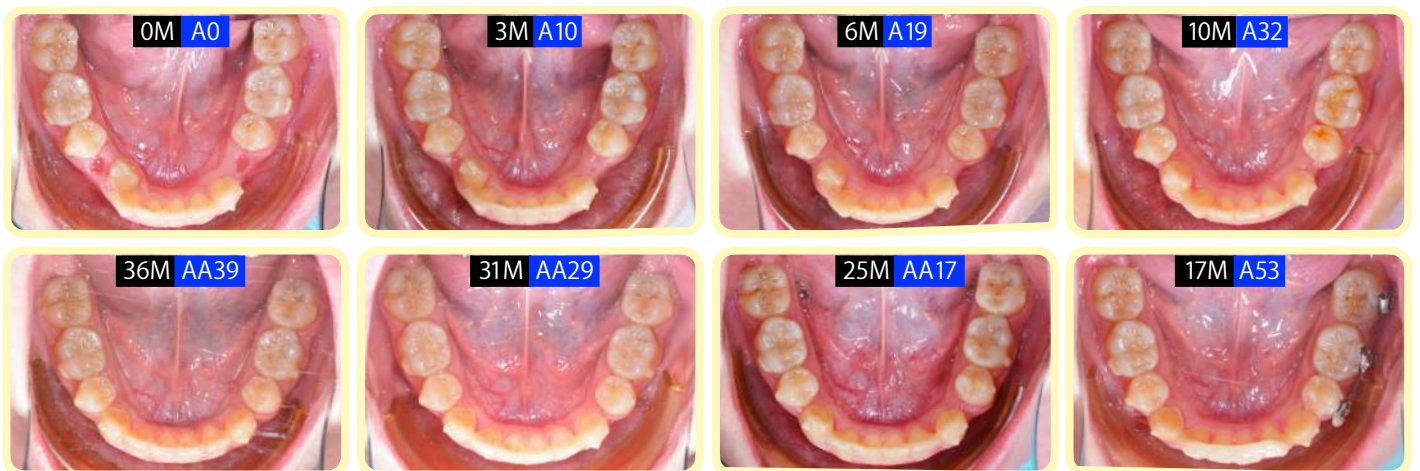


Fig. 11:
Treatment progress from the mandibular occlusal view and aligner progression are shown from the start of treatment (0M) to thirty-six months (36M) in a clockwise order.

molar distalization. In the finishing stage, heavy occlusal contacts on the posterior teeth were reduced. Subsequently, conventional attachments replaced the optimized attachments to provide predictable retention. Button cutouts were prescribed for both upper canines, and cross-arch elastics were applied for further extrusion.

Retention

Sectional twisted wires were bonded from UR2 to UL2 and LR3 to LL3 after the aligner treatment. Two ESSIX (overlay plastic) retainers were given to the patient to maintain the corrected alignment and leveling of the dentition in both arches. The patient was instructed to wear the retainers throughout the



■ **Fig. 12:**
 Treatment progress from the right lateral view and aligner progression are shown from the start of treatment (0M) to thirty-six months (36M) in a clockwise order.



■ **Fig. 13:**
 Treatment progress from the left lateral view and aligner progression are shown from the start of treatment (0M) to thirty-six months (36M) in a clockwise order. Note posterior open bite must close spontaneously after aligner treatment. Hopefully the posterior occlusion would settle naturally through masticatory function to achieve maximum occlusion without casing anterior bite deepening.

day during the first month and only while sleeping thereafter.

Final Evaluation of Treatment

After 43 months of active treatment, this difficult malocclusion (DI = 21) was treated to an optimal

alignment with a Cast-Radiograph Evaluation score of 20 and an excellent Pink and White esthetic score of 2 (see worksheets at the end of this case report). Two main discrepancies from an ideal outcome were noted: (1) mesio-out rotation of the upper left canine, and (2) multiple open contacts of the posterior occlusion (Figs. 15 and 16). Posttreatment panoramic



Fig. 14:
Surgical exposure procedure was performed at tenth months. Soft tissue was removed by diode laser, and underlying hard tissue was trimmed with a high speed bur.

and lateral cephalometric radiographs are shown in Figs. 17 and 18, respectively. Although multiple open contacts were noted at the end of the treatment, they are expected to settle with natural masticatory function. After the functional shift was corrected, the facial profile was improved and the buccal segments were in a Class I occlusion. Superimpositions of the pre- and posttreatment cephalometric tracings reveal late facial growth, dentofacial orthopedic changes of the maxilla, and posterior rotation of the mandible (Fig. 19).

Assessment of specific objectives:

Maxilla (all three planes):

- A-P: *Slightly increased*
- Vertical: *Maintained*
- Transverse: *Maintained*

Mandible (all three planes):

- A-P: *Decreased*
- Vertical: *Increased*
- Transverse: *Maintained*

Maxillary Dentition:

- A-P: *Slightly proclined incisors*
- Vertical: *Slightly intruded molars*
- Inter-Molar/Inter-Canine Width: *Maintained/Increased*

Mandibular Dentition:

- A-P: *Incisors retracted*
- Vertical: *Molars up-righted*
- Inter-Molar/Inter-Canine Width: *Maintained*

Facial esthetics:

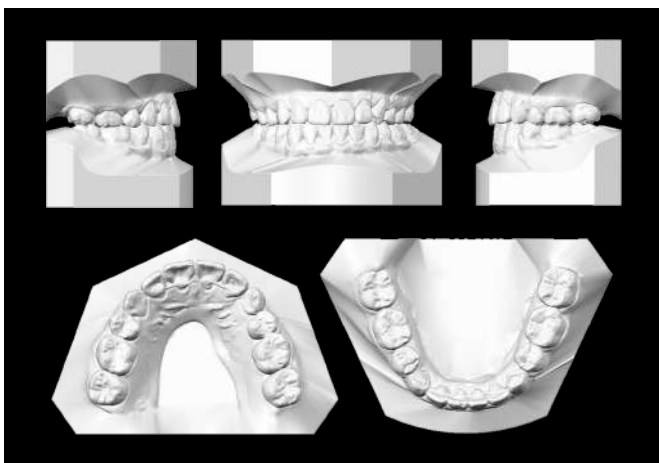
- Lateral profile was significantly improved. Clockwise rotation of the mandible was achieved (Fig. 19) .

Discussion

Due to reasons such as esthetics, comfort, and less risk of developing decay, an increasing number of patients are choosing aligners over traditional braces for full mouth orthodontic treatment. Clinicians using aligners can save a significant amount of chair time if tooth movements progress as planned without unexpected complications. To



■ Fig. 15: Posttreatment facial and intraoral photographs



■ Fig. 16: Posttreatment dental models (casts)

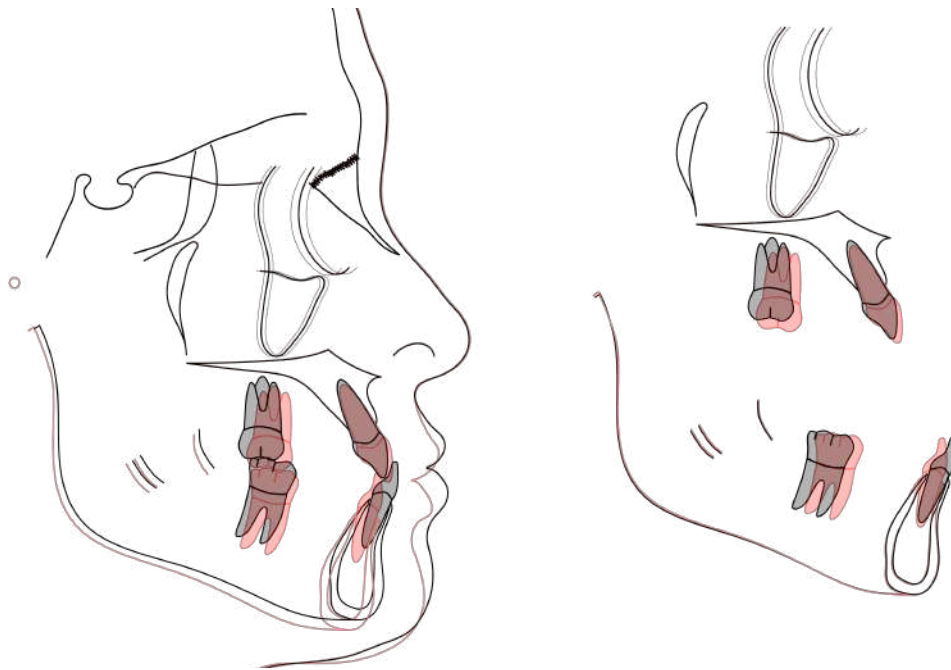


■ Fig. 17: Posttreatment panoramic film



minimize occurrences of undesired outcomes, a thorough understanding of the material characteristics and the pros and cons of aligners is necessary. With fixed appliances, the archwire is engaged on the brackets bonded on the surface of the dentition. The activated archwire is elastically deformed and moves the tooth to a determined position as it returns to its original shape. Three dimensional tooth movements can usually be achieved as planned. Aligner plastic encapsulates the teeth so controlled movement requires both retention and activation. In general, the natural undercuts of the teeth provide the retention. Moments and forces for tooth movement are provided by the elastic deformation of the aligner.

■ Fig. 18: Posttreatment cephalometric radiograph



■ Fig. 19: Superimposed pre-treatment (black) and posttreatment (red) cephalometric tracings show the occlusion was finished at Class I, and anterior teeth and lower molar were up-righted. Lower incisor was intruded. A clockwise rotation of the mandible was noticed.

For example, the predictability of faciolingual movement is enhanced as the entire body of the aligner undergoes elastic distortion. Subsequently, as it reverts to its original form, the aligner carries the teeth along. Conversely, achieving vertical movement requires the aligner to stretch primarily within its plastic matrix. Due to the inherent limitations of elasticity in the aligner, intrusion and extrusion is challenging.

The fundamental differences between aligner and fixed appliance

- The accuracy of tooth movements

In Kravitz et al.'s study⁶ in 2009, the mean accuracy of tooth movement with Invisalign is 41%. The most accurate movement is crown tipping (47%), and the least accurate movement is extrusion (29.6%).⁶ Specifically, central and lateral incisors are the most difficult teeth to be extruded. Despite having either gingival or occlusal bevels, horizontal rectangular attachments are significantly more effective than optimized ones.¹¹ If horizontal attachments are still ineffective, bonding metal buttons to the inner and outer surfaces of the teeth and using elastic bands around the aligner to achieve extrusion is also a viable method.

Moreover, rotation of canines⁷ and premolars¹² have the lowest accuracy because they are round. Lack of purchase points restricts mechanics. An attachment for an aligner is analogous to a handle on a wardrobe or cabinet. The attachment (handle) provides retention for the overlaying aligner.¹³ If placing attachments is still ineffective, button cutouts on the inner and outer sides of the aligner

allows bonding of buttons to improve the situation. Overcorrection is not recommended.¹⁴

- Non extraction treatment

Overall, clear aligner therapy (CAT) is effective in aligning and straightening dental arches, particularly showing better results for mild to moderate crowding compared to fixed appliances (FAs) in non-growing patients.¹⁵ Aligners are particularly adept for adjusting slight buccolingual inclinations of upper and lower incisors.¹⁶ However, with crowding over 6 mm, incisors may protrude post-alignment using CAT.¹⁷ Although CAT can adjust the width of canine, premolar, and molar spaces similarly to FAs, which helps relieve crowding, it struggles with arch expansion through bodily tooth movements.^{17,18}

While crown tipping can be achieved with aligners alone, root movement is more challenging. Therefore, patients treated with Invisalign face relapses more than those treated with conventional fixed appliances.¹⁹ In the last few months of orthodontic treatment, it is necessary to take panoramic films to ensure root parallelism.

- Extraction cases

Using Invisalign for extraction cases is similar to using a soft archwire in traditional orthodontics to close the premolar extraction spaces, which often leads to a drawbridge effect. Aligners, like soft archwires, lack sufficient rigidity and cannot avoid the side effects.

In 2021, Dai, Xu, and Guang²⁰ removed the upper first premolars from 17 patients and treated them using Invisalign G6 protocols throughout the entire



■ Fig. 20:

Diagrams showing the side effects of extraction cases treated with aligners only. Tooth crown movements were not fully achieved as predicted following Invisalign treatment. Differences mainly lie in mesial tipping, buccal inclination, mesial displacement, and intrusion of the first molars, as well as distal tipping, lingual inclination, insufficient retraction, and extrusion of central incisors.²⁰

process. A comparison was made between the actual and expected positions of the maxillary and mandibular central incisors, canines, and first molars. It was observed that first molars achieved greater mesial tipping, medial displacement, and buccal inclination in both the maxilla and mandible. Furthermore, there was more intrusion in the maxilla and greater mesial-lingual rotation with less constriction in the mandible (Fig. 20). The canines were distally tipped in both the maxilla and mandible. Less retraction in the maxilla and greater lingual inclination and extrusion in the mandible were noted. The central incisors were extruded and tipped both distally and lingually.

Is the bowing effect predictable when closing extraction sites with aligners? For a crowded dentition, adjacent teeth require less movement after extraction, reducing the likelihood of incisor lingual tipping and molar mesial tipping. Conversely, in cases with well-aligned dentition,

the larger space to be closed increases the risk of tipping side effects. If these problems are anticipated, the time wearing each set of aligners should be increased. Complementary measures such as using a segmented archwire (Fig. 21), miniscrews, Class II-V, or Class III-V elastics (defined below) should be considered (Fig. 22).

Class II-V and Class III-V elastics

Class II-V and Class III-V elastics (Fig. 22) provide an extrusion force for the tilted canines and molars as well as an uprighting moment which the G6 protocol and SmartStage® cannot provide. Moreover, Class II-V and Class III-V elastics offer the force vector for AP correction. Performing this method requires a metal button, a hook button, and 6 oz 3/8" elastics. In ClinCheck design, the precision cuts should be placed on the canines, and button cut-outs should be placed on the upper and lower first molars (Fig. 22).



Fig. 21:
The lower posterior teeth tilted mesially during extraction space closure. The braces were intentionally bonded mesio-gingivally to obtain an up-righting moment. The angulations of these three posterior teeth were significantly improved within three months.



Fig. 22:
Class II-V and Class III-V elastics require two buttons bonded on the canine and first molar respectively, one hook button bonded on the opposite first molar, and 3/8", 6.5 oz elastics. This can be used either for preventing or correcting the side effect. If there is an esthetic concern, the metal button on the canine can be replaced with a precision cut and rectangular attachment.

• ClinCheck design

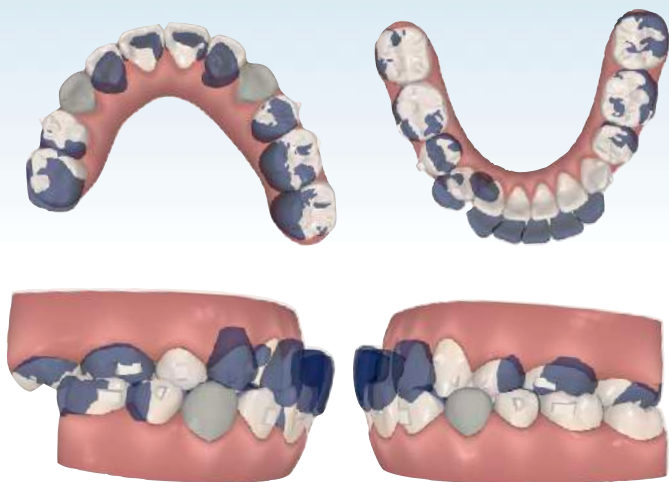
In treating extraction cases, there are several suggestions for ClinCheck design:

1. Set the final overbite with 0.5 mm overcorrection.
2. Sequentially retract anterior teeth to prevent anchorage loss.
3. Increase the number of aligners to assure sufficient time for the roots to move.

4. In ClinCheck, setting the maximum anchorage for each set of aligners gives the roots more time to catch up with the movement of the crowns (Fig. 23).

Impaction management

Treating impactions with aligners requires thorough consideration for the direction of the extrusive force and its reciprocal anchorage. Indeed, anchorage may be acquired from a neighboring tooth, an antagonist tooth,



■ **Fig. 23:**
Initial treatment phase: ClinCheck treatment plan with superimposition (blue: initial arch form, white: simulated arch form after treatment). Maximum anchorage was planned in the upper arch and moderate anchorage in the lower arch.

miniscrews, and even the aligner itself (Fig. 24). When using a fixed appliance, extrusion becomes easier if brackets can be bonded to engage the archwire. With time, the fixed appliance mechanics gradually extrude the impaction.

The present patient had three impactions: UR8, UR3, and UL3. After removing the impeding upper first premolars and performing surgical exposure, UR8 and UL3 gradually erupted (Fig. 14). However, UL3 remained partially erupted and rotated. Extrusion and rotation are two of the less likely achievable movements using only aligners, so off-tracking should be anticipated. If extrusion and rotation are both necessary, rotation should be carried out first. Otherwise, incomplete extrusion or further gingival recession may occur (Fig. 24).

Anterior crossbite correction

During anterior crossbite correction, the lower anterior teeth may be trapped by the upper anterior teeth. In conventional orthodontic correction, the typical approach involves using an anterior or posterior bite turbo to increase the vertical dimension. With aligners, however, due to the thickness of the aligner itself, the bite can be opened. During ClinCheck design, attachments can be strategically placed on the occlusal surfaces. Patients can also be instructed to use a wooden tongue depressor to advance the upper anterior teeth. Both methods can expedite the correction of anterior crossbite (Fig. 25).^{9,10}

Case finishing quality regarding DI/CRE scores

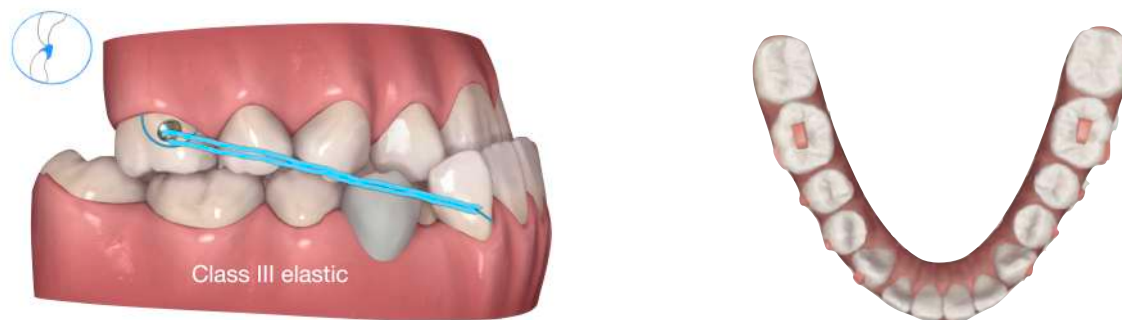
The meta-analysis indicates that treatment with aligners is associated with significantly worse scores in the American Board of Orthodontics (ABO) objective grading system (OGS) compared to braces,²¹ which is clinically relevant. Cases treated with aligners are significantly more likely to be finished with an unsatisfactory quality according to the ABO standards, failing the ABO examination criteria (ABO-OGS score > 30) compared to those treated with braces. In absolute terms, ABO 'fail rates' are 60.6% and 38.9% for aligners and braces, respectively (Fig. 26).²¹

Among the eight indicators of the ABO grading score, the clear aligner therapy (CAT) group clearly falls short of the fixed appliance (FA) group in three indicators: occlusal contacts, overjet, and root angulation.²¹



■ Fig. 24:

The upper left canine erupted after surgical exposure. Since extrusion movement can not be achieved with aligner alone, cross-arch elastics was applied with the antagonist tooth or opposite aligner.



■ Fig. 25:

The anterior crossbite could have been corrected earlier if Class III elastics and occlusal rectangular attachments were applied from the beginning. The collision of upper and lower anterior teeth is the main obstacle for crossbite correction. Virtually planning rectangular attachments on the occlusal surfaces on the first molars might increase the inter occlusal distances while wearing aligners. The aligner was strong enough to confront the force of occlusion. Therefore, it was not necessary to bond a resin core, allowing the patient more comfort when they insert or remove aligners.

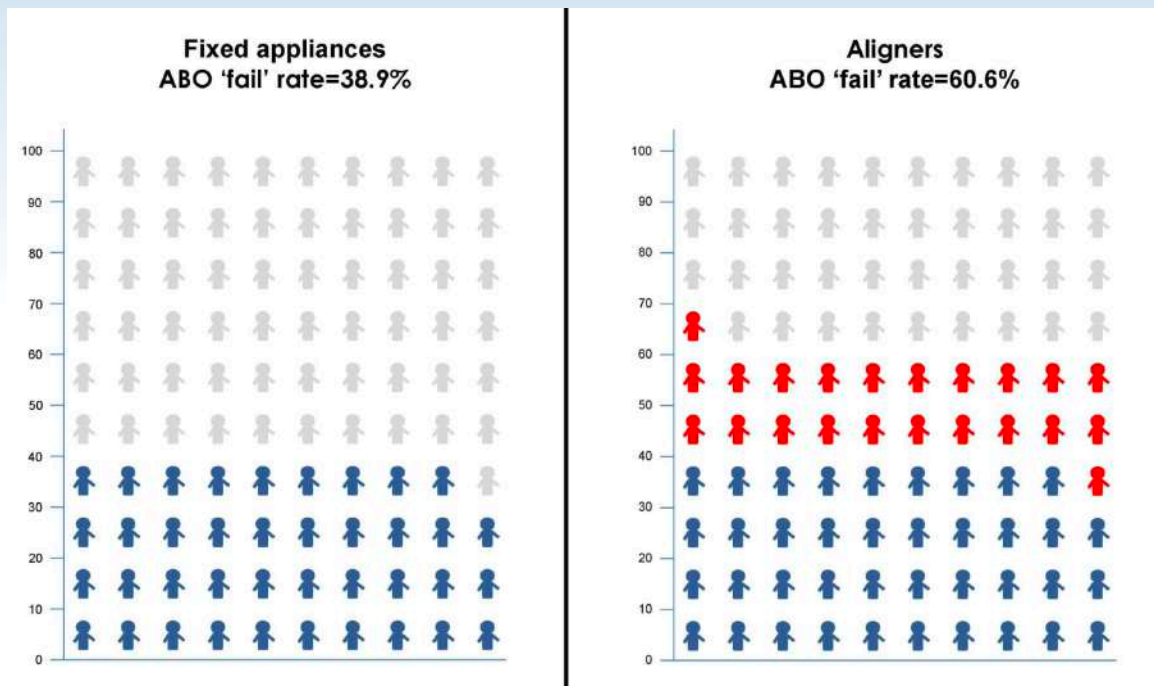
Regarding occlusion contact, the two layers of aligner material in the posterior occlusion usually result in an open bite at the end of treatment. A suggested solution would be to cut off the last set of aligners distal to the first molars and allow the second molars to spontaneously erupt into the occlusion. Then, cut the aligners mesial to the first molars to allow the first molars to erupt. This approach could have provided posterior stops in the occlusion at the end of treatment so the premolars can erupt into the occlusion without deepening the anterior overbite.

Treatment duration

Considerable variation was seen in the effect of treatment modality on treatment duration. Extreme heterogeneity was seen across studies, so it is not possible to claim that CAT is faster or slower than FA.

Conclusions

Impactions, premolar extractions, and anterior crossbites are challenging for aligner treatment.



■ Fig. 26: Illustration of the expected absolute risk for a case to have an ABO-OGS score of over 30 post debond when treated with aligners or fixed appliances, according to the results of the meta-analysis.²¹

Despite the type of appliance correct diagnosis, careful monitoring, and clinical judgements are the keys to attaining an ideal outcome.

Acknowledgements

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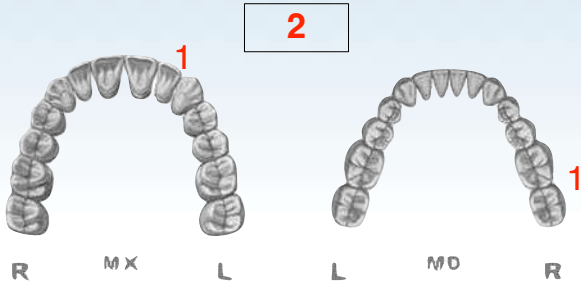
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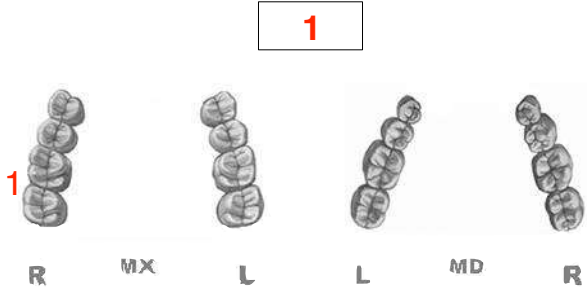
Cast-Radiograph Evaluation

Total Score: 20

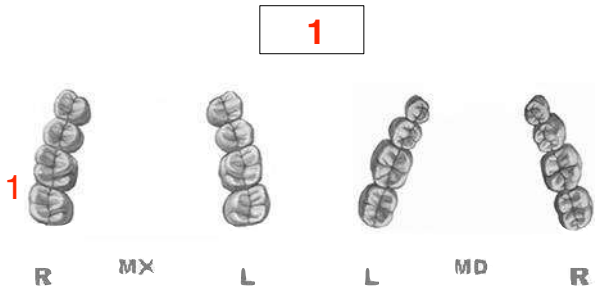
Alignment/Rotations



Marginal Ridges



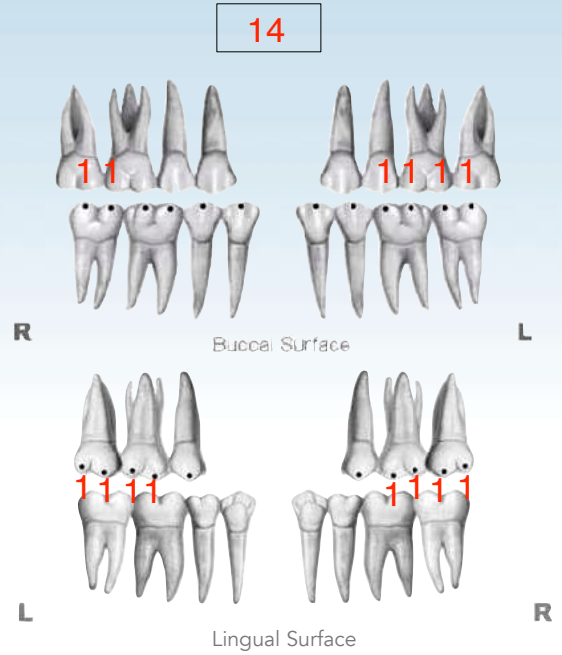
Buccolingual Inclination



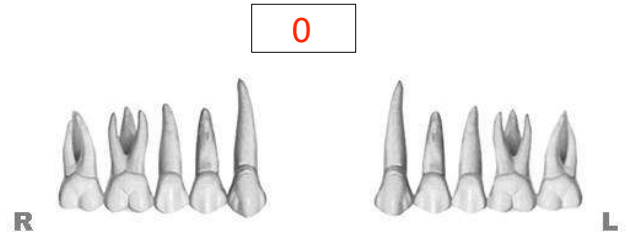
Overjet



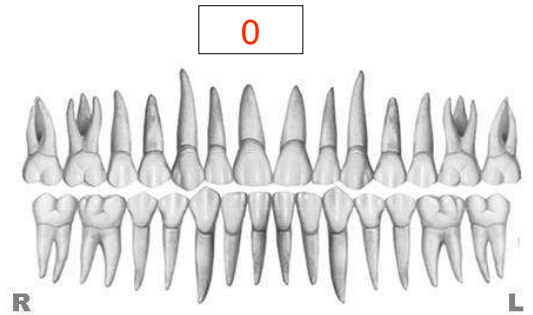
Occlusal Contacts



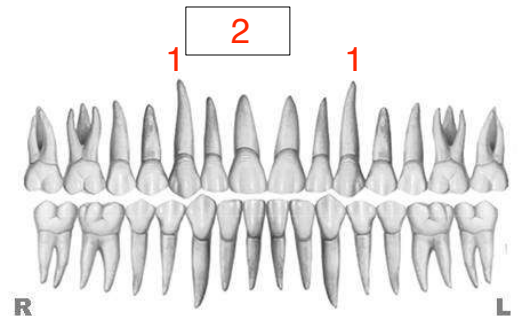
Occlusal Relationships



Interproximal Contacts



Root Angulation



INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 2

1. Pink Esthetic Score

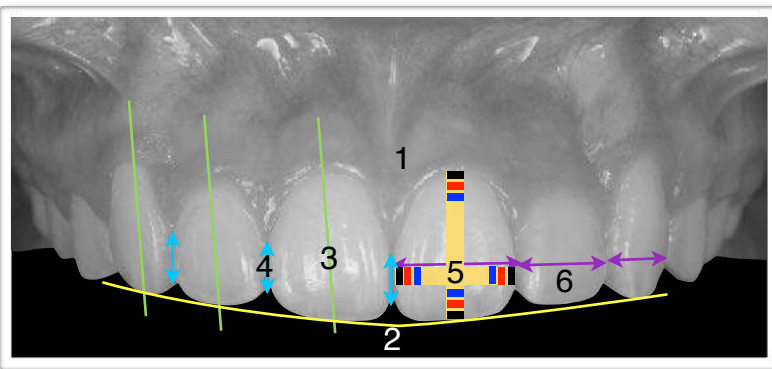


1. M & D Papillae	0 1 2
2. Keratinized Gingiva	0 1 2
3. Curvature of Gingival Margin	0 1 2
4. Level of Gingival Margin	0 1 2
5. Root Convexity (Torque)	0 1 2
6. Scar Formation	0 1 2

Total = 0

1. M & D Papillae	0 1 2
2. Keratinized Gingiva	0 1 2
3. Curvature of Gingival Margin	0 1 2
4. Level of Gingival Margin	0 1 2
5. Root Convexity (Torque)	0 1 2
6. Scar Formation	0 1 2

2. White Esthetic Score (for Micro-esthetic)



1. Midline	0 1 2
2. Incisor Curve	0 1 2
3. Axial Inclination (5°, 8°, 10°)	0 1 2
4. Contact Area (50%, 40%, 30%)	0 1 2
5. Tooth Proportion	0 1 2
6. Tooth to Tooth Proportion	0 1 2

Total = 2

1. Midline	0 1 2
2. Incisor Curve	0 1 2
3. Axial Inclination (5°, 8°, 10°)	0 1 2
4. Contact Area (50%, 40%, 30%)	0 1 2
5. Tooth Proportion	0 1 2
6. Tooth to Tooth Proportion	0 1 2



OBS Super Set

Created by Dr. Chris Chang, OBS is made of medical grade, stainless steel and titanium, and is highly praised by doctors for its simplistic design, low failure rate and excellent quality. OBS is your must-have secret weapon for maximum, reliable anchorage.



Smooth Mushroom Head

For comfort & retention of elastic chain

4-way Rectangular Holes

For lever arm to solve impacted tooth

Double Neck Design

Easy hygiene control & extra attachment



Made in Taiwan

New

Titanium Higher biocompatibility*

1.5 | 1.5X8mm

Stainless Steel**

2.0 | 2.0x12mm

2.7 | 2.0x14mm (with holes)

Buy a Super Set, get **OBS Clinical Guide** (eBook) for free.



* TADs made of Ti alloy have a lower failure rate compared to SS when placed in thin cortical bone. These results are consistent with a biocompatibility-related tendency for less bone resorption at the bone screw interface. Reference: Failure Rates for SS and Ti-Alloy Incisal Anchorage Screws: Single-Center, Double Blind, Randomized Clinical Trial (J Digital Orthod 2018;52:70-79)

** The overall success rate of 93.7% indicates that both SS and TiA are clinically acceptable for IZC BSs.

Reference: Failure rates for stainless steel versus titanium alloy infrazygomatic crest bone screws: A single-center, randomized double-blind clinical trial (Angle Orthod 2019;89(1):40-46)



Screws & Aligners

International Workshop

Beethoven International Workshop

demonstrates how to incorporate TADs and minor surgeries in complex orthodontic treatment. Experienced practitioners get to (1) learn firsthand from the world-renowned orthodontist and lecturer, Dr. Chris Chang, (2) observe management secrets behind a highly efficient clinic, and (3) take home effective clinical tips developed by the Beethoven group to take your clinical results to the next level!



Observership at Beethoven

Chair-side observation of Dr. Chang's clinical treatment and patient communication



Master-level TAD Learning

Identify various clinical indicators for TADs and master application skills



All New Hands-on Workshop

Custom-made model designed by Dr. Fernando Rojas-Vizcaya for realistic impaction treatment practice



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Hsinchu, Taiwan



Screws & Aligners

Keynote (optional)

2024

Nov 26-28

Nov 29

2025

Nov 25-27

Nov 28



Dr. Chris Chang

DDS, PhD. ABO certified, Angle Midwest member, director of Beethoven Orthodontic Center, Taiwan

“Dr. Angle would be glad to know that contemporary orthodontics has a professional as Chris Chang!”



Prof. Dr. Paulo Fernandes Retto, Portugal

Dr. Chang received his PhD in bone physiology and Certificate in Orthodontics from Indiana University in 1996. As publisher of Journal of Digital Orthodontics—a journal for interdisciplinary dental treatment, he has been actively involved in the design and application of orthodontic bone screws.



Course Schedule

DAY

1

Chair-side observation

DAY

2

Lecture, chair-side observation

Lecture topic: *Screws & Aligners*

DAY

3

VISTA & 4 other minor surgeries for orthodontic practice

Hands-on workshop

DAY

4

Keynote workshop

(optional) conducted by Newton's A team



IMPACTION



VISTA ✓

Vertical Incision Subperiosteal Tunnel Access

