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Conservative Treatment of an Angle Class III Malocclusion with Severe Open Bite and Negative Overjet with Clear Aligners
Nawal J. Almutawa, Vicky T. Huang, Chris H. Chang & W. Eugene Roberts

Severe Class III Malocclusion with Anterior Crossbite and Anterior Crowding: Camouflage Treatment with Premolar Extractions
Jason J. Wu, Jenny Y. Chang, Chris H. Chang & W. Eugene Roberts

Center of Resistance: Critical Factor in Expression of Tooth Movement
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Where Legacy Meets Innovation: Reflections on the Mershon Award and an AI-Assisted AAO Presentation
Dr. Lexie Lin

My Journey in Pursuing a Master's Degree in Orthodontics in Germany
Dr. Yi-Hsuan Lin

At this year's AAO annual meeting, Dr. Chris Chang was honored with the 2025 John Valentine Mershon Award, an award that applauds recipients' clinical innovation and treatment philosophy. Dr. Chang is the first-ever Asian, and forth non-American doctor to have received this award. The lecture that followed the award receiving ceremony was fully seated with fellow orthodontists, who were not only awed by the difficult and demanding cases that Dr. Chang presented, but also fascinated by his humor and charisma, once and again.

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2025
熱愛學矯正

全新的貝多芬高效 Damon 矯正大師系列課程是由國際知名講師張慧男醫師親自規劃及授課，課程特色強調由臨床病例帶動診斷、分析、治療計畫擬定與執行技巧。此外，透過數位影片反覆觀看，課堂助教協助操作，以及診間臨床見習，讓學員在短時間能快速上手，感染「熱愛矯正學，熱愛學矯正」的熱情。

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The Beethoven Damon Master Program, led by the world-renowned Dr. Chris Chang, is a 11-module course tailored for clinicians who desire to master the treatment protocols of self-ligating brackets/aligners with the combined use of TADs. The versatile course structure, including webinars and live Q&A, allows participants to receive maximum learning value without interruptions to their busy practice schedule.

2025

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Module 2 - 4/17
Module 3 - 5/1
Module 4 - 5/15
Module 5 - 5/22
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Module 8 - 7/3
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Module 2 - 4/15
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Class - 11/4-6

2026

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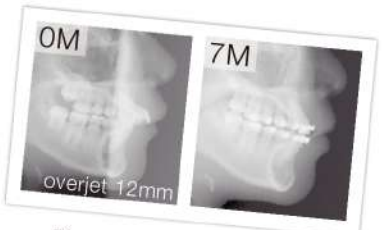

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- American Orthodontic Innovation Award -

John Valentine Mershon Memorial Award

It is an incredible honor to stand before you today as the recipient of the John Valentine Mershon Memorial Award. This award holds a profound significance - not only because of its prestigious legacy within the American Association of Orthodontists, but also because of what it represents: a commitment to innovation, education, and the advancement of our profession.

I am deeply humbled to be included among the distinguished individuals who have received this award before me. It is both a recognition of past efforts and a powerful encouragement to continue striving for excellence in orthodontic care and research.

I would like to express my heartfelt gratitude to the AAO and the awards committee for this meaningful recognition. Thank you for believing in the value of my contributions. I also want to thank my mentors, colleagues, patients , my lovely wife and two daughters - each of whom has inspired and challenged me in different ways along this journey.

This moment is not just a personal milestone; it is a reminder of the shared mission we all carry as orthodontists - to continually grow, to give back, and to shape the future of our field with integrity and purpose.

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Chris Chang PhD, ABO Certified, Publisher of JDO

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Conservative Treatment of an Angle Class III Malocclusion with Severe Open Bite and Negative Overjet with Clear Aligners

Abstract

History: *A 31-year-old male presented for orthodontic consultation with a severe Class III malocclusion, anterior open bite of 5 mm, and a posterior crossbite on both sides.The chief complaints were poor esthetics and inadequate masticatory function.*

Diagnosis and Etiology: *A narrow upper arch and constricted in the 1st molars area, resulted in a crossbite relation on both sides. There was a wide lower arch and moderate crowding in the lower anterior dentition. Anterior open bite was 5 mm, extending to the 2nd premolar area. There was a full-cusp Class III malocclusion with end-to-end crossbite on both sides. However, cephalometric analysis showed a Skeletal Class I relationship with a straight profile. The etiology for the the anterior open bite is likely related to external factors such as pre-existing thumb-sucking as a child and existing habits such as mouth breathing and interincisal tongue posture which inhibited eruption of upper and lower anterior teeth. There was proclination of upper incisors and crowding of lower incisors. A high mandibular angle (FMA, 35°) led to a hyperdivergent facial pattern, anterior open bite, and Class III malocclusion.*

Treatment: *A non-surgical, orthodontic approach with clear aligners and elastics was planned. Full pre-treatment evaluation was carried out. Digital intraoral scanning for digital impressions were done by iTero Element II. Full records and prescription form were submitted for Invisalign comprehensive clear aligners. On arrival of the aligners, a set of 59 aligners was prescribed. After one week, at the second visit, attachments where bonded, and early Class III elastics were used. The patient was appointed every 4 weeks, with 7-day intervals between aligner changes. On completion of the aligner treatment, a significant improvement in overjet and overbite, as well as Class I molar and canine relationships on both sides, were achieved. Retention was done with clear retainers. (J Digital Orthod 2025;77:4-20)*

Outcomes: *Treatment goals were achieved after 18 months of treatment with clear overlay aligners.*

Key words:
Class III malocclusion, Class III molar relationship, open bite, crossbite, Class III elastics, overjet , overbite

Introduction

A 31-year-old male presented with chief complaints of incompetent lips and anterior open bite. He was previously seen by other orthodontists and was told only surgery can solve his problem. Oral soft tissues, periodontium, frena, and gingiva were examined. All were found to be within normal limits. Oral hygiene was very good. No significant medical or dental histories were noted.

Diagnosis and Etiology

Pre-treatment facial and intraoral photographs (Fig. 1) showed a hyperdivergent facial pattern with a straight profile, incompetent lips, and protrusive lower chin. The pre-treatment close-up photographs (Fig. 1) showed a normal lip line smile and 5-mm anterior open bite extending to the 2nd premolars on both sides. The open bite was prominent at the canine area. There was proclined upper anteriors and moderate crowding of lower anterior teeth. A

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Fig. 1: *Pre-treatment facial and intraoral photograph*

constricted upper arch at premolars and 1st molars resulted in crossbites on both sides. A 7-mm Class III malocclusion at 1st molars and canines was observed on both sides. All four wisdom teeth were fully erupted (Fig. 1). The lower mid line was shifted 2 mm to the right side. The patient complained about occasional pain and discomfort in the temporo-mandibular joints (TMJs). He reported mouth breathing habit since childhood because of chronic blocked nose and recurrent pharyngitis. Pre-treatment panoramic and cephalometric radiographs are shown in Figs. 3 and 4, respectively. Cephalometric analysis showed a hyperdivergent skeletal Class I pattern with a protrusive mandible

Fig. 2: *Pre-treatment intraoral digital scans*

Fig. 3: *Pre-treatment panoramic radiograph*

Fig. 4: *Pre-treatment cephalometric radiograph*

and severe Class III dental relationships, as seen clearly in the pretreat mentintraoral digital scans (Fig. 2). The pre-treatment panoramic radiograph showed no significant pathological lesions in the hard tissues (Fig. 3). From the pre-treatment cephalometric radiograph (Fig. 4), pre-treatment analysis data showed the ANB angle was 1˚, the FMA angle was 35˚, the upper incisors were proclined 109˚, and the lower incisors were retroclined 90˚ to the mandibular plane. The cephalometric values are summarized in Table 1. The American Board of Orthodontics (ABO) Discrepancy Index (DI) was 70, as documented in Worksheet 1. The patient was successfully treated with a conservative non-surgical protocol with extraction of the lower 3rd molars only and Class III elastics. Lower molars retraction protocol and the use of early Class III elastics for anchorage were prescribed. A satisfactory esthetic smile was achieved at the end of the treatment, with a Cast-Radiograph Evaluation score of 1 and Pink and White score of 3 as documented in Worksheets 2 and 3 respectively.

Treatment Objectives

In order to improve esthetics of the patient's smile, treatment objectives were (1) sequential retraction of lower posterior teeth to produce a Class I molar and

canine relations on both sides, (2) expansion of the upper arch around the 1st molars and premolars area to correct the crossbite, and (3) extrusion and retraction of anterior teeth to correct the open bite. Extrusion of the upper premolars corrects lateral open bite on both sides Retraction of the lower anterior teeth produces relative extrusion added to the absolute extrusion to improve the vertical dimension of occlusion (VDO). Selective proclination and retroclination of lower anterior teeth to correct the moderate crowding. The patient's chief concerns were esthetics beside the difficulty to close the lips and incising food (Fig. 1). An orthognathic surgical option was previously suggested by other orthodontists, but the patient declined this option because it was too aggressive for him. Therefore, extractions of lower 3rd molars on both sides were planned to provide space for arch retraction prior to intraoral scanning were carried out (Fig. 2). An orthodontic treatment of light force with clear aligner system (Invisalign System Align Tech Inc., San Jose, CA) was recommended to meet the patient's needs:

Treatment goals:

1. Improve overjet and overbite.
2. Achieve Class I molar and canine on both sides.
3. Correct crossbite on both sides.
4. Align lower anterior teeth.

Treatment Strategies :

1. Sequential retraction by 50% of lower posterior teeth
2. Retraction of lower anteriors
3. Constriction of lower arch
4. Expansion of upper arch
5. Extrusion of upper incisors and premolars
6. Intrusion of upper and lower molars
7. Early Class III elastics as inter-arch anchorage hooked from buttons and cutouts

Treatment Progress

The total treatment period was 18 months. The final result was documented in the finish records (Figs. 5-8). A dental scan was taken with iTero Element II (Align Tech Inc., San Jose, CA), and full records were submitted to start the analysis and treatment planning of the case. Instructions to the CAD designer were given as follows: sequential retraction of lower posterior teeth, expansion of upper arch UR5, and no placements of cuts and hooks, which were made manually later on. The treatment simulation of the initial Clincheck (Invisalign System, Align Tech Inc., San Jose, CA) was satisfactory, and minor modifications were made with 3D control. The second Clincheck was approved after reviewing the desired biomechanics design and treatment outcome.

A total of 59 aligners were used. The interval for changing was every 7 days. The treatment began on delivery of the first aligners without placing attachments for one week to allow the patient to accommodate with speech and assure more

Fig. 5: Posttreatment facial and intraoral photographs

Fig. 6: Posttreatment smile of the patient

Fig. 7: Posttreatment panoramic radiograph

Fig. 8: *Posttreatment cephalometric radiograph*

comfort and ease of use. The patient was instructed to wear them full time of 22 hours and was advised to remove them when eating and brushing teeth only. One week later, the patient was seen, and the teeth were polished and prepared for adhesion of attachments with the attachment template. The composite resin used was SDR Flow Bulk Fill flowable composite (SDR Flow, Dentsply Sirona, Germany).

Attachments were bonded as follows :

Upper arch :

1. Conventional rectangular horizontal attachments on UR7, UL6, and UL7
2. Optimized multiplane attachment on UR6
3. Optimized root control attachments on UR5, UR4, UR3, UL4, and UL5
4. Optimized extrusion attachments UR2, UR1, UL1, UL2, and UL3

Lower Arch:

1. Conventional rectangular vertical attachments on LR7, LR6, LL6, and LL7
2. Optimized root attachments on LR5, LR4, LL3, and LL4
3. Optimized rotation attachments on LR3 and LL5

The digital simulation of the treatment outcome was designed to meet the treatment goals (Fig. 9).

At aligners #5, three composite buttons (SDR Flow, Dentsply Sirona, Germany) were bonded on the upper canines and lower canines and 1st premolars on both sides. Cutouts were made at corresponding sites on aligners #5, 6, 7, and 8. The patient was requested to mount elastics in triangular shape (Fig. 10) on both sides while wearing the aligners. At week 9, lingual buttons were bonded on the palatal surfaces of the upper 1st molars and cutouts were made on the corresponding sites on the aligners together with the buttons on the lower canines. Other composite buttons were removed, and Class III elastics (Fox, 1/4-in, 3 oz, Ormco, CA) were prescribed. Metal buttons were bonded on the lingual surfaces of upper first molars, and two other composite buttons were bonded on the labial surfaces of the lower canines. Cutouts on the aligners

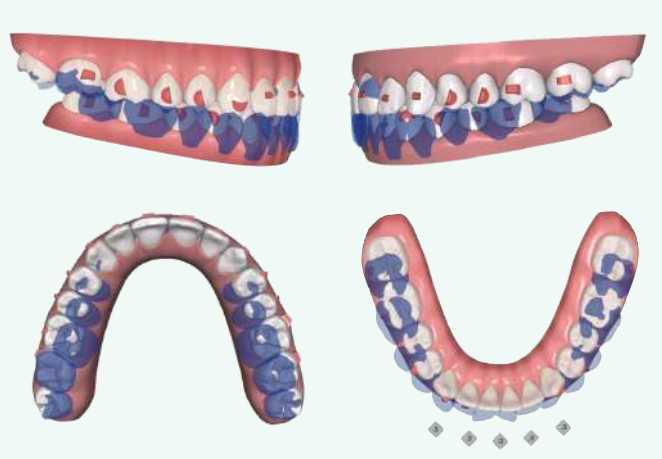

Fig. 9:
The Initial ClinCheck views show initial teeth position (blue) and simulated final position (white).

were made at the corresponding sites. Two elastics were hooked on the buttons (Fox, 1/4-in, 3 oz Ormco, CA) as Class III elastics on each side. The patient was given instructions on how to hook elastics and was requested to keep them hooked at all times and change every 8 hours (Fig. 11) when taken off to eat or brush teeth.

The patient was instructed to wear the last aligners and keep Class III elastics at night only till the arrival of the new aligners. A new scan was taken after aligners #59, and a new ClinCheck was generated and modified to meet the following requirements :

1. Buccal root torque of upper 1st molars
2. IPR of lower anteriors
3. Cuts for buttons on buccal surfaces of upper first molar and canines on both sides

Modifications in the attachments were as follows :

1. All the existing attachments were removed.
2. New optimized retention attachments on UR6, LR4, and LR3
3. New optimized retention attachments on UL6 and LL4
4. Optimized rotation attachment on LL3
5. IPR of 0.2 mm between lower anterior teeth to reduce the black triangle effect

The additional aligners consisted of 7 active aligners and 3 extra pairs for over correction for both arches. All the old attachments were replaced by new attachments as needed. The new attachments were placed with the use of a new template. Four metal buttons were bonded at the place of corresponding cuts, and Class III elastics (Fox, 1/4-in, 3.5 oz, Ormco, CA) were advised for full-time while using aligners. At week 8 of the additional aligners, the patient was seen every week before the insertion of the new aligners for over correction. After aligner #10, all the planned goals were achieved with satisfying results. All attachments were removed, and final records of photos, X-ray, and digital scans for clear retainers were taken. The patient was advised to wear aligner #10 for full time to hold the teeth in place and to wear Class III elastics at night time only while waiting for the retainers.

Retention

Digital scans for clear removable retainers were taken with iTero scanner. Clear retainers (Vivera, Align Tech., CA) were delivered after two weeks and advised to

Fig. 10: *Triangle elastics and bite block effect*

CEPHALOMETRIC SUMMARY			
	PRE-TX	POST-TX	DIFF.
SKELETAL ANALYSIS			
SNA° (82°)	78°	77°	1°
SNB° (80°)	77°	77°	0°
ANB° (2°)	1°	0°	1°
SN-MP° (32°)	44	41°	3°
FMA° (25°)	35°	34°	3°
DENTAL ANALYSIS			
U1 TO NA mm (4 mm)	6	6	0
U1 TO SN° (104°)	109°	106°	3°
L1 TO NB mm (4 mm)	5	3	2
L1 TO MP° (90°)	90°	75°	13°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	-7	-7	0
E-LINE LL (0 mm)	-2	-2	0
%FH: Na-ANS-Gn (53%)	54%	55%	1%
Convexity:G-Sn-Pg' (13°)	25°	17°	-8°

Table 1: *Cephalometric summary*

be used full time for six months. Cuts were made manually for Class III elastics to be used at night only with fox elastics (Fig. 12).

Fig. 11a: *Class III and crossbite elastics from the right buccal view*

Fig. 11b: *Class III and crossbite elastics from the frontal view*

Fig. 11c: *Occlusal view shows the sites of bonded buttons.*

Treatment Results

Posttreatment documentation with photographs (Figs. 5 and 6), radiographs (Figs. 7 and 8),

Fig. 12: *Clear retainers with buttons and elastics*

cephalometric measurements (Table 1), and superimposed tracings (Fig. 13) indicated that both the overbite and over jet were within normal ranges. Class I molar and class I canine at both sides were achieved. Alignment and retraction of lower anteriors and crowding was eliminated. Extrusion of upper anteriors, closing of the open bite, and leveling of the curve of Spee were achieved. Two sets, a total of 69 aligners for both arches, over 18 months produced the final results as planned in the treatment goals and were close to the original 3D ClinCheck projection.

Discussion

The biomechanics of clear aligners could be described as a sequence of crown tipping and root

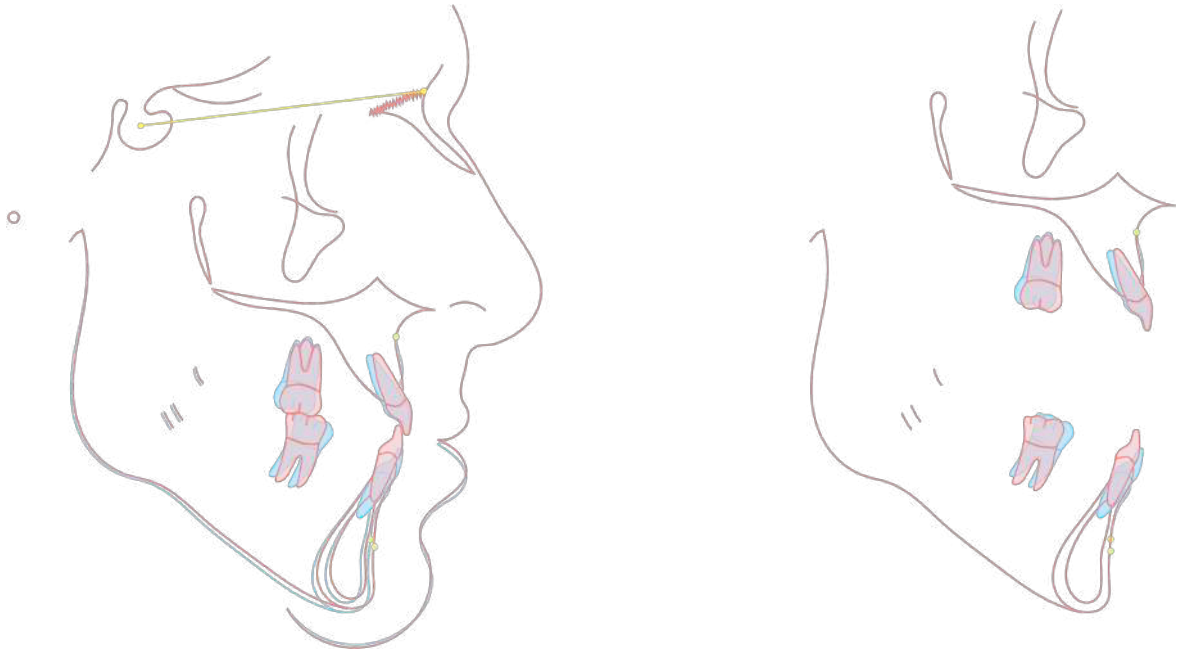

Fig. 13:
Superimposed cephalometric tracings show the dentofacial changes after 18 months of treatment (red) compared to the pre-treatment position (blue).

uprighting.[1] The current evidence in the literature of suggested that the clear aligners were effective in correcting Class III malocclusion with molar retraction.[2] The amount of molar retraction is about 2 to 3 mm, which helps in achieving molar and canine Class I relationship and also improvement of the facial profile. Clear aligner treatment is a good approach for resolving vertical discrepancies like deep bite and open bite. Successful treatment results using clear aligners for these discrepancies were reported in the literature.[3] Open bite is one of the favorable scenarios to be solved by aligners.[4] The bite block effect adds an intrusive force on posterior teeth.[5] In orthodontics, the biomechanics of open bite treatment depends on 1. extrusion of anterior teeth, 2. intrusion of posterior teeth and, 3. a combination of both mechanics.[6] The etiology of this vertical discrepancy is commonly developed at early age during the growth period.[7] Para-functional habits like tongue thrust, thumb sucking, mouth breathing, and malfunction swallowing play a big role in intervention of development of normal overbite and overjet. This case was diagnosed as a Class III canine and molar with open bite of 5 mm and negative overjet of 3 mm. Moderate crowding of lower anteriors was detected and a narrow upper arch with lateral crossbites at premolars and 1st molar could be observed on both sides. The treatment plan was set to achieve the following goals: 1. Class I molar and canine, and 2. normal overjet and overbite. The treatment strategies were designed as follow: 1. sequential retraction of lower posteriors, 2. expansion of upper lateral segment to correct the lateral crossbite, 3. extrusion of upper and lower anteriors, and 4. intrusion of upper and lower posteriors. Lower 3rd molars were extracted on both sides before delivering aligners #1. Sequential retraction was done by 50%, meaning that distal movement of lower 2nd molar was initiated first and once it reached 50% of the distance, the retraction of 1st molars was started at aligners #5. Vertical attachments were requested on the lower molars to facilitate engagement of aligners and teeth by increasing the surface area.[8] Retraction of 2nd molar does not require anchorage as the whole arch supplies it (Figs. 14 and 15).[9] At this early stage of treatment, triangular elastics and the bite block effect of the the aligners induced a wedge effect and aided in extrusion of anterior teeth and intrusion of posterior teeth.[10] Reduction in the vertical discrepancy was noted. The retraction of 1st molar needed anchorage. Class III elastics used for anchorage to over come the side effect of retraction and prevent flaring of lower anteriors.[11] Moreover, the Class III elastics induced an auto-rotation of the mandible in counter-clockwise direction and helped in reducing the open bite. When the lower 1st molars reached 50% of the distal distance, the 2nd lower premolars started to retract and then the 1st premolars and canines. A good space of around 2 mm was observed distal to lower canines (Fig. 15). This space was enough for correcting canine relation to Class I and relieving the crowding in the lower anterior teeth. Lower anterior teeth were moved in a conservative pattern and round tripping was avoided. In the upper arch, expansion was achieved through buccal tipping and with the aid of the cross- and Class III elastics which extended from palatal buttons on upper 1st molars to lower buttons on the lower canines. This mechanism helped not only in the expansion and anchorage but also for the mandible to auto-rotate to reduce the open bite. Buccal root torque of molars was needed to upright molars and to avoid posterior opening of the bite

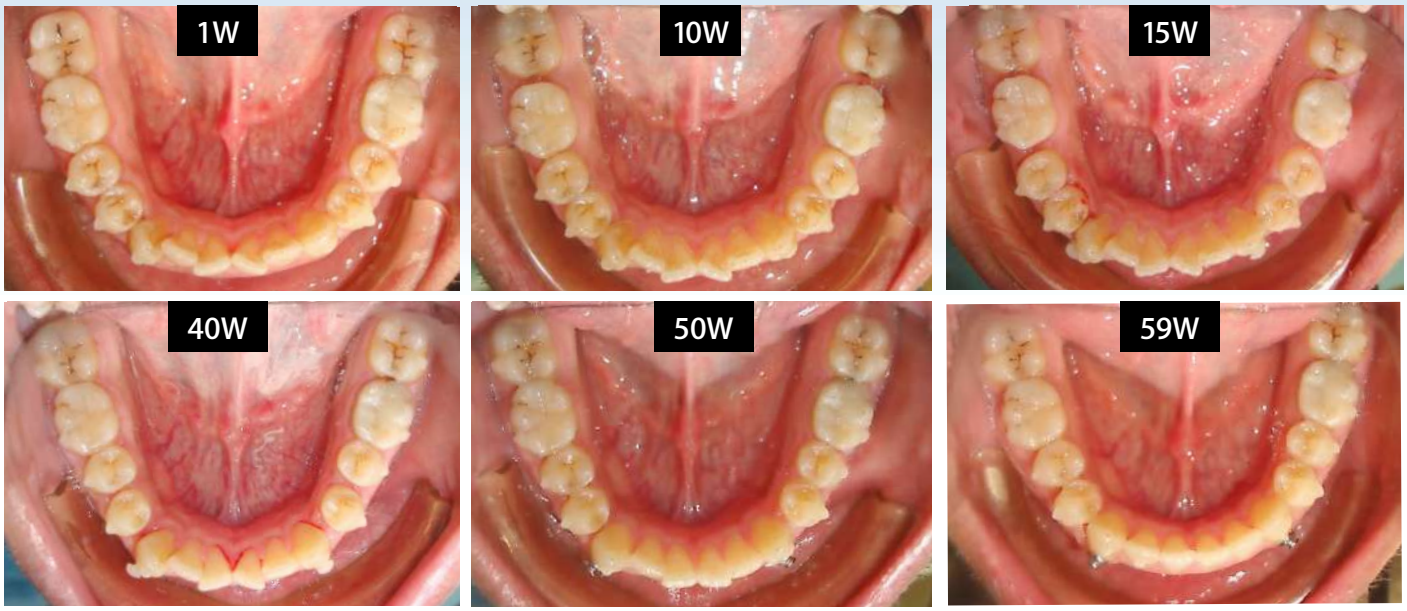

Fig. 14: Occlusal view shows the progress of sequential retraction and alignment of the lower arch in weeks (W).

Fig. 15: Lateral view shows the progress of sequential retraction and correction of open bite in weeks (W).

due to crown buccal tipping and premature occlusal contacts. In the additional aligner treatment plan, buccal root torque of upper molars was planned to overcome the posterior open bite (Fig. 16).[12] Anterior open bite was corrected with: 1. Intrusion of posterior teeth by true intrusion forces with the aid of bite block effect, as well as relative intrusion by buccal root torque of the upper and lower molars; and 2. extrusion of anterior teeth by true extrusion of upper and lower incisors and relative extrusion of lower incisors due to retraction and uprightness of lower anterior teeth. In general, the open bite was corrected by a combination of these forces.[13] The cephalometric analysis showed all these movements (Fig. 13) and the effect of the mandibular counter-clockwise rotation, which improved the overbite. The patient was requested to use Class III elastics with clear removable retainers to maintain the results. The two-year follow-up showed the retention of the treatment results (Fig. 17).

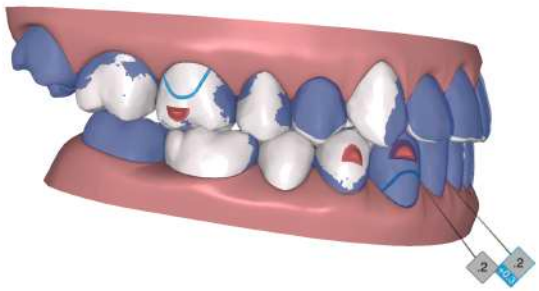

Fig. 16: *Additional aligners ClinCheck*

Conclusions

Clear aligners are a therapeutic modality that can be effectively employed for adult non-surgical treatment of Class III with severe open bite. Sequential retraction with Class III elastics as

Fig. 17: *Two years follow up intra-oral photos*

anchorage and auto-rotation of the mandible played a big role. Vertical attachments on the lower molars are recommended for retraction to increase the surface area and the aligner-teeth engagement. Extrusion and intrusion of teeth are applied depending on existence of a flat curve of Spee and low lip line. Both mechanics work in true and relative forms, and should be employed carefully. Expansion of upper posterior segment is mainly achieved by crowns tipping and could be controlled by adding buccal root torque. Careful observation of lower anterior teeth during retraction was necessary. Relative extrusion was induced and lingual root torque was needed to maintain roots within the bone envelope. Class III elastics at night with clear removable retainers to maintain the results is recommended.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 70

OVERJET

0 mm. (edge-to-edge)	=	
1 - 3 mm.	=	0 pts.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	3 pts.
7.1 - 9 mm.	=	4 pts.
> 9 mm.	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. Per tooth =

Total = 14

OVERBITE

0 - 3 mm.	=	0 pts.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	3 pts.
Impinging (100%)	=	5 pts.

Total = 0

ANTERIOR OPEN BITE

0 mm. (Edge-to-edge), 1 pt. per tooth
Then 1 pt. per additional full mm. Per tooth

Total = 12

LATERAL OPEN BITE

2 pts. per mm. Per tooth

Total = 12

CROWDING (only one arch)

1 - 3 mm.	=	1 pt.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	4 pts.
> 7 mm.	=	7 pts.

Total = 4

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side _____ pts.
Full Class II or III	=	4 pts. per side 8 pts.
Beyond Class II or III	=	1 pt. per mm. additional _____ pts.

Total = 8

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 6

BUCCAL POSTERIOR X-BITE

2 pts. Per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° _____ x 1 pt. = _____

Each degree > 6° _____ x 1 pt. = _____

SN-MP

≥ 38° = 2 pts.

Each degree > 38° 6 x 2 pts. = 12

≤ 26° = 1 pt.

Each degree < 26° _____ x 1 pt. = _____

1 to MP ≥ 99° = 1 pt.

Each degree > 99° _____ x 1 pt. = _____

Total = 14

OTHER (See Instructions)

Supernumerary teeth	_____ x 1 pt.	=
Ankylosis of perm. Teeth	_____ x 2 pts.	=
Anomalous morphology	_____ x 2 pts.	=
Impaction (except 3rd molars)	_____ x 2 pts.	=
Midline discrepancy (≥ 3mm)	@ 2 pts.	=
Missing teeth (except 3rd molars)	_____ x 1 pt.	=
Missing teeth, congenital	_____ x 2 pts.	=
Spacing (4 or more, per arch)	_____ x 2 pts.	=
Spacing (Mx cent. diastema ≥2mm)	@ 2 pts.	=
Tooth transposition	_____ x 2 pts.	=
Skeletal asymmetry (nonsurgical tx)	@ 3 pts.	=
Addl. treatment complexities	_____ x 2 pts.	=

Identify:

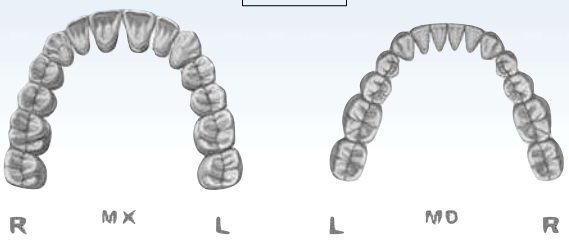
Total = 0

Cast-Radiograph Evaluation

Total Score: 1

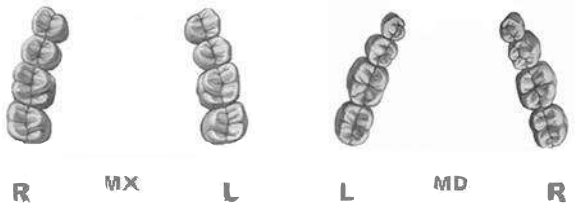
Alignment/Rotations

0



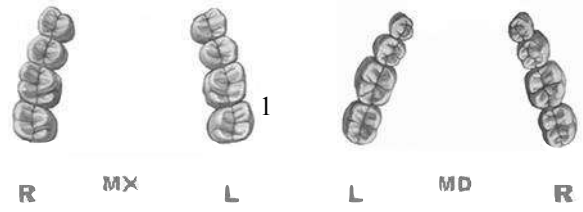
Marginal Ridges

0



Buccolingual Inclination

0

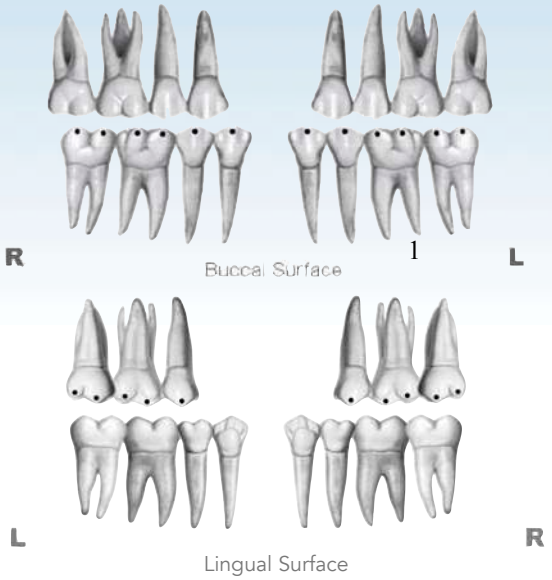


Overjet

0

Occlusal Contacts

1

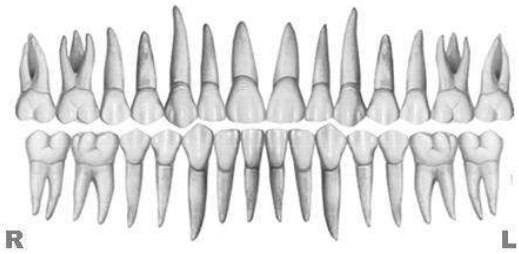


Occlusal Relationships

0

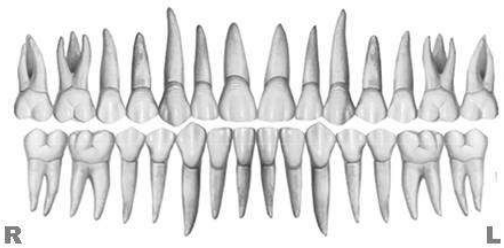
Interproximal Contacts

0



Root Angulation

0



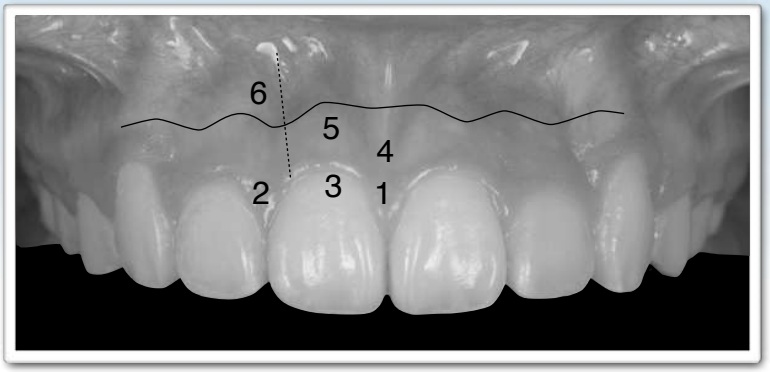
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 0

1. Pink Esthetic Score

Total = 1

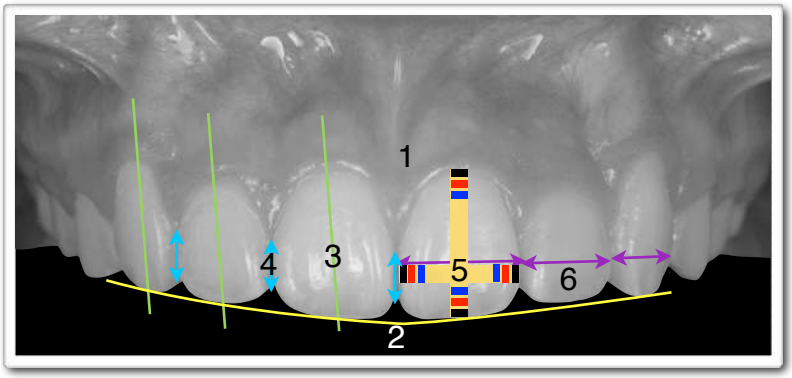


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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)

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

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

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* 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)

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	Screws & Aligners	Keynote (optional)
2025	Nov 04-06	Nov 07
2026	Dec 01-03	Dec 04

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.

IMPACTION

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

VISTA

Vertical Incision Subperiosteal Tunnel Access

Severe Class III Malocclusion with Anterior Crossbite and Anterior Crowding: Camouflage Treatment with Premolar Extractions

Abstract

History: *A 33-year-old male presented with chin protrusion and crossbite.*

Diagnosis: *A skeletal Class III relationship (SNA, 81˚; SNB, 85.5˚; ANB, -4.5˚) along with a full-cusp Class III molar and canine relationships were noted. Dental analysis revealed retroclined upper central incisors (U1-to-NA, 9 mm; U1-to-SN, 103.5˚) and retroclined lower incisors (L1-to-NB, 7 mm; L1-to-MP, 83.5˚) with an overjet of -4 mm and an overbite of 5 mm. The facial profile was concave. The Discrepancy Index (DI) was 39.*

Treatment: *Extractions of both maxillary second premolars and mandibular first premolars were performed to create enough space for relieving the anterior crowding and retracting the mandibular arch. A passive self-ligating fixed appliance was utilized with Class III elastics, bite turbos, and open coil springs.*

Results: *After 39 months of treatment without orthognathic surgery, a near-ideal profile and satisfactory occlusal alignment were achieved. The Cast-Radiograph Evaluation score was 10, and the Pink and White esthetic score was 7. There were two main discrepancies: the upper right first premolar, lower left second premolar, and lower right first molar were rotated. In addition, the mesiobuccal cusp of the lower left second molar was 1 mm out of contact, and the distobuccal cusp was 2 mm out of contact.*

Conclusions: *This case report demonstrates that premolar extraction is crucial in treating a severe Class III malocclusion with anterior crowding. Torque selection is vital for controlling the axial inclination of incisors. Using specific brackets and Class III elastics potential torque loss was compensated. Class III elastics combined with posterior and anterior bite turbos, as well as open coil springs, effectively corrected the anterior crossbite and facilitated overjet correction while minimizing patient discomfort. (J Digital Orthod 2024;77:24-39)*

Key words:

Skeletal Class III, full-cusp Class III, anterior crowding, anterior crossbite, premolar extraction, passive self-ligating appliance, camouflage treatment

Introduction

The prevalence of Class III malocclusions varies across populations, ranging from approximately 4% in Caucasians to over 14% in Asians.[1] In Asian countries such as Japan, patients often exhibit a significantly shorter anterior cranial base, a wider gonial angle, and an increased lower anterior face height. Due to the smaller maxilla, backward rotation of the mandible is required to achieve a proper occlusion.[2] Individuals with Class III malocclusions may present with a combination of dental and skeletal discrepancies that contribute to this condition.

For adult patients with a skeletal Class III malocclusion, treatment typically involves a combination of orthodontic and surgical procedures. However, camouflage treatment can also be effective,

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Jenny Y. Chang,
Training Resident, Beethoven Orthodontic Center (Center left)
Chris H. Chang,
Founder, Beethoven Orthodontic Center
Publisher, Journal of Digital Orthodontics (Center right)
W. Eugene Roberts,
Editor-in-Chief, Journal of Digital Orthodontics (Right)

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

depending on the severity of the condition. Adults with a mild to moderate skeletal Class III malocclusion and a relatively good facial profile can be treated with camouflage techniques. These treatments may include tooth extractions, retraction of the mandibular dentition, and the use of Class III intermaxillary elastics. Camouflage treatment aims to procline the upper incisors and retrocline the lower incisors. The goal is to

achieve acceptable occlusion, function, and facial esthetics through dentoalveolar compensation.[3-6]

The dental nomenclature for this report is a modified Palmer notation. Upper (U) and lower (L) arches, as well as the right (R) and left (L) sides, define the four oral quadrants: UR, UL, LR, and LL. Teeth are numbered 1-8 from the midline in each quadrant, e.g., a lower right first molar is LR6.

History and Etiology

A 33-year-old male presented for an orthodontic consultation with the chief complaints of chin protrusion and crowding. Medical and dental histories were noncontributory. A clinical examination revealed a bilateral full-cusp (> 10 mm) Class III malocclusion which was further complicated by an anterior crossbite, deep bite, and midline deviation (Figs. 1 and 2). There were neither contributing dental traumas, oral habits, nor significant signs and symptoms of temporomandibular disorder (TMD).

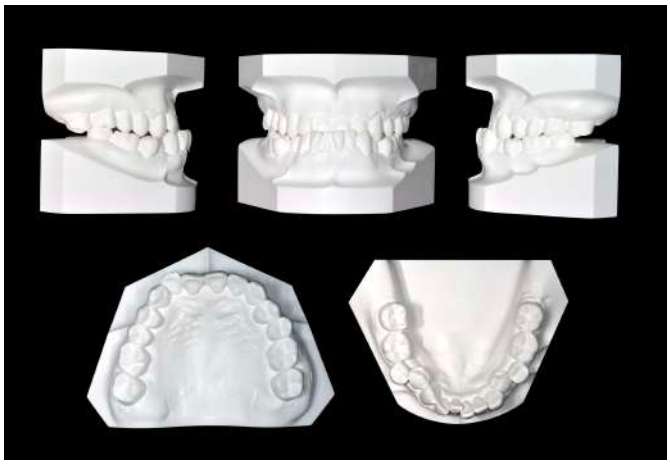

Fig. 2: *Pre-treatment study models (casts)*

Diagnosis

Facial:

- Lower facial height: *within normal limits (WNL), Na-ANS-Gn 50% (Table 1)*
- Convexity: *concave profile with protrusive chin (G-Sn-Pg', -2.5°)*
- Symmetry: *WNL*
- Smile: *Low smile line*

Skeletal:

- Skeletal Class III (SNA, 81°, SNB, 85.5°, ANB -4.5°)
- Mandibular Plane: *WNL (SN-MP, 35°; FMA, 28°)*
- Vertical Dimension of Occlusion (VDO): *WNL (Na-ANS-Gn, 50%)*
- Symmetry: *WNL*

Dental:

- Classification: *bilateral full-cusp Class III relationship*
- Overjet: *-4 mm (anterior crossbite)*
- Overbite: *5 mm (deep bite)*
- Posterior crossbite: *UR4 and UR5 in linguoversion*
- Symmetry: *upper dental midline deviated 2 mm to the right.*

The Discrepancy Index (DI) was 39 as shown in the subsequent worksheet (Worksheet 1).[7]

Treatment Objectives

The treatment objectives were to: (1) retract and posteriorly rotate the lower arch; (2) relieve the crowding in the lower anterior teeth; (3) correct the crossbite and deep bite; (4) align the upper dental midline; and (5) improve the facial profile.

Treatment Alternatives

Plan A

Orthognathic surgery is the conventional approach to correct the skeletal component of a Class III malocclusion. However, the patient refused surgery because of the hospitalization, high cost, and risk of complications.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA° (82°)	81°	81.5°	0.5°
SNB° (80°)	85.5°	84.5°	1°
ANB° (2°)	-4.5°	-3°	1.5°
SN-MP° (32°)	35°	35°	0°
FMA° (25°)	28°	28°	0°
DENTAL ANALYSIS			
U1 TO NA mm (4 mm)	9	9	0
U1 TO SN° (104°)	103.5°	110.5°	7°
L1 TO NB mm (4 mm)	7	2	5
L1 TO MP° (90°)	83.5°	80°	3.5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	-4	-3	1
E-LINE LL (0 mm)	4	0	4
%FH: Na-ANS-Gn (53%)	50%	54%	4%
Convexity:G-Sn-Pg' (13°)	-2.5°	3.5°	6°

Table 1: *Cephalometric summary*

Plan B

Camouflage treatment is directed at occlusal correction and masking the skeletal discrepancy by: (1) extracting UR5, UL5, LR4 and LL4; (2) applying anterior and posterior bite turbos; (3) retracting the mandibular arch with Class III elastics; and (4) using open coil springs to flare out the upper anterior teeth (Fig. 3). These mechanics are designed to correct the anterior crossbite and deep bite to improve the protrusive lower lip. As the patient refused surgery, camouflage treatment was chosen for the correction of the malocclusion.

Appliances and Treatment Progress

After the prescribed extractions, a 0.022-in slot Damon Q® passive self-ligating (PSL) appliance (Ormco, Glendora, CA) was bonded on the lower teeth in the 1st month of active treatment. The upper teeth were engaged in the following month.

Fig. 3:
Bite turbos and Class III elastics (blue line) are the keys to speeding up overjet correction and shortening the period of patient discomfort.

Meanwhile, posterior bite turbos were added on L7s to align the anterior teeth. The initial archwires for both arches were 0.014-in CuNiTi. From the 2nd month of treatment, the lower archwire was changed to 0.014x0.025-in CuNiTi. To retract the lower arch, the patient was instructed to wear early light short elastics (Quail 3/16", 2 oz) from U7s through U6s to L3s. From the 6th month of treatment, the upper archwire was changed to 0.017x0.025-in TMA and the lower one to 0.016x0.025-in pre-torqued CuNiTi. To effectively correct the crossbite, anterior bite turbos were added from LR2 to LL2 and open coil springs were placed between U4s and U6s in the 7th month. The patient was instructed to wear Class III elastics (Kangaroo 3/16", 4.5 oz) from U4s to L3s. In order to speed up the space closure process, lingual buttons were bonded on U4s and U7s in the 15th month. To reduce black triangles, interproximal reduction (IPR) was performed on the incisors in the 19th month of treatment. After 39 months of active treatment, all fixed appliances were removed. Treatment and sequencing details are shown in Table 2 and Figs. 4-6.

Treatment Results

Facial esthetics, dental alignment, and intermaxillary occlusion were remarkably improved. According to the panoramic radiographs (Figs. 7 and 8), there was already bone defects around UR2, UR3, UR5-7, UL6, and UL7 before treatment, but these defects did not seem to worsen after treatment. Interestingly, the bone defect around UR2, UR3, and UR6 was improved. In addition, acceptable root parallelism was also documented. The superimposed cephalometric tracings show 7° increase of the axial

Fig. 4:
Treatment progression - frontal view from the start of treatment (0M) to the end of treatment (39M), as well as at 5-year follow-up (5Y FU)

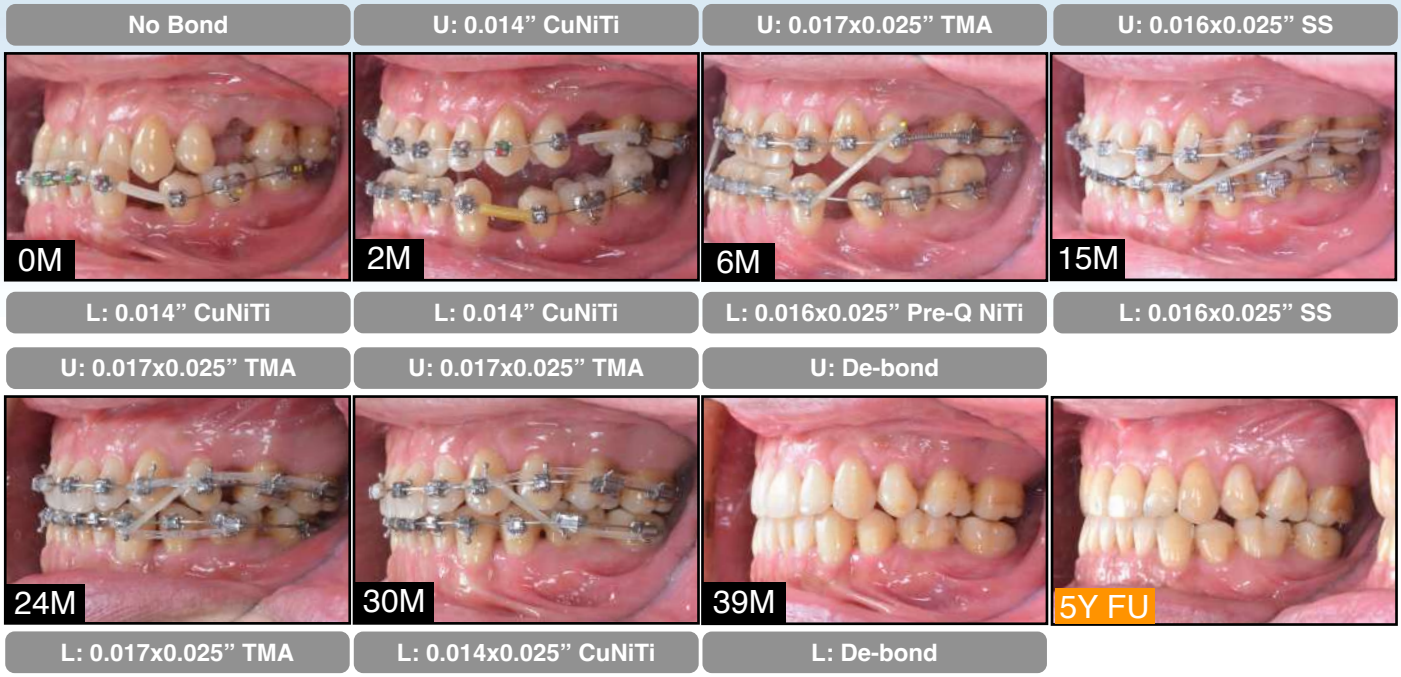

***Fig. 5**: Treatment progression - left buccal view with archwires specified in grey labels*

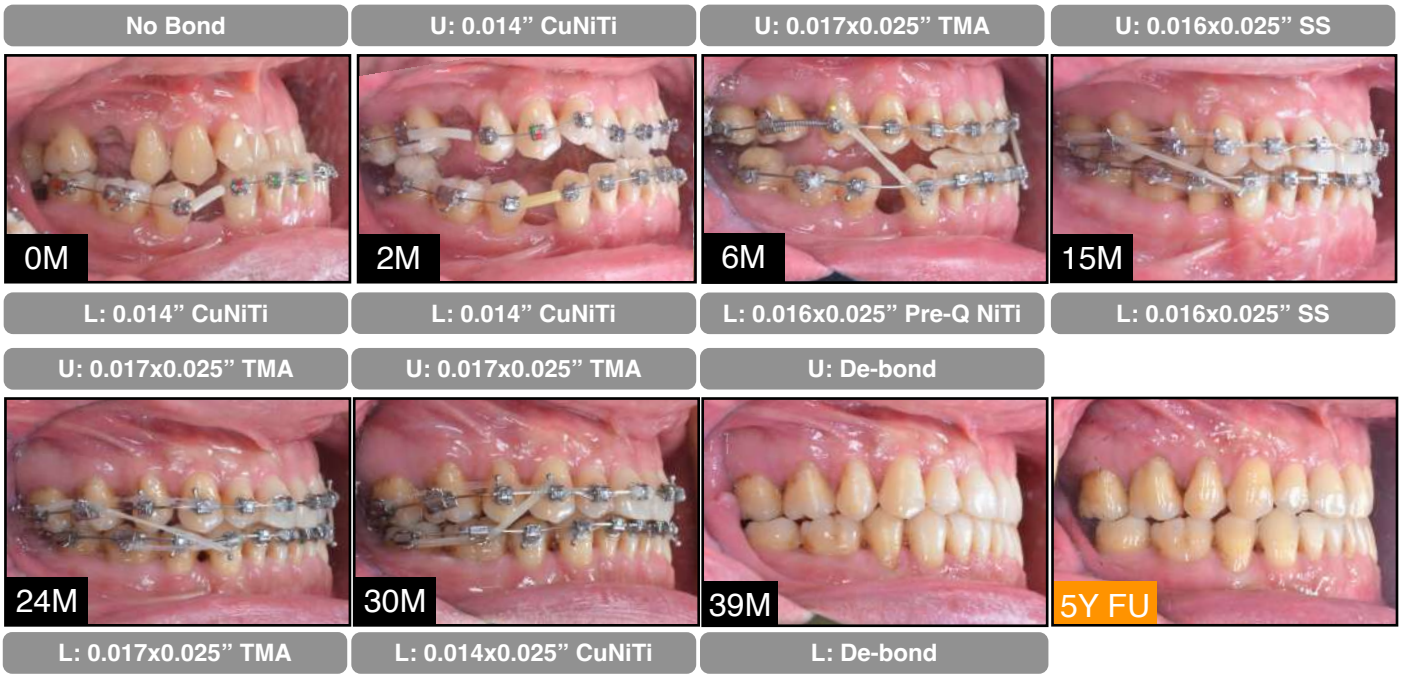

***Fig. 6**: Treatment progression - right buccal view with archwires specified in grey labels*

Month	Archwire	Notes
0	L: 0.014-in CuNiTi	Damon® appliance was bonded on the mandibular arch from LR7-LL7 except L5s.
1	U: 0.014-in CuNiTi L: 0.014-in CuNiTi	Damon® appliance was bonded on the maxillary arch from UR7-UL7 except U4s. Bite turbos were added on L7s.
2	U: 0.014-in CuNiTi L: 0.014x0.025-in CuNiTi	Bite turbos height on L7s was increased. Damon® appliance was rebounded on UR7. Bilateral elastics (Quail, 3/16 in, 2 oz) were applied from U7s through U6s to L3s.
3	U: 0.014-in CuNiTi L: 0.014x0.025-in CuNiTi	Damon® appliance was rebonded on LR2-LL2.
5	U: 0.014-in CuNiTi L: 0.016x0.025-in Pre-Q CuNiTi	Damon® appliance was rebonded on Ur2 and LR5. Bilateral elastics (Quail, 3/16 in, 2 oz) were applied from U7s and U6s to L5s.
6	U: 0.017x0.025-in TMA L: 0.016x0.025-in Pre-Q CuNiTi	Ligature ties (PTs) were inserted on UR3-UL3. Power chains (PCs) were inserted.
7	U: 0.017x0.025-in TMA L: 0.016x0.025-in Pre-Q CuNiTi	Bite turbo was added on UR2-LL2. Open coil springs (OPs) were placed between U4s and U6s.
9	U: 0.017x0.025-in TMA L: 0.016x0.025-in Pre-Q CuNiTi	Both bite turbos on L6s and LR2-LL2 were removed. PCs were inserted. Bilateral elastics (Kangaroo, 3/16 in, 4.5 oz) were applied from U4s to L3s.
10	U: 0.014x0.025-in CuNiTi L: 0.016x0.025-in SS	OPs on U4s and U6s were removed. PCs were inserted. Bilateral elastics (Kangaroo, 3/16 in, 4.5 oz) were applied from U4s to L3s.
11-14	U: 0.017x0.025-in TMA L: 0.016x0.025-in SS	PCs were inserted. Bilateral elastics (Quail, 3/16 in, 2 oz) were applied from U7s and U6s to L5s.
15	U: 0.016x0.025-in SS L: 0.016x0.025-in SS	Lingual buttons were bonded on U4s and U7s. PCs were inserted. Bilateral elastics (Quail, 3/16 in, 2 oz) were applied from U7s and U6s to L3s.
19	U: 0.016x0.025-in SS L: 0.014x0.025-in CuNiTi	Damon® appliance was rebonded on LR3, LR5, and LL5. Interproximal reduction was performed on incisors. Torquing springs were placed on L5s.
20	U: 0.014x0.025-in CuNiTi L: 0.014x0.025-in CuNiTi	Damon® appliance was rebonded on UR6, UR7, UL6, UL7, LL5, and LL6. PTs and PCs were inserted.
21	U: 0.017x0.025-in TMA L: 0.017x0.025-in TMA	Torquing springs were placed on L3s. PTs were inserted. Bilateral elastics (Fox, 1/4 in, 3.5 oz) were applied from U7s and U6s to L3s.
22	U: 0.017x0.025-in TMA L: 0.014x0.025-in CuNiTi	Damon® appliance was rebonded on LR2. Bilateral elastics (Quail, 3/16 in, 2 oz) were applied from U7s to L7s.
23	U: 0.017x0.025-in TMA L: 0.014x0.025-in CuNiTi	Damon® appliance was rebonded on LL5. PTs and PCs were inserted. Torquing springs on L3s were removed.
24	U: 0.017x0.025-in TMA L: 0.017x0.025-in TMA	PTs and PCs were inserted.
26-28	U: 0.017x0.025-in TMA L: 0.017x0.025-in TMA	PTs and PCs were inserted. Bilateral elastics (Fox, 1/4 in, 3.5 oz) were applied from U7s and U6s to L3s.

***Table 2**: Treatment sequence (continued on the next page) (Pre-Q: pre-torqued)*

Month	Archwire	Notes
29	U: 0.017x0.025-in TMA L: 0.017x0.025-in TMA	Lingual buttons were bonded on U3s. PCs were inserted. Bilateral elastics (Fox, 1/4 in, 3.5 oz) were applied from U3s to L6s and L7s.
30	U: 0.017x0.025-in TMA L: 0.014x0.025-in CuNiTi	Damon® appliance was rebonded on L5s. PCs were inserted.
31	U: 0.017x0.025-in TMA L: 0.017x0.025-in TMA	Damon® appliance was rebonded on LR5. Torquing springs were placed on L5s. Bilateral elastics (Fox, 1/4 in, 3.5 oz) were applied from U3s to L6s and L7s.
32	U: 0.017x0.025-in TMA L: 0.014x0.025-in CuNiTi	Damon® appliance was rebonded on LR5. PTs and PCs were inserted.
33	U: 0.017x0.025-in TMA L: 0.017x0.025-in TMA	Torquing spring was placed on LR5. PTs and PCs were inserted. Bilateral elastics (Fox, 1/4 in, 3.5 oz) were applied from U3s to L6s and L7s.
34-36	U: 0.017x0.025-in TMA L: 0.017x0.025-in TMA	PTs and PCs were inserted. Elastics (Fox, 1/4 in, 3.5 oz) were applied from UR1 and UL1 to LL3 and LL6.
39		Debond

Table 2: *Treatment sequence (continued from the previous page)*

inclination of the upper incisors (U1-SN) (103.5˚ to 110.5˚), while that of the lower incisors (L1-MP) was relatively well-maintained (83.5˚ to 80˚) (Figs. 9-11). Moreover, the mandibular arch was retracted about 8 mm, and the lower lip was retracted about 4 mm, coinciding with the E-line.[8] The Cast-Radiograph Evaluation (CRE) score was 10 points, as shown in the supplementary Worksheet 2.[9] The major discrepancies were rotations and occlusal contacts. (Figs. 12 and 13) Teeth with rotations were UR4, LL6, and LR5. The LL5 buccal cusp was 2 mm out of contact. Especially note that the LL7 mesiobuccal cusp was 1 mm out of contact and the distobuccal cusp 2 mm out of contact. The Pink and White dental esthetic score was 7 points (Worksheet 3).[10] Although the contact area scored 2 points, the patient was very satisfied with the result.

Fig. 7: *Pre-treatment panoramic radiograph*

Fig. 8: *Posttreatment panoramic radiograph*

Fig. 9: Pre-treatment panoramic radiograph

Fig. 10: Posttreatment panoramic radiograph

Retention

Fixed lingual retainers were placed on all maxillary incisors and from canine to canine in the mandibular arch. Clear overlay retainers were delivered for both arches. The patient was instructed to wear them full time for the first 6 months and nights only thereafter. Instructions were provided for home hygiene, as well as for maintenance of the retainers.

Discussion

Extraction Considerations

Creating additional space within the dental arch is essential for managing crowding or achieving camouflage result. Common methods include interproximal reduction (IPR), extraction, and arch expansion.[11] When performing camouflage treatment, extraction can effectively compensate for skeletal discrepancies.[12] Typically, molars and/or premolars are chosen for extraction in Class III cases. Molar extraction provides more space (10-11 mm) for retraction compared to premolar extraction (7 mm), although closing molar extraction spaces is more time-consuming and may lead to anterior crowding. Premolar extraction effectively relieves crowding in the anterior segment, despite potentially causing more torque loss in lower incisors than molar extraction does.[12,13] When dealing with severe anterior crowding in Class III malocclusion cases, extracting the upper second premolars and lower first premolars is commonly recommended.

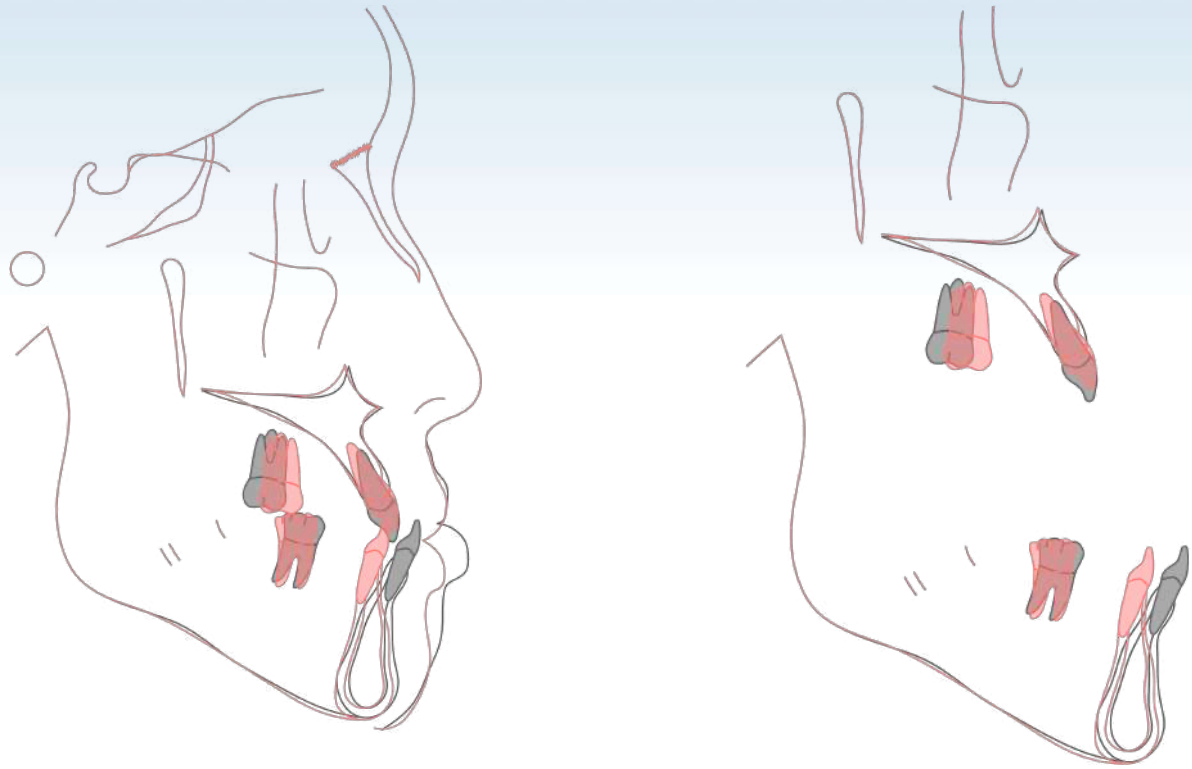

Fig. 11:
Pre- (black) and posttreatment (red) cephalometric tracings are superimposed on the anterior cranial base (left), the maxilla (upper right), and the stable internal structures of the mandible (lower right). See text for details.

Torque Selection and Control

Class III camouflage treatments typically involve proclining the maxillary incisors and retroclining the mandibular incisors to improve the dental occlusion. Differential bracket torque selection is crucial for controlling the axial inclination of these teeth.[14] Normally, low-torque brackets are used for upper anterior teeth and high-torque brackets are selected for lower anterior teeth to compensate for potential side effects from the mechanics of Class III elastics. Since high-torque brackets are unavailable in the Damon system for lower anterior teeth, upside-down low-torque brackets were used to elicit such effect. The mechanics of Class III elastics compensated for the upper anterior torque loss resulting from upper premolar extraction. Hence, for this patient, standard-torque brackets were chosen for upper anterior teeth (Fig. 14). Alternatively, high-torque brackets could also be an option for upper anterior teeth. Class II elastics were applied to increase the lower incisor torque while reducing the upper incisor torque after correcting the negative overjet from the 29th to the 33rd month. Varying bracket torque facilitated differential moment delivery using rectangular leveling archwires early in the treatment. When a rectangular archwire fails to provide sufficient torque, a pre-torqued Ni-Ti archwire (0.016x0.025"/ 0.019x0.025" with 20° torque) is recommended to achieve favorable facial root torque.[15,16] In this case,

Fig. 12: *Posttreatment facial and intraoral photographs*

a 0.016x0.025 pre-torqued Ni-Ti archwire was used on the mandibular arch from the 5th to the 9th month, resulting in satisfactory torque control of the lower incisors as shown in the superimposed cephalometric tracings (Fig. 11).

Correction of Anterior Crossbite

Class III elastics were utilized to correct the anterior crossbite, in combination with posterior bite turbos to initiate the treatment. Posterior bite turbos were placed on the lower molar occlusal surfaces to open the bite.[17,18] Anterior bite turbos on the lingual side of the lower incisors were only added to facilitate overjet correction after the lower incisors were aligned. Minimizing patient discomfort is crucial, especially considering that jumping the bite can lead to discomfort. Open coil springs placed between the upper first premolar

and upper first molar bilaterally facilitated overjet correction by flaring the upper anterior teeth (Fig. 10). The treatment mechanics incorporated Class III elastics, bite turbos, and open coil springs, making the correction process more manageable and less painful for the patient.

Timing of Bracket Torque Expression

High torque was prescribed for the lower anterior teeth, and was achieved by bonding low torque brackets upside down as high torque brackets are unavailable in the Damon system. In the beginning of the treatment, a 0.014" CuNiTi archwire was used. As the archwire was round, bracket torque had very little effect on the teeth. Therefore, after transitioning to a 0.014x0.025 CuNiTi wire in the 3rd month (Fig. 15), the brackets on the lower incisors were rebonded for the rectangular archwire to engage and activate the bracket torque, ensuring effective torque expression to counteract the side-effect of Class III elastics.

Conclusions

Creating additional space within the dental arch is essential for managing crowding or achieving camouflage arch retraction, with premolar extraction being effective in addressing the anterior crowding. Differential bracket torque is crucial for controlling incisor axial inclination when camouflaging Class III malocclusions, with specific brackets and Class III elastics compensating for torque loss. Class III elastics, along with posterior and anterior bite turbos and open coil springs are effective in correcting an anterior crossbite and

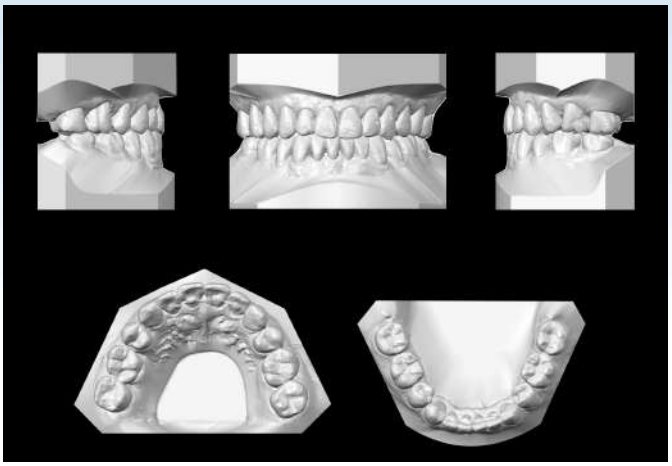

***Fig. 13**: Posttreatment study models (casts)*

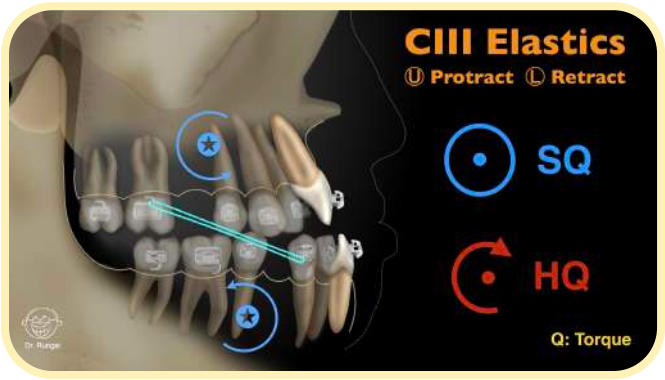

Fig. 14:
Standard-torque brackets for upper and high-torque brackets for lower anterior segments compensated the side effects of Class III elastics.

Fig. 15:
The brackets on lower incisors were rebonded for the rectangular archwire to activate the bracket torque in the 3rd month.

facilitating overjet correction while minimizing patient discomfort.

Acknowledgments

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Discrepancy Index Worksheet

TOTAL D.I. SCORE **39**

OVERJET

0 mm. (edge-to-edge)	=	
1 - 3 mm.	=	0 pts.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	3 pts.
7.1 - 9 mm.	=	4 pts.
> 9 mm.	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. Per tooth = 7

Total = **7**

OVERBITE

0 - 3 mm.	=	0 pts.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	3 pts.
Impinging (100%)	=	5 pts.

Total = **2**

ANTERIOR OPEN BITE

0 mm. (Edge-to-edge), 1 pt. per tooth
Then 1 pt. per additional full mm. Per tooth

Total = **0**

LATERAL OPEN BITE

2 pts. per mm. Per tooth

Total = **0**

CROWDING (only one arch)

1 - 3 mm.	=	1 pt.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	4 pts.
> 7 mm.	=	7 pts.

Total = **7**

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side _____ pts.
Full Class II or III	=	4 pts. per side 8 pts.
Beyond Class II or III	=	1 pt. per mm. 3+4 pts. additional

Total = **15**

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = **2**

BUCCAL POSTERIOR X-BITE

2 pts. Per tooth Total = **0**

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° 2 x 1 pt. = 2

Each degree > 6° _____ x 1 pt. = _____

SN-MP

≥ 38° = 2 pts.

Each degree > 38° _____ x 2 pts. = _____

≤ 26° = 1 pt.

Each degree < 26° _____ x 1 pt. = _____

1 to MP ≥ 99° = 1 pt.

Each degree > 99° _____ x 1 pt. = _____

Total = **6**

OTHER (See Instructions)

Supernumerary teeth	_____ x 1 pt.	=
Ankylosis of perm. Teeth	_____ x 2 pts.	=
Anomalous morphology	_____ x 2 pts.	=
Impaction (except 3rd molars)	_____ x 2 pts.	=
Midline discrepancy (≥ 3mm)	@ 2 pts.	=
Missing teeth (except 3rd molars)	_____ x 1 pt.	=
Missing teeth, congenital	_____ x 2 pts.	=
Spacing (4 or more, per arch)	_____ x 2 pts.	=
Spacing (Mx cent. diastema ≥2mm)	@ 2 pts.	=
Tooth transposition	_____ x 2 pts.	=
Skeletal asymmetry (nonsurgical tx)	@ 3 pts.	=
Addl. treatment complexities	_____ x 2 pts.	=

Identify:

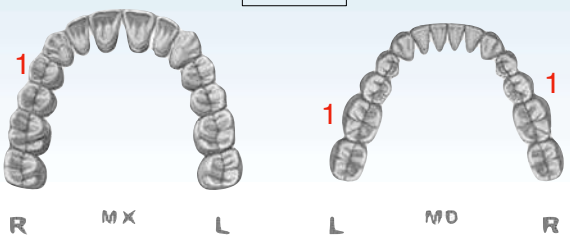
Total = **0**

Cast-Radiograph Evaluation

Total Score: 10

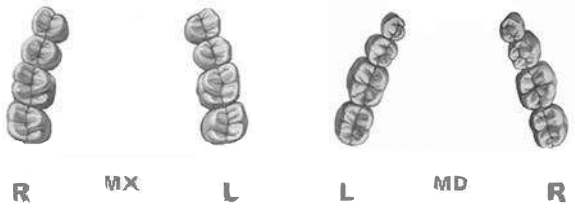
Alignment/Rotations

3



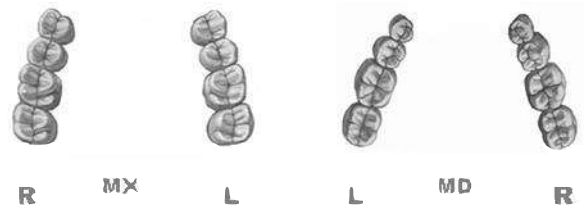
Marginal Ridges

0



Buccolingual Inclination

0

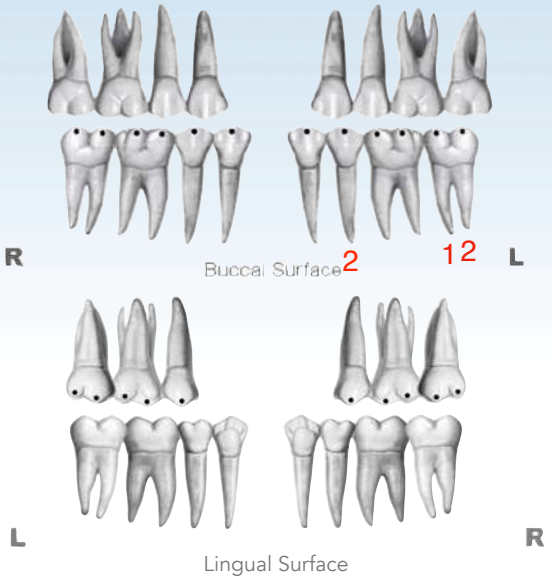


Overjet

1

Occlusal Contacts

5

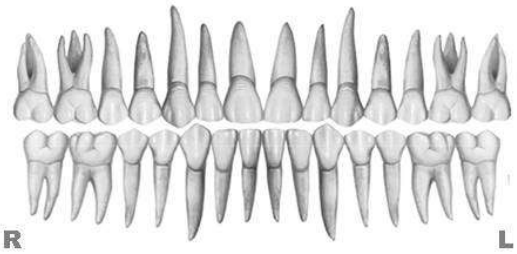


Occlusal Relationships

1

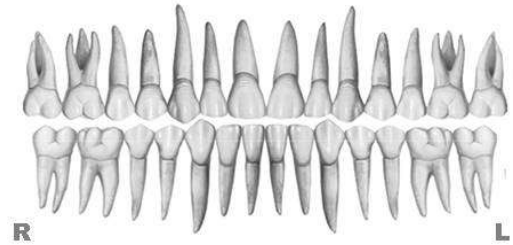
Interproximal Contacts

0



Root Angulation

0



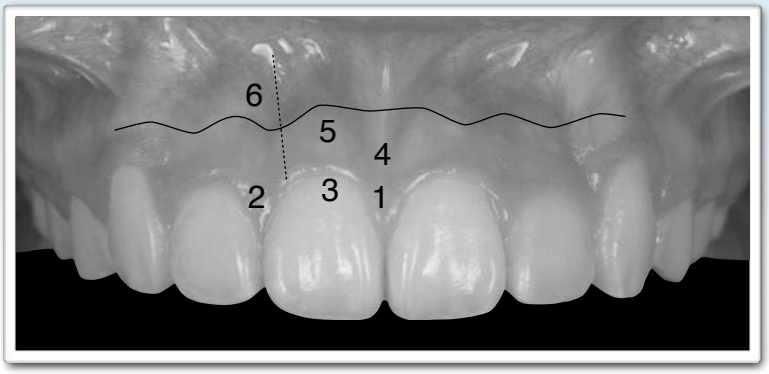
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 7

1. Pink Esthetic Score

Total = 2

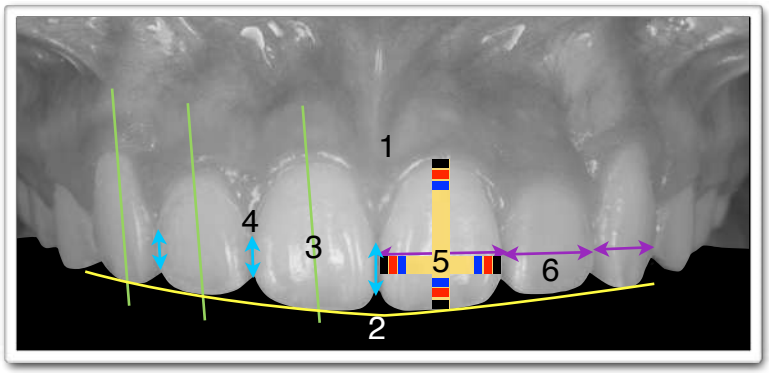


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

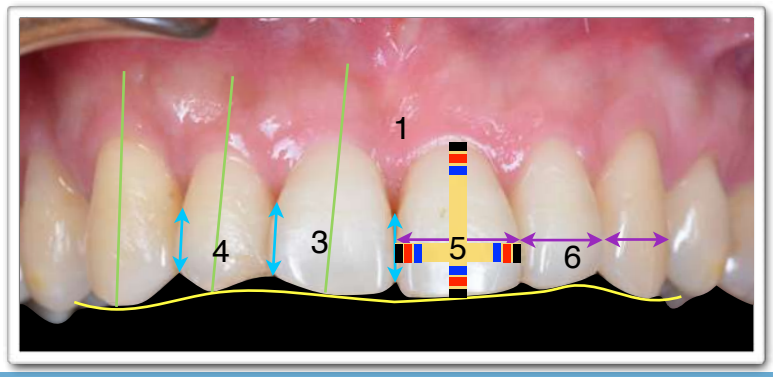
1. M & D Papillae	0	(1)	2
2. Keratinized Gingiva	0	(1)	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	(0)	1	2
5. Root Convexity (Torque)	(0)	1	2
6. Scar Formation	(0)	1	2

2. White Esthetic Score (for Micro-esthetic)

Total = 5



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



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

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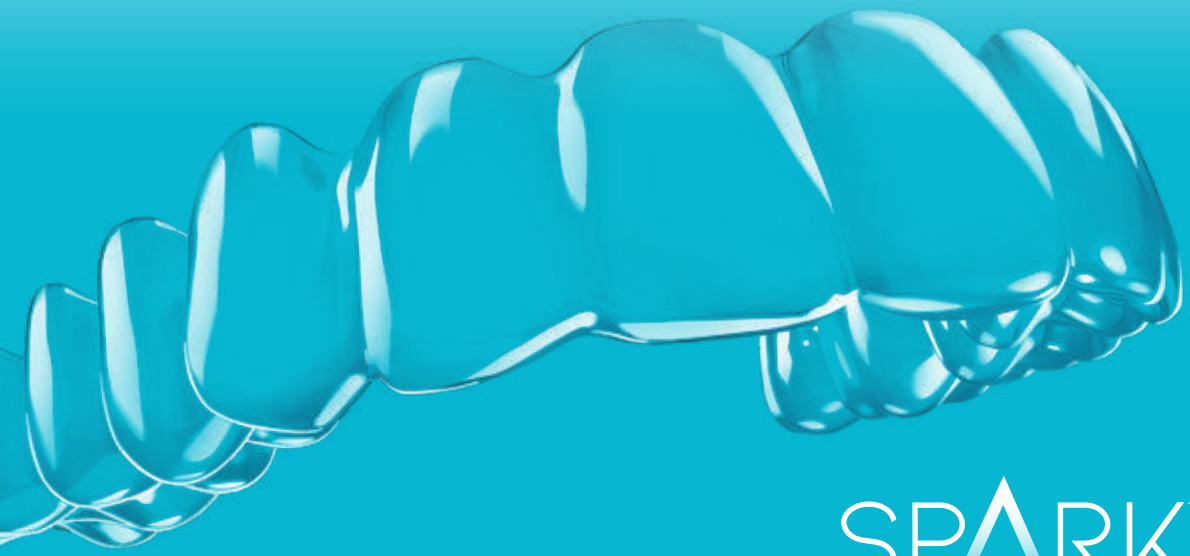

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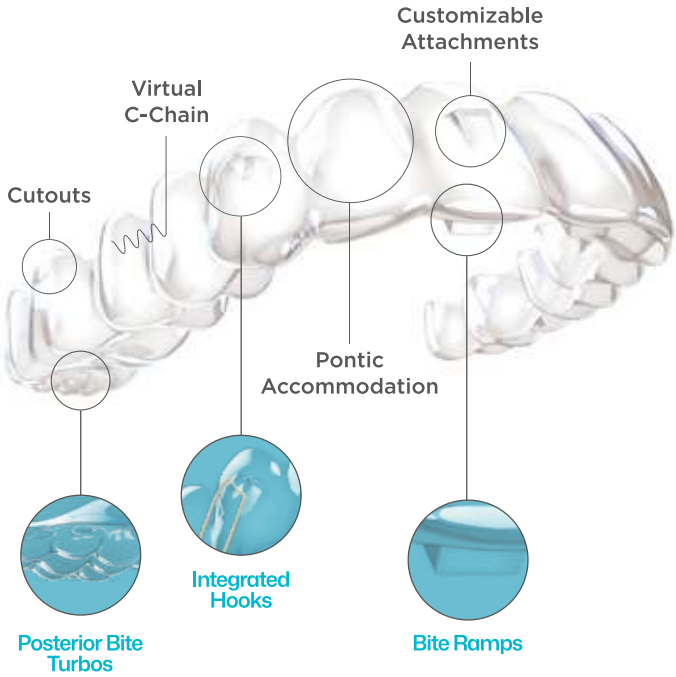

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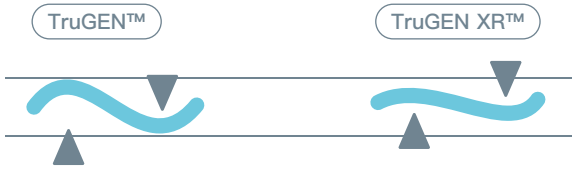

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Center of Resistance: Critical Factor in Expression of Tooth Movement

Abstract

The concept for a tooth's center of resistance (C_{Res}) was introduced about 100 years ago. It is fundamental to the physics of orthodontic biomechanics. The C_{Res} defines the response of a naturally restrained tooth (PDL and alveolar bone) to applied loads. It is typically specified near the center of the bone-supported root. This report describes the dynamic change in the position of the C_{Res} during treatment with fixed appliances (FA) to achieve precise tooth movement with applied force (F) for tipping the tooth and a couple for rotating the root in the plane of the force. The limitation for removable appliances, including clear aligners (CA), is they only readily achieve tipping. A specific set of aligners rarely exceed a treatment efficiency greater than 50% of a programmed clinical simulation like ClinCheck® (Align Technology, Tempe AZ). Removable appliances fail to efficiently control the location of the C_{Res}. (J Digital Orthod 2025;77:46-54)

Introduction

The center of resistance (C_{Res}) for a tooth root restrained by periodontium is the reference point for calculating and understanding tooth movement during orthodontic treatment.[1] The C_{Res} resembles, but not equal, to the center of mass (C_M) for free bodies in physics. Tooth movement is defined by the relationship between the vector(s) applied to the tooth and the position of its C_{Res}. This process is how forces act on a free body relative to its C_M. However, C_{Res} is more complex concept in physics because the "body" (tooth/teeth) is restrained. Unlike the C_M which is a fixed point unless there is a change in the properties of the body. The position of the C_{Res} can change with a decrease in the restrained bone and PDL support, e.g. periodontitis, as well as the position and nature of a load applied to a tooth or segment of teeth, namely a couple at the bracket level.

The C_{Res} controversary in orthodontics has a long history. In 1917, Fish[2] defined the C_{Res} as the three dimensional (3D) point through which a force vector would result in neither tipping nor rotation of the tooth. This pioneering definition was essentially impossible to demonstrate clinically (in-vivo) or in vitro. In 2013, Viecilli, Budiman and Burstone[3] assessed tooth movement in 3D with finite element analysis (FEA). Each plane (X, Y, & Z) had a couple-generated axes of rotation that did not intersect at a 3D C_{Res} as previously postulated. Translation for a given plane is achieved by projecting the intersection of the two axes of resistance perpendicular to the direction of the force.[3]

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Advisor to Chief Surgeon, Meuhedet Medical Services
Private Practice - Tel-Aviv, Israel (Center left)
Agate N. Krausz,
Post Doctoral Fellow, the Graduate Program in Science, Technology and Society, Bar-Ilan University, Ramat Gan, Israel (Center right)
W. Eugene Roberts,
Editor-in-Chief, Journal of Digital Orthodontics (Right)

For the past century, most orthodontic literature suggests the C_{Res} for single-rooted teeth is somewhere between the gingival margin and the mid-root area of the restrained root. C_{Res} is commonly thought to be within the coronal third or apical two-thirds of the root.[4,5] For a multirooted tooth, it is at or near the furcation. The C_{Res} concept applies to all treated and untreated teeth. Physiologic and therapeutic loads are subject to the same restraints. They typically interact to achieve a specific orthodontic outcome.

Objectives of this Report

Analyze current biomechanics literature to elucidate the overall spectrum for tooth movement based on physical principles.[4,5]

Investigate C_{Res} position during orthodontic treatment. Does it change in a manner that influences the tooth movement response?

Determine why CAs only achieve about 50% of programmed tooth movement with a specific set of aligners.[6]

Assess the finishing challenges for CAs compared to fixed appliances.

Center of Mass

The C_M of a free body defines its movement relative to the line of force and/or an applied moment. C_M is amenable to precise mathematical analysis as a behavior due to an applied load. According to physical laws, a force on a tooth if it was a free body in three ways:[3-5]

1. **Through the C_M:** Linear tooth movement (translation) occurs in the direction of the force, and all body parts move respectively.

2. **Offset to the C_M:** Generates combined angular (rotational) and linear (translation) movement when the body rotates around its C_M while moving in the direction of the force.

3. **Applied Couple:** Two equal, but opposite forces, whose lines of action do not coincide produce a moment for pure angular rotation around the C_M.

Contrary to free bodies, teeth are restrained objects.[2-5] Their roots are anchored by the periodontal ligament (PDL) to the supporting alveolar bone.[3,4] Collectively, the periodontium is an organ of reactive tissues responding to repetitive loads with relative high rates of turnover. The PDL is a dynamic tissue about 250 µm thick that turns over very rapidly (in days).[7] Alveolar bone has a high turnover rate compared to

basilar bone.[8] Dynamic turnover properties for periodontium, especially under sustained orthodontic loading, respond to the failure of materials due to the therapeutic load(s) superimposed on the high magnitude, transient loads of mastication. This dynamic natural restraint, dictates tooth movement relative to the C_{Res} position.[3,9]

Numerous *in vivo* and *in vitro* studies of single-rooted teeth in untreated, restrained conditions found C_{Res} at about the middle of the apical two-thirds of the root.[3-5,10] As gingival recession exposes more of the root in the oral cavity, the C_{Res} shifts apically. However, due to variations in biological and physical effects on the surrounding tissues, the precise C_{Res} position varies. Studies on multi-rooted teeth place the C_{Res} near the root furcation.[3,4]

During orthodontic treatment, the variable physical properties of the PDL and alveolar bone make it essentially impossible to pinpoint the C_{Res} at any given moment. Furthermore, unlike free bodies, restrained teeth cannot respond with rotation and translation to force vectors applied to the root. A force applied to the crown results in tipping due to the moment of the force acting on the root. Tipping is the default movement for restrained bodies exposed to a complex environment such as aligners applying forces on all aspects of tooth surfaces. Thus, rotation occurs by tipping.[10]

Biomechanical implications[11-13] of the tooth's natural restraint limit the potential loads acting on it to two types:

1. **Tipping:** Force vectors not passing through the C_{Res} rotate the tooth around the the C_{Res} and not around the center of rotation.[4,5]

2. **Couples:** Generate pure rotation around the C_{Res}.[4,5]

These orthodontic loads differ in application due to the lever arm required for rotation. The further the C_{Res} is from the crown, where loads are applied, the easier it is to achieve tipping from a clinical perspective. Tipping magnitude is directly related to lever arm length. As mentioned above, orthodontic tipping, commonly achieved with removable or fixed appliances, rotates the tooth around its C_{Res}.

When the requirement for apical movement is significantly greater than coronal movement, orthodontic torque (moment applied at the

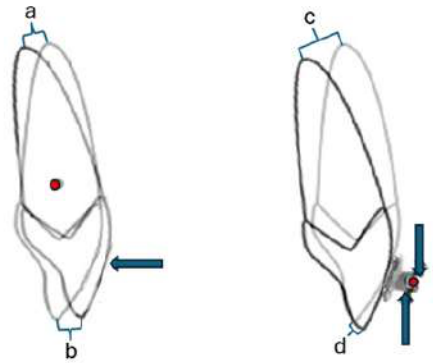

Fig. 1:
The differences between tipping and torque are in tipping, the apex and the crown's edge move about the same (a~b) in opposite directions, while in torque, the apex moves much more than the crown's edge (c>>d), in opposite directions. The red dots marks the C_{Res} during movement, which is equal to the tooth's center of rotation. Note for torque, it corresponds to the bracket where the moment is applied.

bracket) is required. The axis of rotation in the plane of tooth movement shifts from the root to the bracket (Fig. 1). Achieving this important step in the mechanics response is easily facilitated only with fixed appliances. Removable appliances do not change the position the C_{Res} from root to crown for such movements. No aligner or other removable appliance can generate couples in the plane of tooth movement capable of shifting the C_{Res} to the crown of the tooth.

Historical Perspectives

C.S. Case in 1895,[14] achieved the crown tip-based rotation (root torque) by restraining adjacent teeth. The root movement machines achieved root retraction by rotation at the tooth crown level. The necessity for fixed appliances to achieve such precise movement was deemed obvious (Fig. 2).

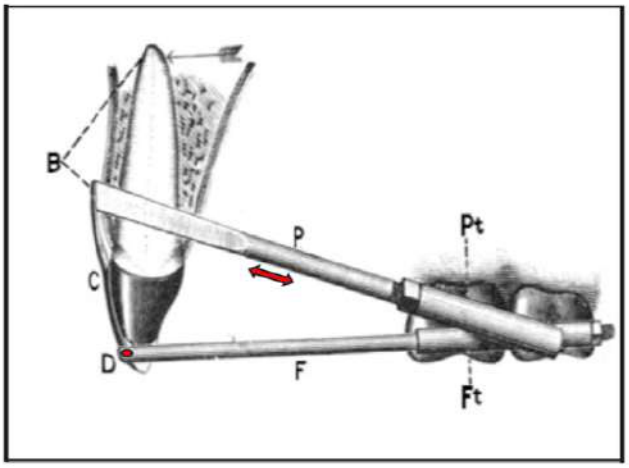

Fig. 2:
The root movement machine built by C.S Case (1895)
Changing the P-arm length rotated the tooth around point D, delivering torque as should be defined: the apex moves more than the crown's edge in different directions. The B-C lever elongates the B-D arm to decrease the needed force for the tipping movement. That cumbersome movement was replaced by the couple in brackets, by EH Angle (1927)

This nuanced understanding of a tooth's C_{Res} challenges a clinician's concept of traditional physics applied to orthodontics. However, Case's "Root Movement Machine" underscores the critical role of precise biomechanics in achieving optimal treatment outcomes.[14] This level of precision is not possible with a flexible plastic CA designed to create root torque by engaging ridges on bonded attachments with the aligner material.[15]

An alternative fixed appliance (FA) method for root movement is an archwire-mounted torque spring, which generates a tipping vector that relies on an axis of rotation determined by the archwire.[16] The latter is retained by fixed appliances bonded to the teeth. However, the torque spring load is typically lower than rectangular archwire torsion because of the torque spring lever arm. Torque springs are usually applied to a single tooth that requires root movement (Fig. 3).

The third FA option is to apply a couple directly in the rectangular slot of the bracket (Fig. 1). This form of root torque depends on torsion in a rectangular

Fig. 3: *Torquing spring*

archwire when it is inserted into a rectangular bracket attached to the tooth. With these mechanics, the center of rotation (C_{Rot}) is identical to the C_{Res} location. Both correspond to the point of action of the couple.[4]

Orthodontic couples precisely applied are complex and demanding mechanics governed by four strict rules outlined below.[11-13] The center of rotation, due to the mechanical restraint of the tooth, resides at the center of the bracket bonded to the tooth crown:

1. **Equal magnitude of opposite forces** (vectors) generating the couple.

2. **Exact opposition in the direction** of the vectors.

3. **Action in separate planes**, ensuring the vectors do not intersect.

4. **Essential integration** demands that the components generating the couple on a tooth (or teeth) remain securely connected throughout the entire period of movement. For example, a stable bond is required between the wire (e.g., a rectangular metallic archwire) and the tooth via a bracket affixed to its surface. The same principle applies to groups of teeth.[15]

The developed and/or frictional forces between the appliance components add to the natural restraint of the tooth. Collectively these physical factors are deemed artificial restraint. Due to its relatively high magnitude, this artificial restraint shifts the C_{Res} from the root to the bracket. While the artificial restraint is active and maintains its magnitude, the C_{Res} remains at the bracket level. However, when the bond between the bracket and the wire weakens due to less activation the artificial restraint diminishes or disappears. Then the C_{Res} reverts to its natural location, influenced by the natural restraining structures such as alveolar bone and periodontal ligament (PDL). This is the restrained body concept in orthodontic biomechanics that is critical for understanding orthodontic tooth movement.

Any couple or force applied to the bracket that results in activation exceeding the natural restraint will relocate the C_{Res} to the bracket corresponding to the C_{Rot}.[5] Even slight deviations from the specified conditions will nullify couple mechanics resulting in rotation of the tooth at the bracket level.

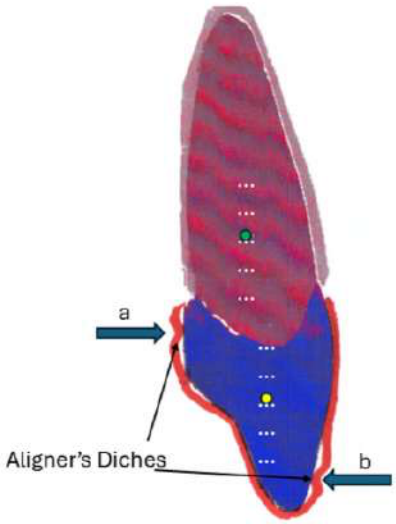

Fig. 4:
The center of resistance is the green point with the root and the center of rotation is the yellow point midway between the lines of the opposite force supposedly generated by the couple. This 2D concept is invalid for clinical use of aligners. Aligners always apply forces in 3D despite the position of ridges and attachments. The 3D force system when an aligner is seated completelynegates simplified 2D concepts.

Generating Couples with CAs

J.J. Sheridan[17] and R. Nanda[18] report a couple is generated by a CA on the tooth crown via opposite vectors applied via ridges in aligners or bonded attachments. It is presently argued that their concept is more aspiration than science.[15] It is not possible to routinely produce a couple on the surface of a tooth in the desired plane of tooth movement using a removable appliance like CAs.[19]

Fig. 4 illustrates the claimed generation of a "couple" using internal protrusions (prominent bands) in aligners. Such a system fails to meet the stringent criteria for a couple. It lacks a continuous integral connection to the tooth throughout the path of tooth movement.

Aligners are removable devices that cannot produce a couple typical of fixed appliances (Fig. 1), so their scope of action is limited to a single type of movement: tipping. This type of movement is achieved via a single force vector (or the resultant of forces in different directions resolved with a parallelogram).

Applying a single vector to a naturally restrained tooth crown causes tipping, meaning the tooth rotates near its natural C_{Res} located in the root, according to the vector's direction. To maintain the desired tipping direction over time, the vector must be applied consistently to maintain the rotation axis relative to the estimated C_{Res}. The variables are the magnitude and direction of the vector relative to the exposed portion of a tooth which is usually the crown. Deviations from this axis, particularly during relatively long-term movements, may cause undesirable tooth rotation requiring corrective adjustments that extend treatment time (new set of aligners). However, aligners only achieve about 50% of programmed tooth movement.[6,9] An acceptable finished result is only achieved by overcorrection with a new set of finishing aligners to deliver what turns out to be an array of tipping forces.[20]

The challenge of maintaining precise tipping over time contributes to the inefficiency of aligners. Complex treatment typically requires many reboots with new sets of aligners. This limitation stems from the inability to generate couples typical of fixed appliances. Simulations of bodily translations with overtreatment by multiple sets of aligners may be deemed "walking" teeth to the desired position. This is a limitation for all removable devices compared to the precise mechanics of fixed orthodontic appliances.

Compensating for Aligner Limitations

In recent years, numerous studies have proposed methods to improve treatment outcomes with aligners, primarily through finite element analysis (FEA).[21-25] These studies suggest enhancements to improve efficiency such as attachment placement, ridges in aligners or composite bumps on teeth to secure seating. Treatment planning involves overcorrection, over-treatment strategies, and other compensating techniques. These recommendations assume that such preemptive adjustments will finally achieve the desired tooth positions. Compensations can improve outcomes with CAs, but there is no improvement in biomechanics efficiency. Aligners deliver indeterminate mechanics.

So it requires multiple sets of records and new aligners along the way.[19]

Shifts in C_{Res} During Fixed Appliance Treatment

C_{Res} shifts occur naturally due to natural and artificial restraints during fixed appliance treatment. For example, consider the distal movement of a canine to close a first premolar extraction space. Using a power chain or closed spring applied at bracket height, the canine initially rotates around its natural C_{Res} in the root. As deformation and friction in the slot-wire junction increases, the movement transitions to a couple, shifting the C_{Res} to the slot. This autogenous interplay continues cyclically until the space is closed. This example demonstrates the dynamic C_{Res} relocation required for translational movement with fixed appliances.

Fundamental Differences in Biomechanics

Orthodontic biomechanics must distinguish between the capabilities of fixed versus removable appliances. Fixed appliances, with interaction between natural and artificial restraints, enable all types of orthodontic movements (e.g., tipping, torque, as defined above, via couples, and translation). In contrast, removable appliances like CAs can only perform complex patterns of tipping movements. With programmed overcorrection and multiple sets of aligners, a reasonable outcome is possible. However, precise finishing in 3D requires fixed appliances.

The most definitive advantage of fixed appliances over CAs lies in their ability to dynamically control the C_{Res} position. Precise shifting of the C_{Res} between the root and crown enables ideal orthodontic outcomes. This precision is absent in aligners. Achieving optimal outcomes with respect to translation requires overcorrection with multiple sets of aligners. Rebooting with new 3D records at whatever position the teeth achieve with a particular set of aligners is essential. The entire aligner alignment process is "walking" the teeth to an optimal outcome with a complex array of tipping movements.

Conclusions

1. Artificial restraint imposed by fixed appliances plays a pivotal role in shift of the C_{Res}.
2. Optimizing fixed appliance capabilities to dictate the position of the C_{Res} is essential for advancing excellence in treatment outcomes.
3. Achieving precise tooth movement with fixed appliances requires control of the interface between the archwire and bracket slot, i.e it must be a 'strong' or 'unequivocal' connection.
4. Movement boundaries are significantly greater with fixed appliances than with removable ones.
5. Lack of precision in controlling boundary conditions decreases the clinical efficiency of clear aligners.
6. Consequently, aligner-based treatment is unlikely to match the clinical excellence of fixed appliances particularly with respect to finishing details.

7. Fixed appliances exceed all removable appliances including clear aligners in achieving precise tooth movement in 3D.

Acknowledgement

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2025 一年一度 Damon Master Program


+


全新改版的 2025 年貝多芬高效 Damon 矯正大師系列課程，是由國際知名講師張慧男醫師親自規劃及授課，課程特色強調由臨床病例帶動診斷、分析、治療計畫擬定與執行技巧，本年度亦特別加入最新的**數位矯正與隱形牙套**的內容，並邀請了貝多芬牙科集團各院院長演講特別矯正專題。

此外，透過數位影片反覆觀看，結合矯正與電腦教學，課堂助教協助操作，讓學員在短時間能快速上手，感染「熱愛矯正學，熱愛學矯正」的熱情。

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2. Bonding position
3. Bonding + BT + ceph tracing
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5. Finishing bending & fixed retainer

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2. Simple and effective anchorage system
3. Extraction vs. non-extraction analysis

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1. Soft & hard tissue diagnostic analysis
2. Big overjet correction
3. Damon diagnosis & fine-tuning

Practice: Ceph tracing（金牛頓工程師）

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Practice: Ceph superimposition & measurement（金牛頓工程師）

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1. Class III correction
2. Class II correction

Topic: Early orthodontic treatment（曾淑萍醫師）

Module 7 - 6/19

1. Upper impaction
2. Lower impaction
3. Gummy smile correction

Topic: Modified VISTA（蘇筌瑋醫師）

Module 8 - 7/3

1. ABO DI, CRE workshop (林彥君醫師)
2. Open bite

Topic: Ortho-viewed interdisciplinary treatment（徐重興醫師）

Module 9 - 7/17

1. Implant-ortho combined treatment
2. Asymmetry

Topic: Impacted cuspid treatment（張譯文, 張瑜珍, 黃亭雅, 陳韻如醫師）

Module 10 - 7/31

1. Minor surgeries in orthodontics
2. Digital orthodontics

Topic: Modified 2X4 appliance in ortho treatment（李亮賢醫師）

Module 11 - 8/14

1. Aligner design
2. Comprehensive aligner treatment
3. Aligner & its challenges

Topic: Pre-aligner treatment（林詩詠醫師）

▲ **Special lecture: 1:30-3:00 pm**

時間：週四全天（9:20 am - 5:00 pm）

地點：金牛頓藝術科技（新竹市建中一路 25 號 2 樓）

費用含課程視訊*、iPad、課程電子書與材料。

*贈送之課程視訊提供兩年時間串流觀看。

報名專線 湧傑 Yong Chieh

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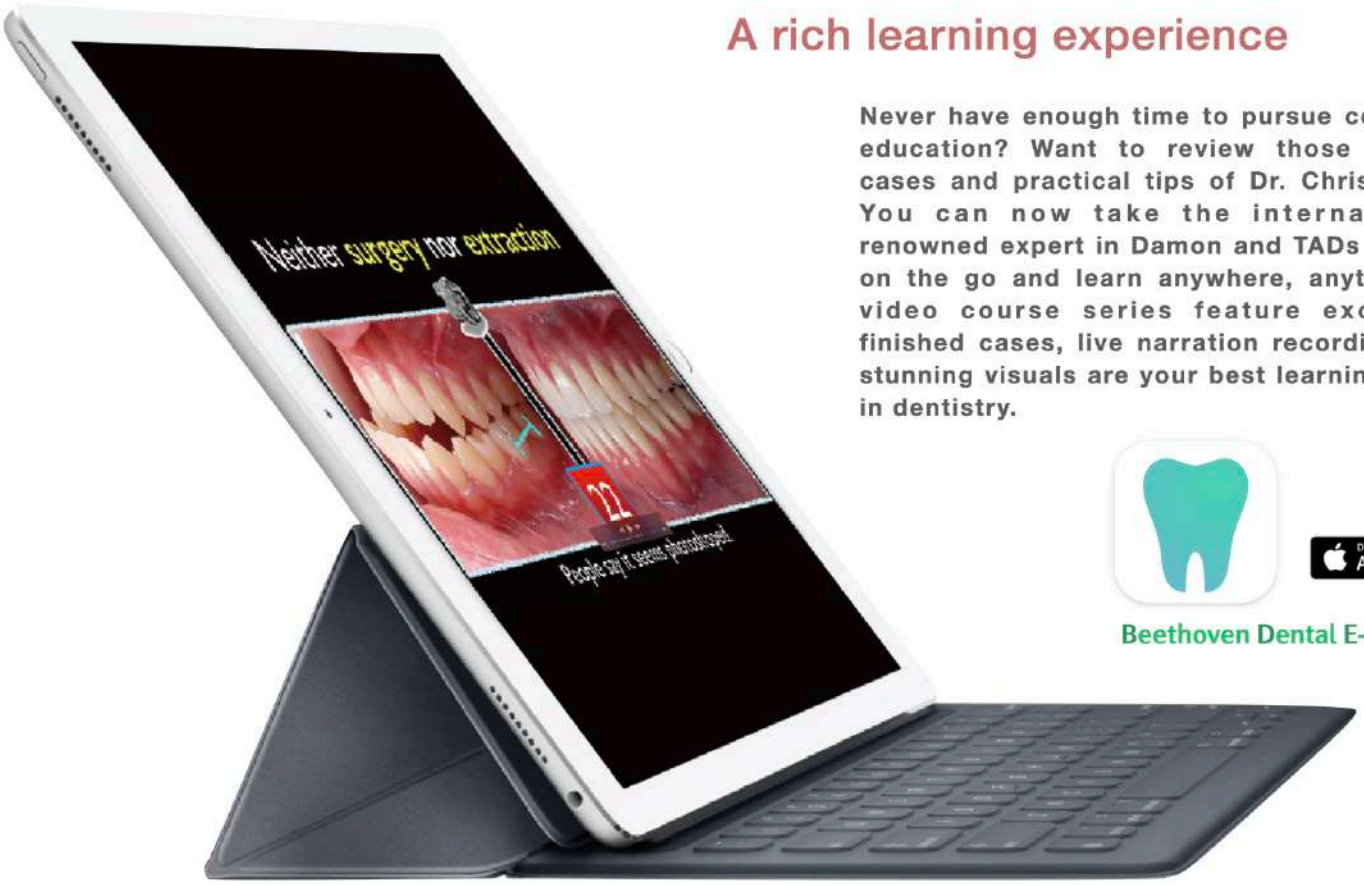

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(9 seasons)

non-narrated

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non-narrated

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non-narrated

E Implant

E-Implant

non-narrated

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Note:

1. Most video courses are available in both English and Chinese and are sold separately.
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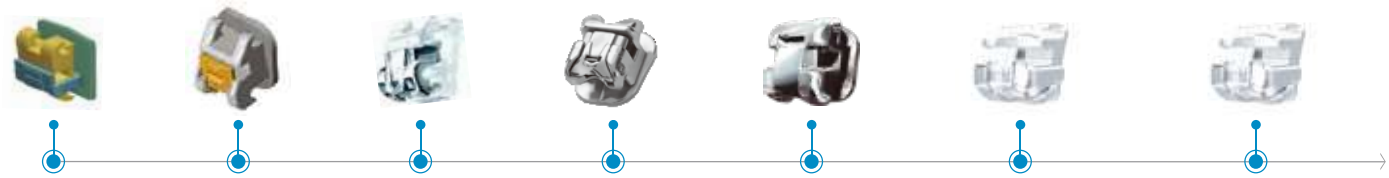

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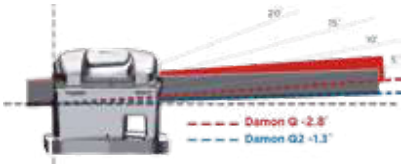

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DAMON™ CLEAR 2	NT$189,999	NT$459,999

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Fig. 1: Dr. Chris Chang, recipient of the 2025 John Valentine Mershon Memorial Award[*1]*

Where Legacy Meets Innovation: Reflections on the Mershon Award and an AI-Assisted AAO Presentation

傳承與創新的交會點：
從 Mershon Award 到 AI 輔助AAO演講的啟示

Anyone who has devoted themselves to the field of orthodontics has likely heard of the John Valentine Mershon Memorial Award. Established by the American Association of Orthodontists (AAO) in 1960, it is the third oldest honor - following the Ketcham and Hellman Awards - designed to recognize individuals who have made visionary and inspiring contributions to the profession. Dr. Mershon was a direct student of Dr. Edward H. Angle and served as Head of the Department of Orthodontics at the University of Pennsylvania from 1916 to 1925, during which time he developed the innovative removable lingual arch. His influence continues to shape the field, and the award that bears his name has become a symbol of excellence in clinical innovation and treatment philosophy. In an era where orthodontic tools and concepts are increasingly refined, receiving this honor carries even greater significance.

*[1]圖一：張慧男醫師於 2025 年獲頒 John Valentine Mershon 紀念獎。

Lexie Y. Lin
Resident, Beethoven Orthodontic Center

每一位投身矯正學的專業人士，或許多少都曾聽過 John Valentine Mershon Memorial Award 的名字。這個由美國矯正醫學會（AAO）於 1960 年設立的獎項，是僅次於 Ketcham 與 Hellman 獎的第三個最古老榮譽，旨在表彰那些在矯正學領域提出具遠見與啟發性理念者。Dr. Mershon 本人不僅是 Dr. Edward Angle 直接教導的學生，更在任教於賓州大學期間（1916–1925）創新性地發展出 removable lingual arch。他的貢獻延續至今，這項獎項也因此被視為象徵矯正臨床實踐與治療哲學創新卓越貢獻的成就。在治療理念和矯正工具越發成熟的今日，要榮獲此殊榮，著實別具意義。

Two weeks before the lecture, Dr. Chang asked me to use AI to create a Keynote presentation introducing the history of the Mershon Award. That request became the starting point for a new kind of preparation - one that embraced AI as a tool for both thinking and design. Beyond helping me clarify historical context and personal connections, ChatGPT became a creative partner in shaping the narrative. I also incorporated Ghibli-inspired illustrations into the Keynote slides, giving the presentation not only accuracy and fluency, but also warmth and imagination. AI became more than just a tool - it was a dialogue partner and a source of inspiration. The entire process reminded me of orthodontic treatment itself: once the

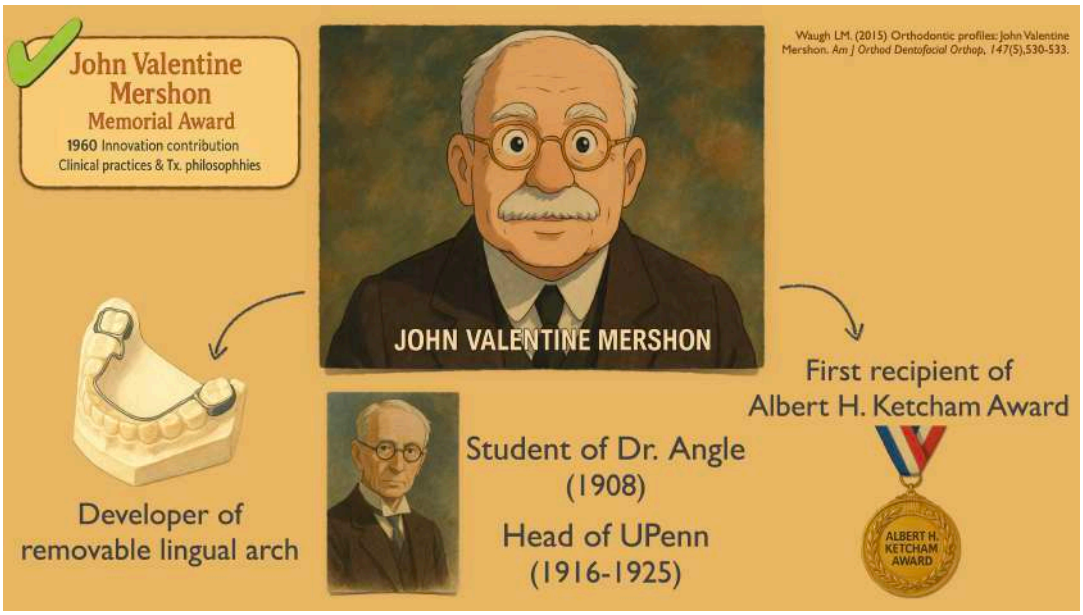

Fig. 2: Dr. John Valentine Mershon, a student of Dr. Angle and former Head of UPenn Orthodontics, developed the removable lingual arch and was the first Ketcham Award recipient. The Mershon Award, founded in 1960, honors clinical innovation.[*2]

[*2]圖二：John Valentine Mershon 博士是 Angle 博士的學生，也是賓州大學矯正所的前所長，他發展出卸除式舌側牙弓維持器，也是第一位 Ketcham 獎的得獎者。成立於 1960 年的 John Valentine Mershon 紀念獎讚揚的是臨床上的創新。

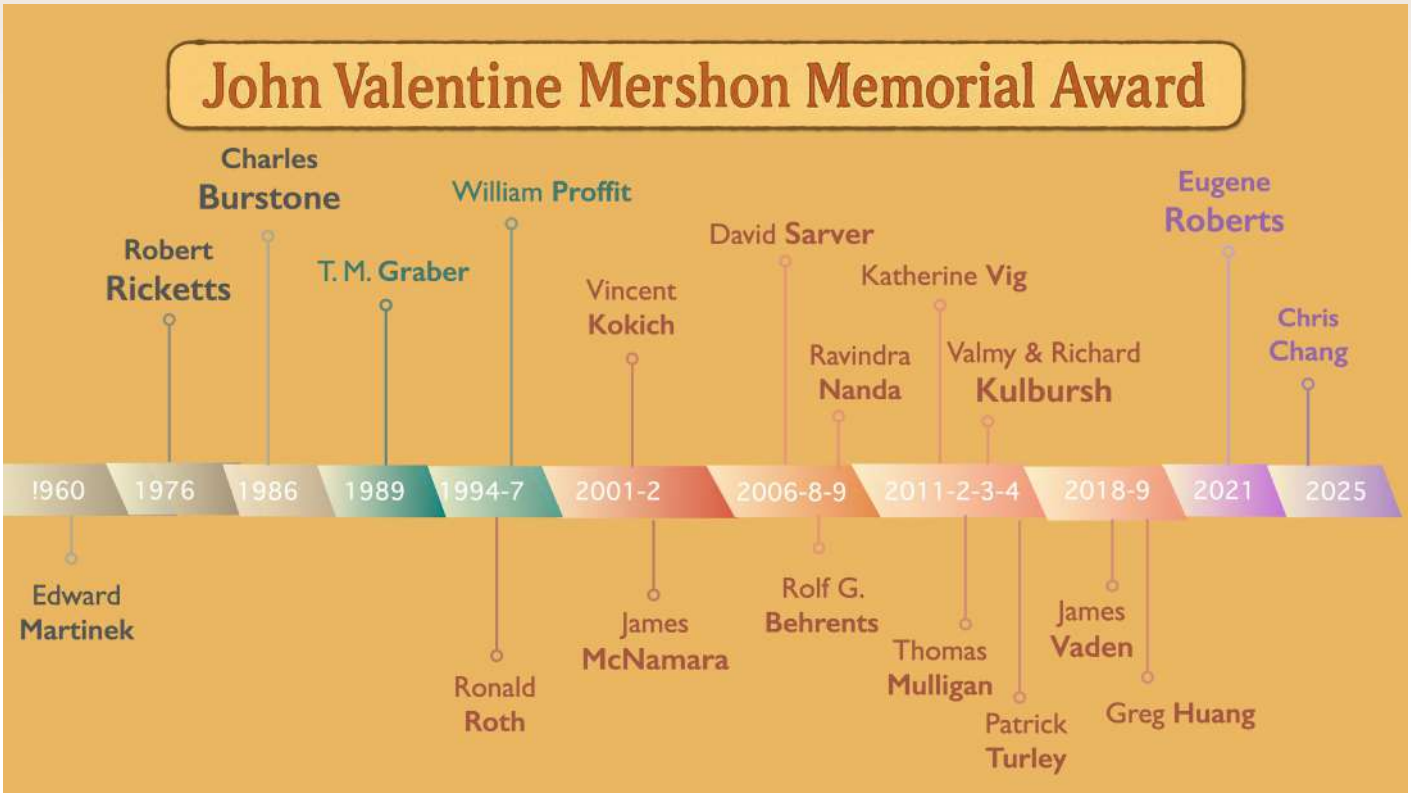

Fig. 3: Timeline of distinguished recipients of the John Valentine Mershon Memorial Award.[3]

direction is clear, we rely on the right tools and refine each step, continuously optimizing to strike the right balance between beauty and gentle force.

在演講前兩週，張醫師請我用 AI 製作一份關於 Mershon Award 歷史的 Keynote 簡報，這也成為我嘗試以一種新的方法做簡報的契機：善用 AI 技術輔助思考與設計。除了透過 ChatGPT 釐清人物關係、歷史脈絡，更在 Keynote 的設計中加入吉卜力風格的插畫，讓這份介紹不僅正確、流暢，也更富創意與溫度。AI 不再只是工具，它也成為了高質量對話的對象、靈感的觸發點。整個準備過程就如同進行矯正治療：先確立方向，再善用工具，在細節中持續打磨，追求美學與力度之間的最佳平衡。

Witnessing Dr. Chris Chang receive the Mershon Award in Philadelphia this year was one of the most thrilling moments of my trip. Not only is he a role model and mentor within my family, but he is also the first Asian recipient in the award's history. Within a minute, the lecture room was packed with

*[3]圖三：John Valentine Mershon 紀念獎獲獎者時間軸。

Fig. 4: Among 65 recipients of the Mershon Award, only four have been from outside the United States. Dr. Chris Chang is the first Asian honoree.[4]*

over a hundred attendees. Dr. Chang opened with his signature humor, pausing perfectly for three seconds after a well-timed remark that instantly captivated the audience. He then delivered decades of insight into orthodontics with clarity and conviction, sharing not only his clinical wisdom but also the deep sense of responsibility he carries for the profession. As gasps and murmurs of admiration echoed through the room, we witnessed how some of the most complex and demanding cases were solved through his unconventional thinking and masterful technique. The pacing and timing of the entire lecture were flawless - concluding with a seemingly self-deprecating joke that, in truth, landed like a strategic mic drop, deterring any would-be challengers.

今年在費城親身見證 Dr. Chris Chang 獲頒 Mershon Award，是我此行最令人激動的時刻之一。他不僅是我家族中的榜樣與導師，更是歷來首位獲此殊榮的亞洲人。講座開始前不到一分鐘，演講廳迅速湧入了上百位聽眾；張醫師以一貫幽默的風格揭開序幕，丟

*[4]圖四：在 65 位紀念獎得獎者中，只有 4 位非美國籍，張醫師更是亞洲第一位得獎者。

出一句話後精準停頓三秒，立刻吊足了全場胃口。隨後，他以簡潔而深刻的語言，分享了自己數十年來對矯正學的洞見與責任感。台下一聲聲驚嘆中，我們一同見證了那些極度困難、刁鑽的案例，如何被他以跳脫框架的思維與高超的臨床技術逐一破解。整場演講的節奏與時間控制無可挑剔，最終以一個看似自嘲的笑話作結，實則是一記高明的降維打擊，讓別人不敢輕易提出挑戰。

At that moment, I truly understood the saying: "Teaching by words is not as powerful as teaching by action; and teaching by action is still not as powerful as shaping through presence." True influence is not delivered - it is absorbed, through a continuous and transformative experience. Perhaps ten years from now, neither I nor his daughters will remember every detail of the lecture. But the spirit of legacy will continue to flow through our veins - like a long-distance relay, quietly urging us to keep refining ourselves - until the day comes when we too are ready to pass on the baton.

那一刻，我深刻體會到：「言教不如身教，身教不如境教」— 真正的影響力，不是灌輸的知識，而是潛移默化、持續發生的動態歷程。或許十年後，對我與他兩位女兒而言，這場演講的細節未必仍清晰可辨，但那份堅定傳承的精神肯定會在我們的血液中持續流淌，如同一場長跑接力，默默驅動我們不斷精進，並在某個時刻，穩穩地把我們所學與信念傳遞出去 — pass on the baton。

Fig. 5: Dr. Chang and family with the current president of AAO, Dr. John Callahan, and his wife, Elet Callahan.
圖五：張醫師一家與現任 AAO 會長 Dr. John Callahan 及其夫人 Elet Callahan。

Fig. 6: Dr. Chang and a fully seated hall during his lecture that followed the award receiving ceremony.
圖六：張醫師與高朋滿座的演講廳。

Fig. 7: Dr. Chang and Beethoven's doctors with Dr. Rolf Behrents, the former chief editor of AJO-DO, at the AAO meeting
圖七：張醫師及貝多芬的年輕醫師團與前任 AJO-DO 主編 Dr. Rolf Behrents 於 AAO 大會上合影。

2025 第十七屆

貝多芬 矯正精修班

時間：週二上午 09:20-12:00

地點：金牛頓教育中心（新竹市建中一路 25 號 2 樓）

上課日期：

2025　3/18、4/15、5/13、6/10、7/8、8/5、9/9、10/21、11/11、12/9、1/13/26'

全新的第十七屆貝多芬精修班是由國際知名講師-張慧男醫師主持，並偕同貝多芬牙醫住院醫師群聯合講授，內容包含下列主題：

1. 精選矯正權威期刊 AJODO 的文章做文獻分析與評讀。
2. 精緻完工 ABO 案例報告，其中因應數位矯正的世界趨勢，Invisalign 病例為課程探討的主要內容之一。
3. 分享臨床上常犯的錯誤以及解決方法。

2025 貝多芬精修班內容豐富精彩，讓您經由每個月一次的課程，在面對各式的臨床案例時，更能游刃有餘、得心應手。

學習目的：

研讀最新趨勢文章可以窺知世界文獻公認的治療方式，而藉由評論文章的優缺點不僅能夠訓練判斷與思考能力，更可以清楚比較作法上的不同，達到完整理解治療方向、內容與穩定性的目標。

報名專線：03-5735676 #218 陳小姐

2025 第四届 张慧男正畸大师班


全新重启的 2025 贝多芬张慧男正畸大师系列课程是由**国际知名讲师张慧男医师亲自规划及授课，课程特色强调由临床病例带动诊断、分析、治疗计划拟定与执行技巧**。

本年度**特别新增两天的课程，加入最新的隐形牙套内容**，让学员可以物超所值地学习最新正畸趋势！透过数位视频反覆观看，课堂助教协助实操，让学员在短时间能快速上手，感染**“热爱正畸学，热爱学正畸”**的热情。

名额有限，一年仅有一次机会完整体验正畸大师课程，错过只能等明年啰！

课程地点：五星级厦门五缘湾凯悦酒店（厦门，湖里区，湖里区日圆二里五号）

课程 1- 6/24 (二)

1. 如何选择第一个病例:建立自信
2. 精准的托槽定位法
3. 高效正畸治疗“四步法”
4. 病例总结和讨论
5. 托槽粘结+BT(合垫)+头影测量

练习：临床摄影技术

课程 2 - 6/25 (三)

1. 简单高效的支抗系统的运用
2. 拔牙与否的诊断分析
3. 病例总结和讨论
4. 实操：微种植支抗系统 + 间隙关闭法 + 牵引钩的使用 + 弹簧的使用

练习：头影测量；完成患者照片记录（模板）

课程 3 - 7/15 (二)

1. 戴蒙系统的诊断与微调
2. 正畸完成后的效果评判
3. 病例总结和讨论
4. 实操：弓丝的弯制和固定保持器的制作

练习：指导患者拍照记录（用自己的时间）；修图技术

课程 4 - 7/16 (三)

1. 完美的结束：病例演示
2. 保持和复发：病例演示
3. 病例总结和讨论
4. 实操：演讲演示

练习：演示病例报告

课程 5 - 9/16 (二)

1. 正畸中生物力学的诊断分析
2. 正畸中软组织和硬组织的诊断分析
3. 青少年与成人正畸的诊断分析
4. 病例总结和讨论

练习：病例报告

课程 6 - 9/17 (三)

1. 对于拥挤病例拔牙与否的诊断分析
2. 如何实现上颌的压入
3. 如何实现下颌的压入
4. 病例总结和讨论

文献探讨：托槽的定位；埋伏尖牙的正畸

课程 7 - 10/14 (二)

1. 缺失牙的正畸分析：前牙缺失 vs. 后牙缺失
2. 反合的正畸分析：前牙反合 vs. 后牙反合
3. 病例总结和讨论

文献探讨：尖牙替代缺失的侧切牙的正畸分析

课程 8 - 10/15 (三)

1. 高角开合与低角深覆合病例的诊断分析
2. 美国正畸协会，DI CRE 分值测量实操
3. 病例总结和讨论

文献探讨：DI & CRE 文献

课程 9 - 11/18 (二)

1. 如何改善露龈笑；矫治器拆除的注意事项
2. 正畸结束时的微调
3. 病例总结和讨论

文献探讨：完美的正畸效果（良好的咬合；前牙的美学效果）

课程 10 - 11/19 (三)

1. 联合种植支抗的正畸治疗
2. 多学科联合治疗成人复杂病例
3. 病例总结和讨论

文献探讨：IDT

课程 11 - 12/23 (二)

1. 隐形牙套正畸
2. 隐形牙套及其挑战

文献探讨：隐形正畸前置治疗

课程 12 - 12/24 (三)

1. 隐形牙套结合支抗钉治疗
2. 隐形牙套力学

文献探讨：（待公布）

课程含案例互动与模型实操，并赠课程电子书讲义、课程视讯。
（赠送之课程视讯提供两年时间串流观看）

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My Journey in Pursuing a Master's Degree in Orthodontics in Germany

In my early dental training, my specialization focused on prosthodontics. As I gained more clinical experience, I began to realize a key issue: the alignment of teeth significantly affects the quality and success of prosthetic treatment. When teeth are not in ideal positions, even with the utmost effort put into making prostheses, both function and esthetics may fall short of expectations.

This clinical dilemma led me to reflect: if orthodontic treatment could be introduced before prosthetic rehabilitation, moving teeth into more favorable positions, it would enhance the precision of prosthesis design and bring outcomes closer to our shared goal of natural harmony. After all, no matter how refined, a prosthesis can never fully replicate the beauty and function of natural teeth. I discovered that by extracting compromised teeth and rearranging the dentition, it is sometimes possible to reduce the need for prosthetic reconstruction, allowing patients to achieve both function and esthetics with their natural dentition. This insight deeply resonated with me and sparked my dedication to studying orthodontics.

During my orthodontic learning journey, I was fortunate to attend the courses of Dr. Chris Chang. His teachings became a pivotal milestone in my transition into the field. Dr. Chang not only taught systematic and practical orthodontic knowledge and procedures, but more importantly, encouraged us to think deeply about every step - why it was done and what logic it followed.

Fig. 1 :
Dr. Lin with Dr. Chris Chang and other course attendees at the 2018 Beethoven Damon Master Program in Taiwan.

His philosophy emphasized simplicity and effectiveness. He believed that through genuine understanding and diligent practice - by collecting data, analyzing thoroughly, and improving step by step - every doctor could achieve consistent growth. One of his core messages was: "Continuous improvement, wholehearted dedication; mastering one method thoroughly is more powerful than learning many superficially." These values deeply influenced me and helped me, an ordinary general practitioner, to gradually build confidence and competence in orthodontics.

In 2022, Dr. Chang introduced us to the International Orthodontic Master Program, offered in collaboration with the University of Duisburg-Essen

Yi-Hsuan Lin,
Training Resident, Beethoven Orthodontic Center

in Germany. This program held great significance for us - not only as an advanced orthodontic training opportunity but also as a formally recognized and well-structured academic degree. It allowed us, while maintaining our clinical duties, to systematically develop over two years and ultimately earn a solid orthodontic qualification, enhancing both our academic credentials and clinical capabilities.

The curriculum of this master's program emphasizes not only theoretical and academic foundations but also practical clinical applications. It begins with essential research skills, including scientific reasoning, literature analysis, clinical study design, and evidence-based practice, while reinforcing ethics and quality standards. These skills prepared us for the master's thesis with both scientific depth and clinical value.

Clinically, the program progressed from foundational topics such as tooth biomechanics, facial growth, and muscle-related jaw development to three main orthodontic approaches: functional appliances, fixed braces, and clear aligners. It also incorporated advanced interdisciplinary treatments, including orthognathic surgery and cleft care, which provided us with comprehensive clinical frameworks. Additional topics such as space management, ectopic teeth, periodontal diagnostics, and treatment planning for younger patients further prepared us to deliver individualized and patient-centered care.

Moreover, courses on local anesthetics and their complications, risk management in tooth extractions, and pain control strategies underscored the program's commitment to patient safety and clinical detail, helping us develop a broader clinical mindset.

Each student was assigned a personal academic advisor to guide us through the process of writing a master's thesis. Through the cycles of data collection, analysis, and discussion, we gradually built meaningful and clinically relevant research. Prior to this academic journey, we had already completed the foundational and advanced-level Beethoven Damon Master Program designed by Dr. Chris Chang. Following his Clinical Education course, we also published two clinical papers under his guidance. These experiences laid a solid foundation for our academic writing and ensured a smooth transition into thesis development.

The program also included online case report discussions, where each participant presented and analyzed their own clinical cases. This interactive format allowed us to gain insight not only from our own experiences but also from our peers, encouraging critical thinking and fostering practical, case-based learning.

Among all components of the master's program, the two in-person training sessions in Germany were the most exciting and remarkable. Held at the University of Münster, they provided a rich, hands-on learning experience that reflected the standards of international dental education. A wide range of

topics were covered - from complex cases such as craniofacial anomalies and cleft-related orthodontics to everyday treatments using functional appliances and wire-bending in fixed appliances, further extending to mini-screw applications. A dedicated certification course in lingual orthodontics also broadened our understanding of esthetic-driven treatment. These sessions were led by a team of experienced German clinicians and academic experts who not only shared practical techniques, but also emphasized diagnostic reasoning and strategic treatment planning, helping us grow rapidly in a short period of time.

To ensure comprehensive knowledge acquisition and clinical readiness, the program included two formal assessments: the Basic Course Examination and the Specialization Course Examination. These exams served as essential components of the academic certification process.

Additionally, we had the opportunity to participate in a three-day clinical observership at the orthodontic department of University Witten Hospital. There, we gained firsthand insight into the real-time clinical workflow within Germany's formal healthcare system and exchanged ideas with local residents and staff, deepening our understanding of their treatment protocols and academic environment.

Uniquely, both of our trips to Germany coincided with festive seasons. The first visit fell just before Christmas, allowing us to stroll through lively holiday markets and warm ourselves with a cup of mulled wine in the winter chill - an experience I still cherish. On our second visit, we attended Germany's Carnival, where colorful parades and dazzling costumes filled the streets with energy and joy. These cultural encounters enriched our learning journey, making it truly memorable.

Fig. 2:
Dr. Lin with Professor Arlene Hohoff and fellow participants during the master's program at the University of Münster.

Fig. 3:
Dr. Lin with instructors, residents, and fellow doctors at University Witten Hospital during a clinical observership.

The moment I completed my thesis, passed my defense, and stood on the stage at graduation to receive my diploma was indescribable. It was a deeply emotional "I did it" feeling. Despite the demands of work and family, I managed to persevere by making the most of my spare time - and that achievement became one of the proudest milestones in my dental career.

This journey helped me transition from a prosthodontics-focused clinician to an orthodontic professional with broader integrative skills. I am especially grateful to Dr. Chris Chang for his continued mentorship and encouragement, which gave us the courage and opportunity to step beyond our comfort zones, engage with international education, achieve professional certification, and expand our orthodontic horizons.

Fig. 4:
Dr. Lin completed the 2-year Master's Program in Specialized Orthodontics in the International Medical College at the University of Duisburg-Essen, Germany in 2024.

Fig. 5:
Dr. Lin with the examination committee and program colleagues at the University of Duisburg-Essen after completing the thesis defense presentations.

Looking ahead, I aspire to continue integrating my expertise in both prosthodontics and orthodontics to provide dental care that is not only esthetically pleasing but also functionally sound and minimally invasive. Orthodontics has given me the tools to transform smiles and the insight to appreciate the harmony between structure and beauty. I hope to apply this knowledge through interdisciplinary collaboration to create comprehensive, patient-centered treatment plans. This journey has not only made me a more confident and capable clinician, but also rekindled my passion for lifelong learning within a global professional community.

A letter from Dr. Gene Roberts

Dear Chang Family,

I returned home late last night. The flight to San Francisco out of Taipei was late leaving, but there was no problem because I had a several hour layover at SFO. All the luggage made it including the heavy blue trunk full of gifts that all of you so generously bestowed. The lock was destroyed so my big blue trunk has made its last trip. Cheri and I are having great fun going through all the gifts you sent. Now we must dig into all the photos and videos!

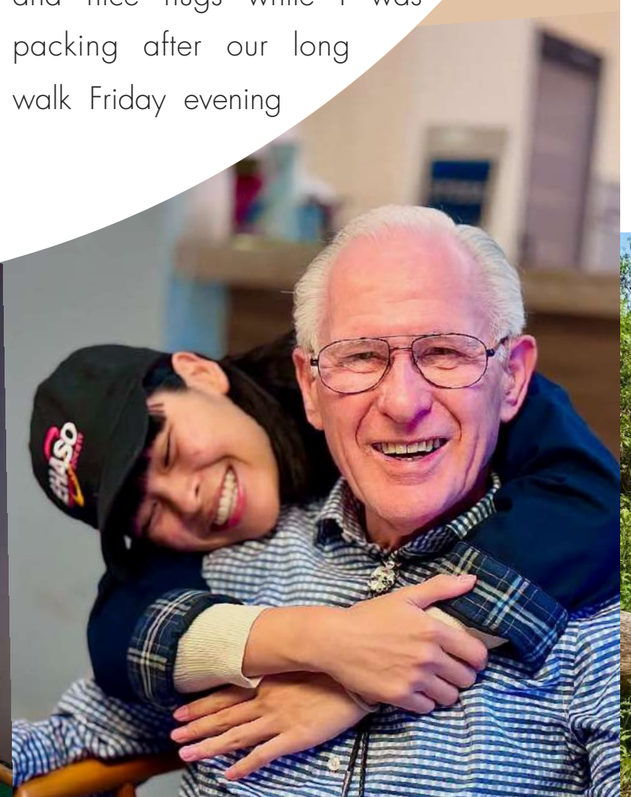
There is no *adequate* way to thank you for the marvelous generosity. The trips, family togetherness, rose stones, Jimmy & Lily, and the excellent single malt whiskey were really special. The four Beethoven Girls are quite a group! We had so much fun at the spas, shopping and dining. They brought me special gifts (Truffle paté, wrinkle rub-out for Cheri, and coins for the beautiful Frog set) and nice hugs while I was packing after our long walk Friday evening when I was preparing to leave. Please give them my warm personal regards!

It was fun to spend time with Brian, Alex and Joshua. You can be quite proud of those three! I am working on Brian's manuscript, and hope to have it done in a few days. I am enjoying the Facebook posts about my trip. They are such fun. The gourmet luncheon with Tom Wong and Vicky's parents was really a big surprise and a true highlight! I could go on and on about all the wonderful events.

Meeting Nasib and Susu was also great fun. I am looking forward to seeing them again at the 2026 AMW meeting in Arizona. I could go on and on about the wonderful visit. Thank you again for your marvelous hospitality!!!!!

Warm Personal Regards,

Gene



親愛的張醫師一家：

我於昨日深夜回到家了，從台灣飛往舊金山的班機延誤，但因為在舊金山機場還有幾個小時的轉機時間，所以沒有造成困擾。所有的行李都順利抵達，包括我那個裝滿了你們慷慨贈送的禮物、沈甸甸的藍色大行李箱。Cheri 和我正開心的一一瀏覽著這些禮物，還有所有的照片和影片等著我們欣賞！

任何方式都不足以表達我對你們的感謝，安排行程、一家人的親密無間、玫瑰石、Jimmy 和 Lilly、還有那支出色的單一麥芽威士忌，每一樣都別出心裁。貝多芬四位女孩的組合十分有趣，我們一起腳底按摩、購物、吃飯，非常開心，他們還帶了很多特別的禮物給我（松露醬、給 Cheri 的除皺霜、漂亮的咬錢蟾蜍和一些硬幣 ），週五下午一起散步之後，女孩們也在我整理行李準備離開時送來擁抱，請幫我向他們獻上至親的問候！

和 Brian、Alex、及 Joshua 一起渡過的時間同樣令人愉快，你可以以他們三位為傲！我正在修改 Brian 的稿件，期待過幾天就能夠完成。我也很享受你在 Facebook 上關於我本次來台之旅的發文，真有趣。和 Tom Wong 及 Vicky 父母一起簡易但精美的午餐饗宴是個很棒的驚喜和亮點！這些美好的活動，我可以一直一直細數下去。

和 Nasib 及 Susu 初次見面也非常愉悅，我很期待在 2026 年亞利桑那的 AMW 大會上和他們再次碰面。我可以再一直說下去。謝謝你們讓人驚呼連連的款待！！！

溫暖至親的問候，

Gene

"From this book we can gain a detailed understanding of how to utilize this ABO system for case review and these challenging clinical cases from start to finish."

Dr. John JJ Lin, Taipei, Taiwan

"I'm very excited about it. I hope I can contribute to this e-book in someway."

Dr. Tom Pitts, Reno, Nevadav, USA

"A great idea! The future of textbooks will go this way."

Dr. Javier Prieto, Segovia, Spain

"No other book has orthodontic information with the latest techniques in treatment that can be seen in 3D format using iBooks Author. It's by far the best ever."

Dr. Don Drake, South Dakota, USA

"Chris Chang's genius and inspiration challenges all of us in the profession to strive for excellence, as we see him routinely achieve the impossible."

Dr. Ron Bellohusen, New York, USA

"This method of learning is quantum leap forward. My students at Oklahoma University will benefit greatly from Chris Chang's genius. "

Dr. Mike Steffen, Oklahoma, USA

"Dr. Chris Chang's innovation eBook is at the cutting edge of Orthodontic Technology... very exciting! "

Dr. Doraida Abramowitz, Florida, USA

"Dr. Chang's technique is absolutely amazing and cutting-edge. Anybody who wants to be a top-tiered orthodontist MUST incorporate Dr. Chris Chang's technique into his/her practice."

Dr. Robert S Chen, California, USA

"Dr. Chris Chang's first interactive digital textbook is ground breaking and truly brilliant! "

Dr. John Freeman, California, USA

"Tremendous educational innovation by a great orthodontist, teacher and friend."

Dr. Keyes Townsend Jr, Colorado, USA

"I am awed by your brilliance in simplifying a complex problem."

Dr. Jerry Watanabe, California, USA

"Just brilliant, amazing! Thank you for the contribution."

Dr. Errol Yim, Hawaii, USA

"Beyond incredible! A more effective way of learning."

Dr. James Morrish Jr, Florida, USA

New Release!

Dr. Chang and family with the current president of AAO, Dr. John Callahan, and his wife, Elet Callahan, at the 2025 AAO annual meeting.