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Introductory Keynote workshop led by Dr. Chris Chang (first row, fourth from the left) in Kuala Lumper, Malaysia, Aug. 19, 2016. Participants took the photo with Dr. Chris Chang, teaching assistants and staff.

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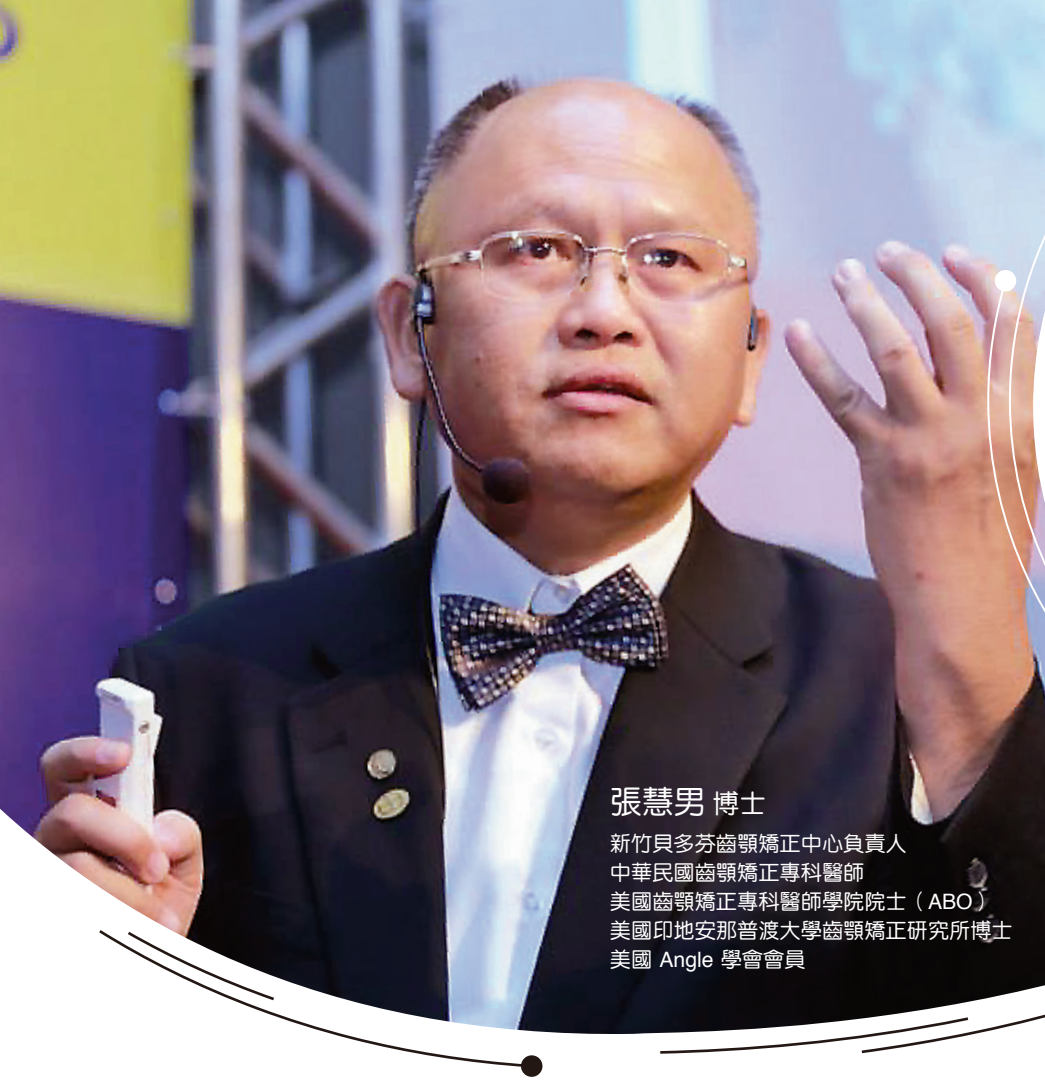
《僅供牙科專業人士參閱》



2016-17
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。

張慧男 博士

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Damon Master

(Thu) 9:00-5:00 中文授課

The new 2017 Beethoven Damon Master Program, created by Dr. Chris Chang, is a two-year clinical program. Its hands-on orientation features case study-based diagnosis, analysis, treatment planning and result evaluation. Combining in-class teaching assistants, after-class video review and chair-side observation, participants will learn to master the essential tips of the Damon System.

Year 1 2017

Module 1 - **5/4**/17' Module 4 - **8/10**
Module 2 - **6/8** Module 5 - **9/28**
Module 3 - **7/6** Module 6 - **To be announced**

Year 2 2017-18

Module 1 - **10/6** Module 4 - **1/4**/18'
Module 2 - **11/9** Module 5 - **2/1**
Module 3 - **12/7**

Damon + .014 Cu NiTi

Excellent Finishing

(Tue) 9:00-12:00 中文授課

Critically reviewing classical literature and contemporary papers and applying lessons learned to clinical work; utilising ABO's DI and CRE standards to turning excellent finishing into attainable goals.

Finishing VIII

Module 1 - **8/9**/16' Module 6 - **2/14**/17'
Module 2 - **9/20** Module 7 - **3/14**
Module 3 - **10/18** Module 8 - **4/11**
Module 4 - **11/22** Module 9 - **5/9**
Module 5 - **12/13** Module 10 - **6/13**
Module 11 - **7/11**

Damon Clear

Damon, OBS & VISTA International Workshop

English Class

The Workshop provides a 2.5 day, advanced hands-on program to experienced Damon users. The program includes world-class lectures, model and surgical hands-on workshops and clinical observation on patient care and clinic management.

course@newtonsa.com.tw
+886-3-573-5676 #218 Bella

2016

Class 1 - **4/26-29** Class 2 - **10/18-21**

2017

Class 1 - **5/16-19** Class 2 - **11/28-12/1**

Damon + Bite Turbo +
Early Light Short Elastic

每次上課請依最新一期 IJOI 公告為主

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Automation: The top secret of highly effective people

As yet another edition of IJOI is almost ready for publication, I have often been asked just how do we manage it? How are we able to handle our time and maintain a healthy work-life balance, when our hands are so full with clinical work, teaching and research? Just what is the formula for this? Our clinic handles a huge amount of patients, we manage to publish a lot of research projects and we also host workshops for international doctors and have, with over 400 presentations on Youtube, the biggest forum of teaching material in the history of Orthodontics. And as you are reading this, you are also aware that we publish a quarterly journal containing comprehensive coverage of a selection of our clinical cases, which are therefore available for teaching and further research.

All of us are equal in that we all only have 24 hours a day; entrepreneurs such as Warren Buffett and Steve Jobs started with nothing and earned their fortune, with no more hours in a day than we have.

They have used a formula, which is divided into things one loves or hates; these can be further divided into things one has to do and doesn't have to do. Obviously, the things one loves, one focuses on and the things one hates and doesn't have to do, are eliminated. The things one dislikes, but has to do, are automated.

Automation is very important when running any kind of business. Our research and journal are both automated, even though I actually like researching and publishing, but I only have 24 hours a day, so this means I have no other choice! As you all know, clinical work (*although very enjoyable*) can also be automated, so all three aspects of our work, clinical, teaching and research are actually automated, therefore our professional life is automated!

This means that we have actually improved upon the original formula, as we are able to focus on and also automate the things which we love, which results in our being able to work, enjoy the fruits of our labor and have a very good work-life balance.

I hope that you will join us and enjoy marching along the path to glory in fully-automated fashion!

Chris Chang DDS, PhD, Publisher of IJOI.

Conservative Management of Class I Crowded Malocclusion Complicated by Severe Maxillary Protrusion, Facial Convexity and Deepbite

Abstract

A 20-year-9-month old male presented with a Class I malocclusion complicated with severe crowding in the lower arch (-7mm), Class II skeletal pattern (SNA 88.5º, ANB 8.8º), steep mandibular plane (FMA 29.4º), convex profile (G-Sn-Pg' 20º), and anterior deepbite (5.5mm). Despite the severe skeletal discrepancy, the patient had good facial balance, so conservative treatment with no extractions or orthognathic surgery was indicated. The nonextraction treatment plan relied on infrazygomatic (IZC) miniscrew anchorage to retract both arches and rotate the mandible anteriorly, to decrease the vertical dimension of occlusion (VDO) and increase lower lip protrusion. Space to correct the severe crowding was accomplished with posterior arch expansion, retraction of upper and lower molars, and increased axial inclination of the lower incisors. In brief, this severe skeletal malocclusion (DI 24) was corrected in 15 months to an overall excellent outcome (CRE 16), but it was necessary to flare the lower incisors, and accept a Class II buccal occlusion on the right side, to avoid facial compromise. Step-by-step procedures are provided for the efficient camouflage approach used to resolve this severe, compensated malocclusion in an efficient manner. (Int J Orthod Implantol 2016;44:4-16)

Key words:

Class I, crowding, protrusive maxilla, deepbite, non-extraction conservative treatment, TADs (temporary anchorage devices), IZC (infrazygomatic crest) miniscrews, compromise treatment, camouflage

History

A young adult male (*20y9m*) presented with severe crowding, deep overbite, lingual crossbite of the upper left lateral incisor, and buccal crossbite of the lower right canine (*Figs. 1-3*). Despite the skeletal discrepancy, convex profile, and severe space deficiency, the patient's facial proportions were acceptable, so conservative treatment with no extractions or orthognathic surgery was indicated. Extra-alveolar bone screw anchorage, bilateral infrazygomatic (*IZC*) miniscrews, was used to retract both arches and rotate the mandible anteriorly, to partially correct the intermaxillary skeletal discrepancy. Fifteen months of active treatment with a passive self-ligating (*PSL*) appliance (*Damon Q®, Ormco, Glendora, CA*) produced an excellent alignment (*CRE 16*) for a severe Class II skeletal malocclusion (*DI 24*) (*Figs. 4-6*). Treatment documentation is provided by cephalometric and panoramic radiographs before and after treatment in (*Figs. 7 and 8*), in addition to superimposed cephalometric tracings (*Fig. 9*).

Dr. Irene Yi-Hung Shih,
Visiting Staff, Beauty Forever Dental Clinic (Left)

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Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)

Fig. 1:
Pre-treatment facial photographs show a convex profile, good facial proportions, and a chin point deviated slightly to right.

Fig. 4:
Post-treatment facial photographs document maintenance of the profile with a slight increase in lower lip prominence.

Fig. 2:
Pre-treatment intraoral photographs reveal a bilateral Class I occlusion with coincident upper dental and facial midlines, but the lower dental midline was 3mm to the right. Overjet was 1mm and overbite was maximal (5.5mm or 80%) in the left lateral incisor area.

Fig. 5:
Post-treatment intraoral photographs show a near ideal dental alignment except for a Class II buccal segment on the right.

Fig. 3: Pre-treatment study models (casts)

Fig. 6: Post-treatment study models (casts)

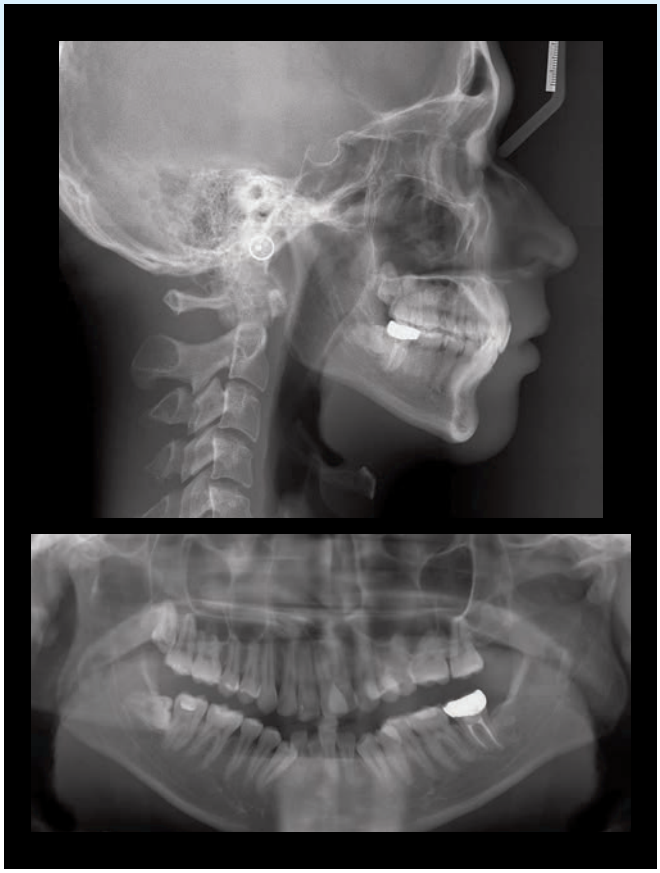

Fig. 7:
Pre-treatment cephalometric (above) and panoramic (below) radiographs

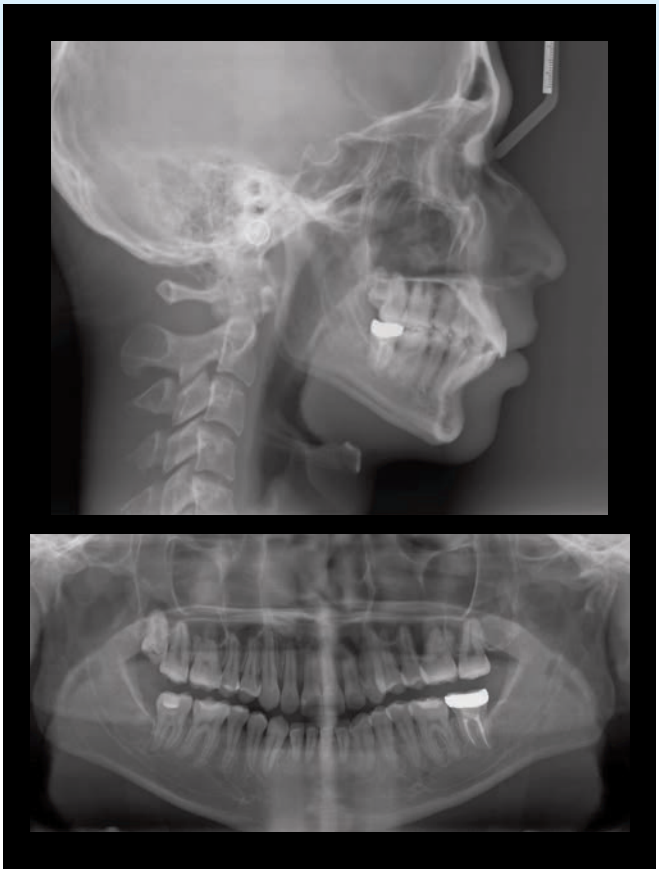

Fig. 8:
Post-treatment cephalometric (above) and panoramic (below) radiographs

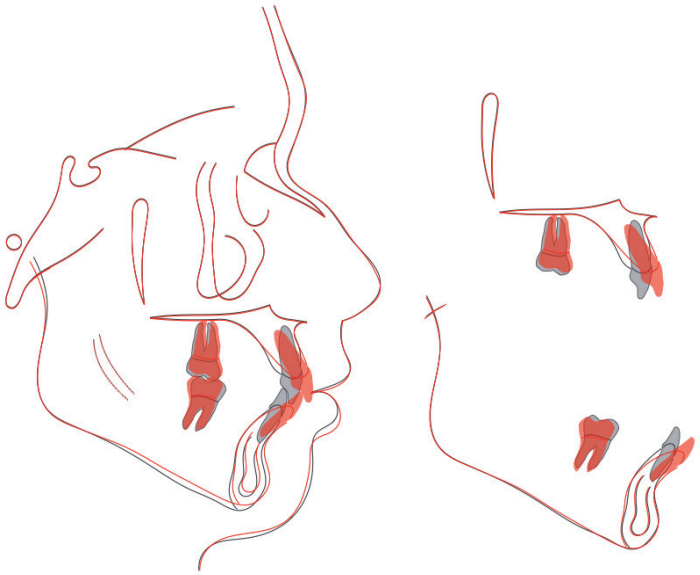

Fig. 9: Superimpositions of cephalometric tracings (Blue: initial, Red: final)

Diagnosis and Etiology

Pre-treatment facial photographs reveal a tapered lower facial form with a convex profile (*Fig. 1*). Although the facial and maxillary dental midlines were coincident, the left central incisor was tilted to the left, and the chin point was deviated slightly to the right. Pre-treatment intraoral photographs and study casts revealed Class I buccal segments, bilaterally. Crowding was 4mm in the upper arch and 7mm in the lower arch (*Figs. 2 and 3*). The lower dental midline was deviated about 3mm to the right, and the overbite was 5.5mm (*80%*). Cephalometric analysis (*Table 2*) revealed a Class II skeletal pattern with an increased facial height: 8.8° ANB, 35.1° SN-MP, 29.4° FMA. Dental compensation (*82.3° U1-SN, 92.5° L1-MP*) resulted in Class I canine and molar relationships despite the severe Class II skeletal discrepancy. Because of an acceptable facial form, conservative treatment was indicted, utilizing extra-alveolar miniscrews for anchorage to retract the arches and close the vertical dimension of occlusion (*VDO*), i.e. decrease lower facial height.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	88.5°	89.1°	0.6°
SNB°	79.7°	80.6°	0.9°
ANB°	8.8°	8.5°	-0.3°
SN-MP°	35.1°	34.3°	-0.8°
FMA°	29.4°	28.6°	-0.8°
DENTAL ANALYSIS			
U1 TO NA mm	-3.3 mm	1.7 mm	5 mm
U1 TO SN°	82.3°	102.2°	19.9°
L1 TO NB mm	7.6 mm	11.2 mm	3.6 mm
L1 TO MP°	92.5°	110.6°	18.1°
FACIAL ANALYSIS			
E-LINE UL	-1.2 mm	-0.6 mm	0.6 mm
E-LINE LL	0.1 mm	3.2 mm	3.1 mm

■ Table 1: Cephalometric summary

Objectives

Maxilla (*all three planes*):

- A - P: *Maintain*
- Vertical: *Maintain*
- Transverse: *Maintain*

Mandible (*all three planes*):

- A - P: *Maintain*
- Vertical: *Decrease*
- Transverse: *Maintain*

Maxillary Dentition:

- A - P: *Labially tip the incisors*
- Vertical: *Maintain*
- Transverse: *Expand*

Mandibular Dentition:

- A - P: *Labially tip the incisors*
- Vertical: *Maintain*
- Transverse: *Expand*

Facial Esthetics:

- Increase lip protrusion

Treatment Plan

Non-extraction treatment was planned to utilize a PSL appliance, IZC miniscrew anchorage, and Class III elastics to gain space and relieve crowding. The overall objective was to align the dentition, while simultaneously maintaining facial balance.

Appliances and Treatment Progress

The lower right 3rd molar was extracted before initiating orthodontic treatment. A full fixed .022" slot Damon Q® PSL appliance (*Ormco, Glendora, CA*) was installed with standard torque brackets for both arches (*Fig. 10*). All archwires, elastics and fixed appliance accessories were supplied by the same manufacturer. The initial archwires were .013" CuNiTi. Two 2x8mm stainless steel (*SS*) IZC miniscrews were installed to retract the upper canines (*Figs. 10 and 11*). GIBTs (*Glass Ionomer Bite Turbos*) were installed on the occlusal surface of the lower first molars to prevent interference of the lower incisor brackets in function. A segment of open coil spring was used to increase space to accommodate the upper left lateral incisor (*Fig. 10*).

In the 2nd month of treatment (*20y10m*), short Class III elastics were attached from the lingual surface of the upper first molar to the labial surface of the lower canine bilaterally, to retract and tip back the lower dentition, while expanding the upper inter-molar width (*Fig. 12*). After 5 months of treatment, sufficient space was created and the blocked-in upper left lateral incisor was bonded with a standard torque bracket. The bite turbos were augmented to prevent occlusal interference as the upper left lateral incisor was aligned.

Fig. 10:
Active treatment commenced at 20y9m of age with a full fixed PSL appliance supplemented with IZC anchorage, and bite turbos on the occlusal surface of the lower first molars to eliminate occlusal interference on lower incisor brackets.

Fig. 11: Bilateral IZC miniscrews (2x8mm, SS) were utilized to retract maxillary canines.

At 6 months into treatment (*21y2m*), mesial tilting of the left miniscrew was noted, but there was no pain or mobility, so the bone screw continued to serve as effective anchorage throughout treatment (*Fig. 13*). The upper left lateral incisor was corrected at 21y3m, after 3 months of archwire traction (*Fig. 14*). Repositioning of brackets (*Fig. 15*) and archwire detailing was accomplished in the 11th month of treatment (*21y8m*). All fixed appliances were removed after 15 months of active treatment (*Figs. 4-6*).

Fig. 12:
In the 2nd month of treatment (20y10m), Class III elastics were extended from the lingual surface of the upper first molar to the labial surface of lower canine, bilaterally.

Fig. 13:
After 5 months of treatment (21y2m), enough space was created for the upper left lateral incisor. It was bonded with a standard torque PSL bracket, and the posterior bite turbos were augmented to eliminate incisal interference during alignment.

Fig. 14: After 3 months of active treatment (21y5m), both crossbites of anterior teeth were corrected.

Fig. 15:
At 11 months of treatment (21y8m), detailing was accomplished with bracket repositioning and archwire adjustments.

Results Achieved

The patient was treated to an acceptable result as documented in Figs. 4-6. The cephalometric and panoramic radiographs document the pre-treatment condition and post-treatment results, respectively (*Figs. 7 and 8*). Superimposition of cephalometric tracings (*Fig. 9*), and the summary of cephalometric measurements are provided in Table 1. ABO Cast-Radiograph Evaluation (*CRE*) was 16 as shown in the subsequent worksheet.

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

- A - P: *More anterior position as the mandible rotated forward*
- Vertical: *Decreased as the mandible rotated counter-clockwise*
- Transverse: *Maintained*

Maxillary Dentition:

- A - P: *Incisors tipped labially*
- Vertical: *Both upper molars and incisors intruded*
- Transverse: *Expanded*

Mandibular Dentition:

- A - P: *Incisors tipped labially*
- Vertical: *Lower molars were tipped distally and intruded; lower incisors were tipped labially and slightly intruded*
- Transverse: *Expanded*

Facial Esthetics:

- Lower lip slightly more protrusive and everted
- Maintained facial profile

Retention

Upper Hawley and lower spring retainers were delivered, with instructions for full time wear the first 6 months, and nights only thereafter. Because of the labial tipping of the lower incisors, the patient was informed that long-term retention was essential. In addition, the patient was instructed in the proper home hygiene and maintenance of the retainers.

Final Evaluation of Treatment

Overall, the patient was satisfied with the treatment outcome. Both arches were well-aligned in only 15 months, and the facial esthetics were maintained. A slightly more protrusive and everted lower lip was consistent with the acceptable post-treatment profile (*Fig. 4*). The slight change in the position of the molars in both arches (*Fig. 9*) is deceptive relative to the effectiveness of the arch retraction mechanics (*Fig. 16*). Since the length of an arch decreases as it is expanded, maintaining the sagittal position of the molars actually reflects several mm of bilateral molar retraction, compared to the mesial molar movement that normally occurs with arch expansion.

The CRE score was excellent (*16 points*), but there were numerous marginal ridge discrepancies, and the occlusal relationships on the right side were Class II. For details, refer to the CRE worksheet at the end of this report. Carefully analyzing the dental alignment relative to the superimposition of the cephalometric tracings (*Fig. 9*) is important for understanding the pros and cons of the mechanics.

Fig. 16:
A schematic drawing (right) demonstrates the 4 solid wall mechanism (tube structure) for PSL brackets that permits efficient dental retraction along an archwire. The photograph on the left shows the mechanics for retracting both arches with IZC bone screw anchorage: 1. chain of elastics retracting the maxillary canines, and 2. Class III elastics.

Discussion

When treating severe arch-length deficiency, space is most commonly derived from arch expansion, labial tipping of anterior teeth, molar retraction or tip back, interproximal enamel reduction (*IPR*), and premolar or molar extractions.[1] Facial esthetics is a critical consideration when considering extractions to alleviate crowding. The current adult male was satisfied with his facial features, so he preferred a conservative dental correction with no extractions. His chief complaint was an irregular smile due to crowding, deepbite, posteriorly tipped upper incisors, and crossbite of the upper left lateral incisor. The treatment objective was to correct dental alignment, without compromising facial form. IZC miniscrew anchorage was selected to retract and expand both arches to relieve severe crowding.[2,3] Light (*2oz*) Class III elastics were applied from the beginning of the treatment to accelerate correction of lower anterior crowding (*Fig. 16*).[4] Miniscrews appear to be rigid clinically, but they still may move relatively to the apical base of bone, as evidenced by the mesial tilting of the upper left miniscrew (*Figs. 11-13*). Since the tilted miniscrew was not mobile or painful, the skeletal anchorage it provided was continued until the end of treatment (*Fig. 17*).

Anterior crowding was resolved by a staged approach in the lower arch (*Fig. 18*). At the beginning of treatment, the archwire was not fully engaged in the PSL brackets of the most lingually positioned lower incisors; the latter were attached to the archwire via ligation

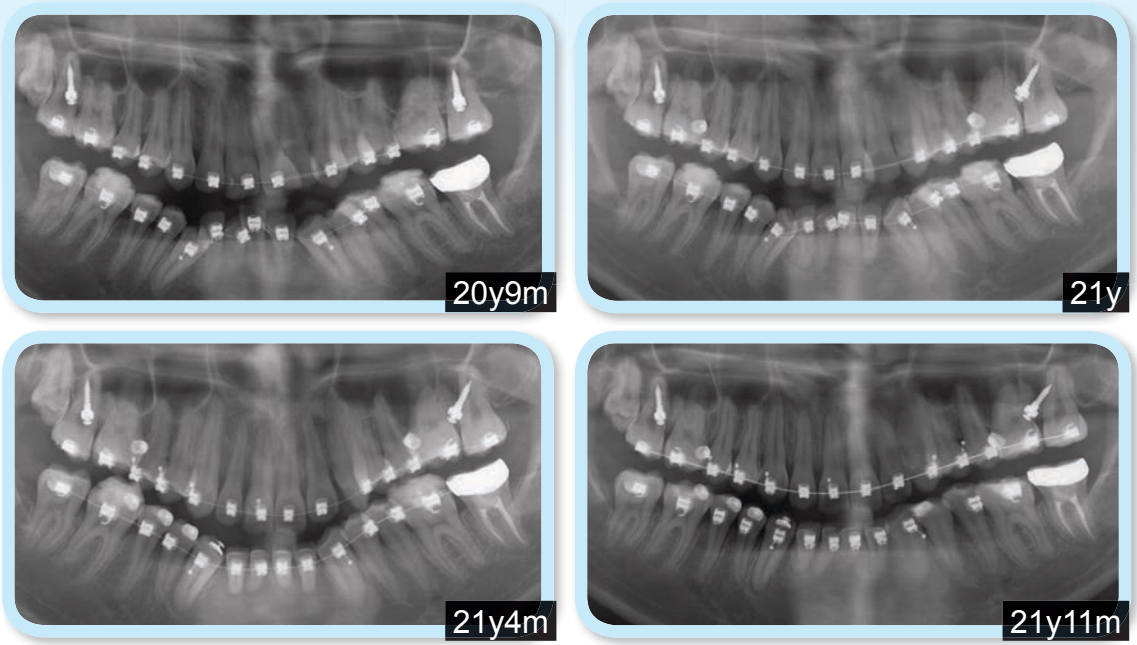

Fig. 17:
Compared to the vertical position when it was placed (20y9m), mesial tipping of the upper left IZC miniscrew was noted after 3 months of active treatment (21y). The tilted miniscrew was neither mobile nor painful, so it continued to serve as adequate anchorage throughout active treatment (21y4m and 21y11m).

Fig. 18:
A staged approach was utilized to relieve crowding in the lower dentition. When the initial archwire was placed (20y9m), the most irregular (lingually positioned) incisors were not fully engaged in the slot, by using a drop-in hook to apply traction. A light force open coil spring was used (21y) for only 1 month to gain space for full engagement on lower left central incisor (21y1m).

through the holes of drop-in hooks. A light force, open coil spring was used for 1 month to gain space for full archwire engagement of the lower left central incisor (*Fig. 18, 21y*). Open coil spring use in the anterior segment must be minimized to avoid flaring and labial tipping of the lower incisors. In the upper arch, the incisors were tipped lingually (*U1-SN: 82.3°*), so extended use of an open coil spring (*5mo*) to open space for the upper left lateral incisor was acceptable. When evaluating the final treatment result, the upper left lateral incisor required more labial root torque. In retrospect, that problem is best managed by bonding a standard torque bracket upside down or using a lower torque bracket.

The lower right third molar was extracted prior to distal tipping and retraction of the lower molars. Cephalometric superimpositions (*Fig. 9*) show that IZC miniscrew anchorage retracted the lower molars, but it was less effective in the upper arch, resulting in a Class II buccal segment on the right side (*Fig. 6*). In retrospect, that negative outcome may have been controlled by: 1. extraction of the upper right 3rd molar prior to treatment, and 2. attaching the Class III elastic to the IZC miniscrew rather the 1st molar (*Fig. 12*). However, the Class II occlusion on the right side was part of the compromise that was necessary to compensate for the severe skeletal discrepancy (*ANB 8.5°*).

A major lesson taught by this case report is the importance of the DI score for revealing the complexity of a malocclusion prior to instituting irreversible procedures such as extractions. The surprisingly severe complexity (*DI=24*) of this seemingly routine Class I crowded malocclusion was due to maxillary protrusion 88.5°, ANB angle of 8.8°, deepbite, and dental compensation with two anterior teeth in crossbite. Extractions in the lower arch were not a good option because of the risk for retracting the lower incisors and flattening the lips. Upper arch only extraction has major deficiencies: 1. fails to address the severe crowding in the lower arch so posterior expansion and flaring of the incisors would be necessary, and 2. closing premolar space would probably result in severe labial inclination of the upper incisors, which would create a significant esthetic problem. The present nonextraction approach with IZC miniscrew anchorage produced good dental and facial results (*Figs. 4-6*). However, the severe Class II skeletal discrepancy was only partially compensated by decreasing the FMA about 1°, so the outcome for the lower incisors was excessive tipping (*L1-MP 110.6°*). In retrospect, more buccal segment intrusion with IZC anchorage may have produced additional forward rotation of the mandible, but that would be difficult to accomplish because of the deepbite. Although long-term, essentially permanent retention of the lower arch is required, the dental compensation achieved (*U1-SN:102.2°; L1-MP: 110.6°*) was the best compromise for the current patient.

Incisor angulation is an important factor in achieving ideal interdigitation.[5] Enamel stripping of the lower anteriors to obtain overjet for correction of the buccal segments with of Class II elastic is a common finishing approach.[6,7] However, this was not a viable option for the currant patient because Class II elastics typically open the bite and rotate the mandible posteriorly. Accepting the Class II buccal segment on the right side was the best option (*Figs. 5 and 6*).

Deep overbite is usually treated with incisor intrusion and/or slight opening of the bite by extrusion of the buccal segments. However, when it is necessary to close the VDO with posterior bite turbos to help correct a Class II skeletal discrepancy, deepbite is a substantial complicating factor. For the present patient, the best option for correcting the deepbite was to flare the incisors (*Fig. 9*), and accept the Class II buccal segment on the right side (*Figs. 5 and 6*).

Conclusions

A non-extraction treatment plan for a Class I occlusion, with severe crowding and a skeletal discrepancy, was the best option because of the convex profile and long face. "*Extraction for the face, not for the space*" was the guiding philosophy. This severe skeletal malocclusion (*DI 24*) was corrected to an overall excellent outcome (*CRE 16*), but it was necessary to compromise with lower incisor flaring and a Class II buccal segment on the right side. As discussed, this approach was clearly the best option for this complex malocclusion.

Acknowledgement

Thanks to Dr. Leslie Yen-Peng Chen for his generous sharing of the idea to utilize IZC screws not only for upper retractions, but also lower retractions. The non-extraction approach has been utilized and solved many cases, which should've been treated with extraction, in my office ever since.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 24

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 = 8

OVERBITE

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

Total = 3

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 _____ pts.
Beyond Class II or III	=	1 pt. per mm. additional _____ pts.

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

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. = 2

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 pts. =	_____
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	0 x 2 pts. =	0

Identify:

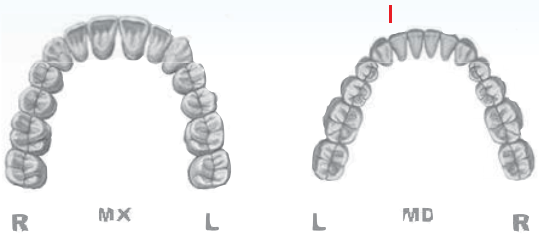
Total = 0

Cast-Radiograph Evaluation

Total CRE Score 16

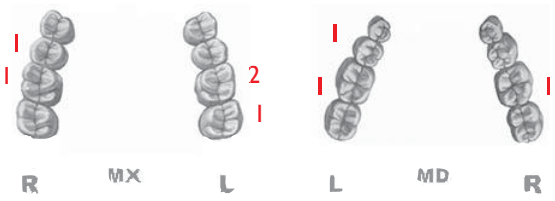
Alignment/Rotations

1



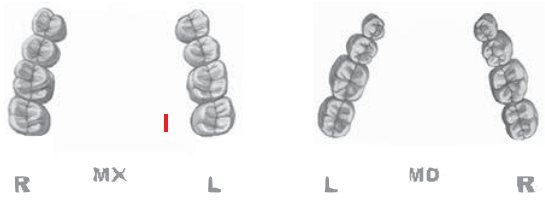
Marginal Ridges

8



Buccolingual Inclination

1

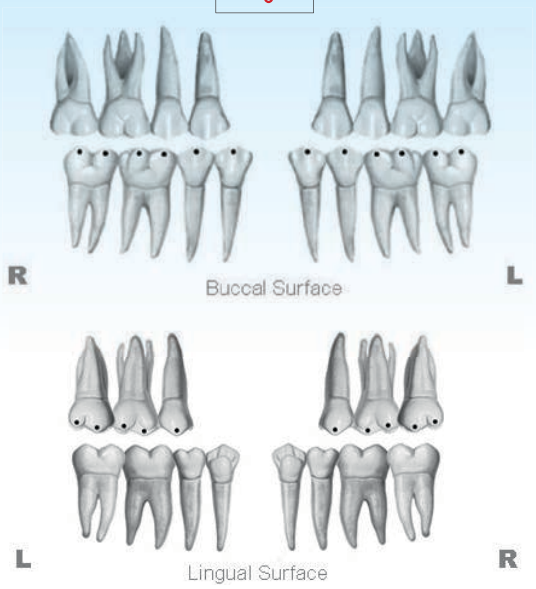


Overjet

0

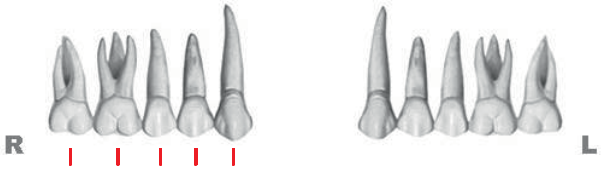
Occlusal Contacts

0



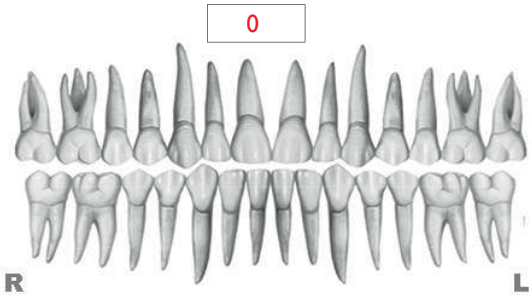
Occlusal Relationships

5



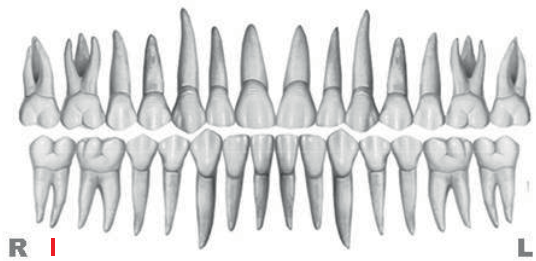
Interproximal Contacts

0



Root Angulation

1



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.

2016~2017
Beethoven Damon Advanced Course

貝多芬矯正進階班

時間：週二上午9：00-12：00

地點：金牛頓教育中心（新竹市建中一路25號2樓）

No.	日期 (W2)	Paper Reviews	Topics & Case Demo
1	10/4 '16	Bracket Placement	Crowding: Ext. vs. Non-ext
2	10/25	Impacted Canines	Upper Impacted Teeth
3	11/1	Canine Substitution	Lower Impacted Teeth
4	11/29	Missing 2nd Premolar	Missing: Ant. vs. Post.
5	12/6	DI Workshop	Crossbite: Ant. vs. Post.
6	12/20	CRE Workshop	Open Bite High Angle
7	12/27	Excellence in Finishing (occlusion)	Deep Bite Low Angle
8	1/3 '17	Excellence in Finishing (esthetics & perio)	Gummy Smile & Canting
9	1/10	Ortho-Perio-Restore Connection	Esthetic Finishing (Transposition)
10	1/17	Adjunct to Perio	Implant-Ortho
11	1/24	Unhappy Patient	IDT - Adult Complex

課程目標：

以病例討論為主軸，培養學員如何正確診斷及快速排除臨床疑點，課程中亦訓練每位學員善用KEYNOTE。

報名專線：03-5735676＃219，詹雅婷

International Association for Orthodontists & Implantologists

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2017 iAOI Symposium

Introducing

TMJ Orthodontics in the Damon System

Dr. Elizabeth Menzel

B.CH.D.University Stellenbosch. Orthodontic training at the University of Frankfurt, training in the practice of Dr. König-Toll Kronberg, Dr. Toll in Bad Soden, Germany and with Prof. Axel Bumann in Kiel with an emphasis on jaw diseases and how to treat them. Works in a practice in Herrsching am Ammersee, Germany since 15 years.

She has also worked in Great Britain and Vilnius, Lithuania for the orthodontic treatment of patients with severe jaw diseases. Internationally recognized lecturer since 2006. Damon user since 2003.

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- Diagnostic classification with treatment examples
- Understanding facial growth and the significance of the D-Gainer
- Asymmetries and the effect on the mandibular position in Class II Subdivision cases
- A dysfunctional oral system: open bite

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- Payment: wire transfer (no credit card)

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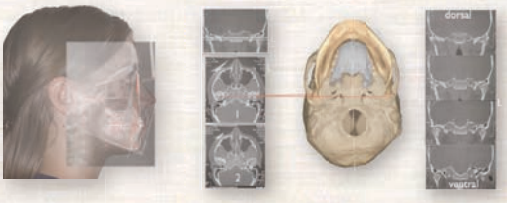

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Bimaxillary Protrusion with Missing Lower First Molar and Upper Premolar: Asymmetric Extractions, Anchorage Control and Interproximal Reduction

Abstract

A 38-year-old female presented with a Class I bimaxillary protrusion, complicated by asymmetric anterior spacing in both arches. Early loss of a lower right (LR) first molar resulted in mesial tipping of adjacent molars, a unilateral excessive curve of Spee, and an atrophic ridge. The upper left (UL) second premolar was missing and there was extensive subgingival calculus. Following periodontal scaling, additional extractions were needed to correct the protrusion, so the most compromised teeth in the affected quadrants were selected: upper right (UR) first premolar with cervical abrasion, a super-erupted maxillary left third molar, and a lower left (LL) first molar with extensive caries. The asymmetric extraction spaces required careful management of anchorage to retract the anterior segments without canting the occlusal plane and/or producing a midline deviation. After 34 months of active treatment, the partially edentulous compensated malocclusion with a discrepancy index (DI) of 18 was treated to an acceptable cast-radiograph evaluation score of 23. The facial profile was corrected by retraction of the lips, and the dental esthetics were improved with space closure, symmetrical alignment, and coincidence of the midlines. (Int J Orthod Implantol 2016;44:20-41)

Key words:
Adult orthodontic treatment, complex asymmetric malocclusion, bimaxillary protrusion, atrophic edentulous spaces, extraction of compromised teeth, asymmetric mechanics, midline diastema

Introduction

The mandibular first molars are typically the first permanent teeth to erupt, at about age 6 years. They are very important for the occlusal function and normal development of the dentition, but they are at high risk for early loss due to caries.[1,2] The enamel of the first molars develops during the infant and toddler period (*<3yrs of age*), which is a common interval for illnesses with high fever. Up to 20% of mandibular first year molars erupt with enamel hypomineralization defects, that render the teeth highly susceptible to caries and early loss in <2yr after they erupt.[3,4] Generalized oral hygiene negligence may result in rampant caries of permanent and deciduous teeth, but the isolated loss of permanent first molars is usually related to molar-incisor hypomineralization (*MIH*).[1-4] Since the permanent first molars are centric stops in occlusion during the late transition stage of dental eruption (*age 10-12yr*), severe acquired malocclusions may occur.[1,2] Restoring atrophic spaces in a compromised permanent dentition is challenging, so orthodontic space closure or opening sites for implants is often preferable if the periodontium is healthy.[1,5]

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Resident, Beethoven Orthodontic Center
Editor, International Journal of Orthodontics & Implantology (Left)

Dr. Chuanwei Su,
Director, Newton's Implant Center
Associate Editor, International Journal of Orthodontics & Implantology (Center left)

Dr. Chris Chang,
Founder, Beethoven Orthodontic Center
Publisher, International Journal of Orthodontics & Implantology (Center right)

Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)

Fig. 1: Pre-treatment facial and intraoral photographs

Closing first molar extraction spaces in adults may be complicated by mesial-tipped second molars and atrophic alveolar ridges, particularly if the teeth were lost early (*<age 8yr*).[1,2,5] Correcting edentulous spaces is a common request for adults. However, loss of bone in the vertical and buccolingual dimensions results in narrow atrophic edentulous spaces.[6,7] Protracting second molars to close atrophic ridges requires extensive osteogenesis (*anabolic bone modeling*) to expand the ridge and thicken the cortical plates.[8,9] Furthermore, when wide tooth roots are protracted through narrow alveolar ridges, enhanced anchorage may be required.[10-12] Evaluate all teeth in the arch and prioritize the degree of compromise due to restorative, endodontic and/or periodontal problems. If extractions are required to manage a malocclusion, good clinical practice is to select the most compromised teeth, even if that approach results in asymmetric spaces. Closing asymmetric extraction spaces can result in canting of the occlusal plane and midline discrepancies.[12,13] Closure of edentulous spaces may produce a desirable result,[14-17] but complex mechanics and temporary anchorage devices (*TADs*) are often required to maintain or correct symmetry.[18-23]

The aim of this case report is to investigate the etiology of a complex malocclusion as a guide for developing a relatively conservative, extraction approach for resolving the malocclusion, while also eliminating problem teeth. Cost effective oral rehabilitation was an important service for the current patient, who required orthodontics to manage a partially edentulous, acquired malocclusion with a Discrepancy Index (*DI*) score of 18.

Diagnosis and Etiology

A 38-year-old woman sought orthodontic evaluation with concerns about missing teeth, an unesthetic anterior dentition, prominent lower incisors and protrusive lips (*Fig. 1*). There was no contributing medical history, but she had a long history of limited, restorative dental care. Extra-oral evaluation with the lips closed showed a symmetric bimaxillary protrusion with coincident dental and facial midlines. Upon smiling her dentition was unattractive due to an end-to-end incisal relationship, occlusal cant (*more inferior on the right side*), irregular spacing in the anterior segments, and intermaxillary midline diastemas (*Figs. 1 and 2*).

Intraoral examination revealed three missing teeth: LR first molar, LL third molar, and the UL

Fig. 2: Frontal oral view for smile evaluation.

second premolar (*Fig. 3*). There was a bilateral Class I relationship of the molars and canines. The UL third molar was extruded due to lack of an antagonist. Because of an edge-to-edge incisal relationship, there was no overbite or overjet. Large calculus deposits were noted on the lingual surfaces of the teeth in the lower anterior segment (*Fig. 1*), and the LL first molar had extensive caries on the distal and occlusal surfaces. The length of the edentulous spaces was 8mm for the missing first molar, and 7mm for second premolar; both were atrophic with decreased occlusal and buccolingual dimensions (*Figs. 1 and 3*).

Pre-treatment cephalometric evaluation confirmed a bimaxillary protrusion, with a protrusive lower lip. There was a steep mandibular plane angle (*SN-MP 40º, FMA 32º*). Both jaws were protrusive (*SNA 85º, SNB 84º*), but the incisor inclinations to the maxilla and mandible were within normal limits (*Fig. 4 & Table 1*).

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	85°	85°	0°
SNB°	84°	84°	0°
ANB°	1°	1°	0°
SN-MP°	40°	40°	0°
FMA°	32°	32°	0°
DENTAL ANALYSIS			
U1 TO NA mm	9 mm	4 mm	5 mm
U1 TO SN°	113°	103°	10°
L1 TO NB mm	10 mm	3 mm	7 mm
L1 TO MP°	92°	70°	22°
FACIAL ANALYSIS			
E-LINE UL	-2 mm	-5 mm	3 mm
E-LINE LL	3.5 mm	-3 mm	6.5 mm

Table 1: Cephalometric summary

Fig. 3: Pre-treatment study models (casts)

Fig. 4: Pre-treatment lateral cephalometric radiograph

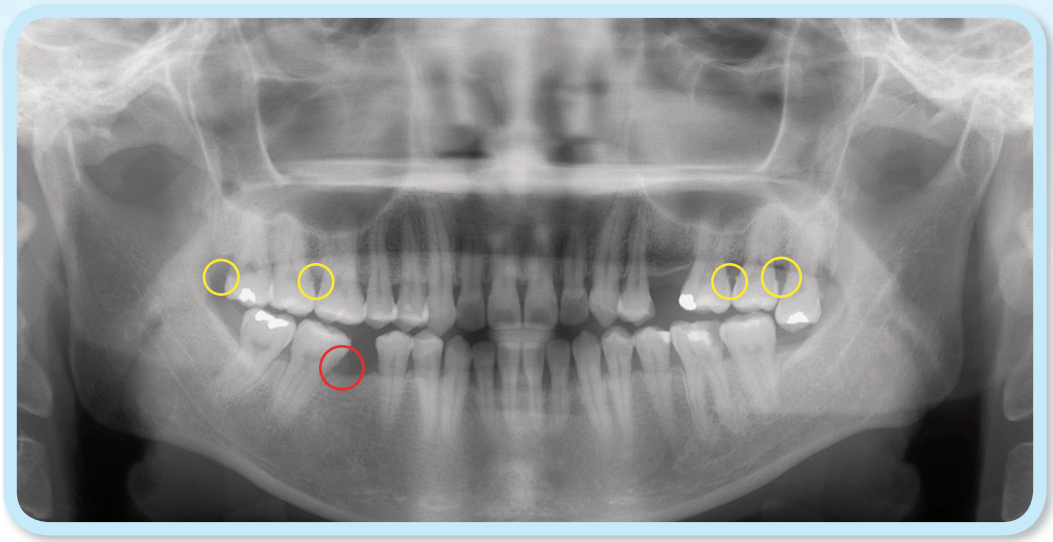

Fig. 5:
Pre-treatment panoramic radiograph provides an overall impression of the dentition and the morphology of the mandibular condyles. Note the extensive subgingival calculus particularly in the maxillary posterior region (yellow circle). An area of subgingival calculus is also noted on the mesial surface of the lower right mandibular second molar (red circle).

The panoramic radiograph (*Fig. 5*) revealed deep caries on the distal and occlusal surfaces of the LL first molar. Extensive subgingival calculus was noted particularly in the maxillary posterior segments. As noted clinically, the UL third molar was extruded below the occlusal plane because there was no mandibular antagonist. Second and third molars in the LR quadrant were mesially inclined, consistent with drift into the first molar extraction site. There was no radiographic evidence of significant periodontal defects on the mesial surface of the LR molars but, some subgingival calculus was noted on the mesial of the LR second molar (*Fig. 5*).

The patient did not report any temporomandibular disorder (*TMD*) signs or symptoms, and there was no functional deviation on opening (*Fig. 6*). The temporomandibular joint (*TMJ*) arthrograms showed no unusual differences between the right and left sides (*Fig. 7*).

Isolated loss of lower first molars in childhood is increasingly associated molar-incisor enamel hypomineralization (*MID*), rather than routine caries.[1,2] Defective enamel at the time a permanent first molar emerges affects up to 20% of children worldwide, and is thought to result from common illnesses with high fever in the first year or two of

Fig. 6:
A facial intraoral photograph shows asymmetry as the patient opens the mandible, apparently due to the interference of the extruded UL third molar.

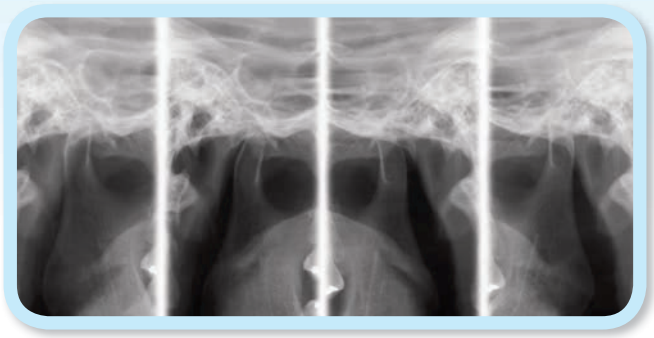

Fig. 7:
Pre-treatment temporomandibular joint (TMJ) direct arthrograms are shown from the left: R TMJ closed, R TMJ open, L TMJ open, and L TMJ closed.

life.[3,4] When the affected first molars enter the oral cavity, they are susceptible to catastrophic caries, resulting in extraction during the early mixed dentition period (*6-8yr*). Early loss of lower first molars is often a developmental problem because there is no posterior stop in occlusion when the adjacent second primary molar is lost. This occlusal instability can result in functional shifts such as anterior crossbite, a deep curve of Spee on the affected side, and/or facial asymmetry (*Figs. 2 and 3*).[1,2]

The American Board of Orthodontic (*ABO*) discrepancy index was 18 points, as shown in the supplementary worksheet 1.

Treatment Objectives

The objectives in order of priority were:

1. **Restorative**: Restore all caries as needed, evaluate compromised teeth.
2. **Periodontal**: Remove all calculus, pre-orthodontics preparation as needed.
3. **Orthodontics**: Retract protrusive lips to correct bimaxillary protrusion.

- Maintain maxillary and mandibular orientation in three dimensions (*3D*).
- Extract three compromised teeth: UR first premolar because of cervical abrasion, super-erupted UL third molar, and deeply-decayed LL first molar.
- Use a full fixed appliance to level and align both dental arches.
- Upright and protract mandibular second molars to substitute for missing first molars.
- Differential retraction of upper and lower incisors to correct the edge-to-edge bite.
- Asymmetric space closure to minimize iatrogenic midline discrepancies.
- Finishing: optimize alignment with bracket repositioning and archwire adjustments.

Treatment Alternatives

Because of the asymmetric extraction spaces, retracting the incisors risked occlusal plane canting and/or midline deviation. The patient was prospectively warned about these potential side effects, but was also informed that a 4mm midline deviation is clinically acceptable. She agreed to the use of OrthoBoneScrew® (*2x12mm, Newton's A Ltd, Hsinchu City, Taiwan*) anchorage if needed.

Treatment Progress

After the initial restorative and periodontal care was completed, three compromised teeth were extracted: UR first premolar, UL third molar and LL first molar. A .022" Damon Q® (*Ormco, Glendora, CA*) fixed appliance was bonded on all permanent teeth and high torque brackets were selected for the maxillary incisors and canines. Standard torque brackets were used on the entire mandibular arch. The upper arch was leveled and aligned with the following wire sequence: .014" CuNiTi, .014x.025" CuNiTi, .017x.025" TMA and .016x.025" SS. The corresponding lower arch sequence was .014" CuNiTi, .018" CuNiTi, .014x.025" CuNiTi, .017x.025" TMA and .016x.025" SS.

In the first month of active treatment, posterior bite turbos were constructed with Fuji II type II glass ionomer cement (*GC America, Alsip IL*) on the occlusal surfaces of the mandibular second molars. Bilateral bite turbos were effective for opening the bite, reducing occlusal interferences, preventing functional debonding of molar tubes in the lower arch, as well as for facilitating overjet and overbite correction (*Fig. 8A*).

In the eighth month, inter-proximal reduction (*IPR*) of all incisors was performed as needed to optimize the shape of the crowns, and to facilitate correction of root inclinations, as monitored with panoramic radiography. IPR improved the tooth size ratio, changed triangular shapes of incisors to a more esthetic rectangular form, corrected dark interproximal triangles, and provided space for correction of the overjet. To help balance the anchorage value of the asymmetric upper extractions sites, a power-chain was applied from the UL first premolar to the adjacent first molar to retract the premolar, to help balance the asymmetry of upper posterior anchorage (*Fig. 8B*).

In the eleventh month of treatment a positive overjet was achieved (*Fig. 8B*). Differential activation of space closure was an attempt to equalize the size of the bilateral spaces as much as possible, (*Fig. 8B*) before initiating bilateral mechanics to retract the anterior segments (*Fig. 8C*). To enhance space closure efficiency, lingual buttons were bonded bilaterally in all four quadrants to control rotations and prevent binding on the labial archwire (*Figs. 8B-D*).

In the fifteenth month, the lower dental midline deviated ~2mm to the right (*Fig. 8C*). The space closure force applied to the right posterior segment was decreased until the midline deviation was corrected by additional space closure in the left quadrant. Twenty months into treatment about half of the midline discrepancy was corrected (*Fig. 8D*), and there was additional space in the LL quadrant to complete the process by the end of active treatment (*Fig. 9*).

As third order alignment was corrected with the rectangular TMA and SS archwires, symmetric Class II elastics (*Fox, 3.5oz*) were applied from the mandibular second molar to the maxillary canine bilaterally. As the spaces were closed, a bilateral posterior crossbite tendency was noted. In the last stage of treatment, the .016x.025" stainless steel archwires were expanded in the upper arch and constricted for the lower arch. To supplement these mechanics,

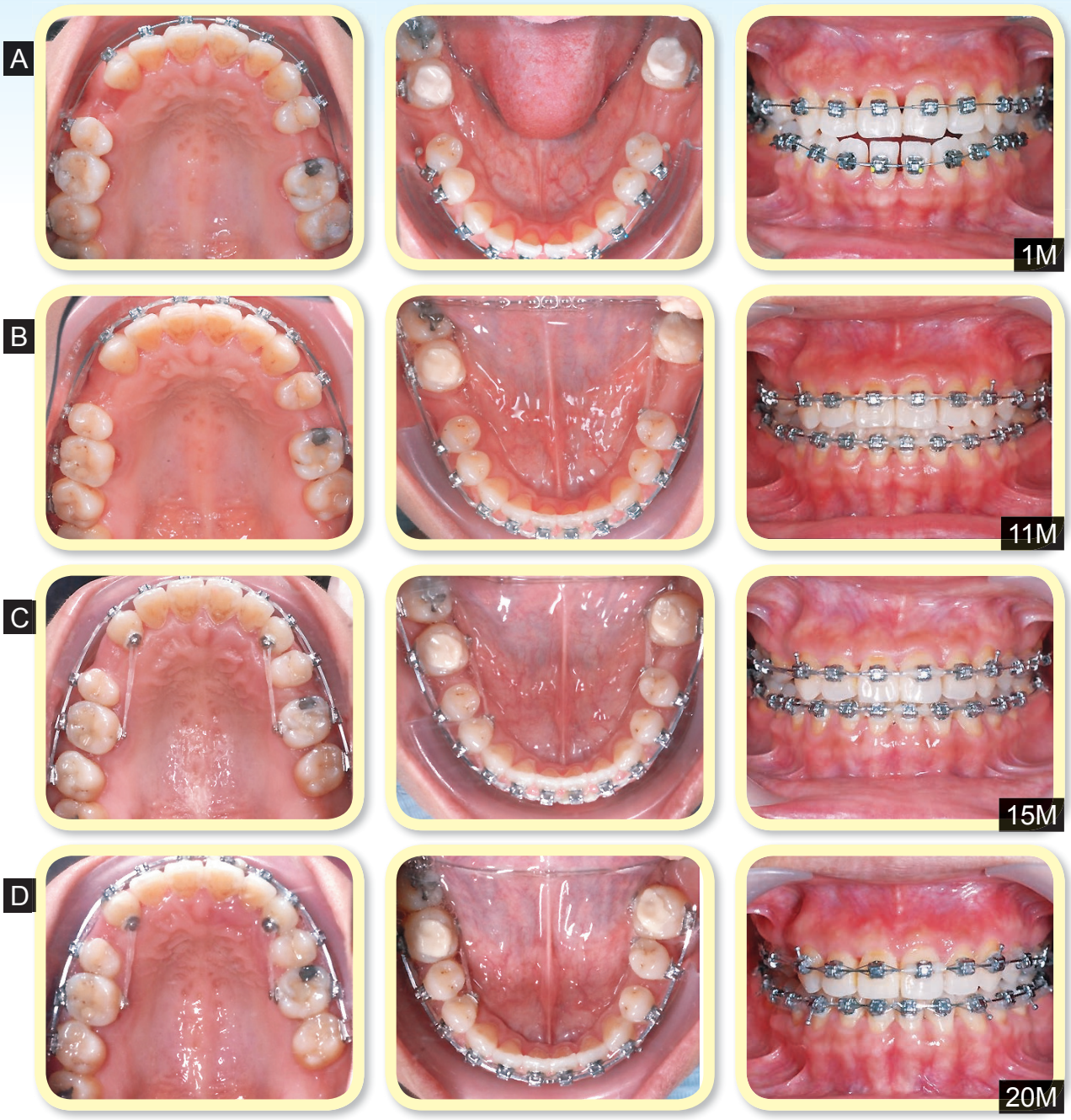

Fig. 8:
Intraoral photographs showing asymmetric mechanics, unilateral power chains and buccal/lingual mechanics to control asymmetric space closure and iatrogenic rotations:

A. 1st month,
B. 11th months,
C. 15th months,
D. 20th months.

Fig. 9: Post-treatment facial and intraoral photographs

posterior bite turbos and cross-elastics were used to facilitate the correction of the lingual crossbites. The occlusion was finished with detailing adjustments.

After thirty-four months of active treatment, all appliances were removed. Retention was provided with maxillary and mandibular clear overlay retainers.

Treatment Results

Facial esthetics were improved by retracting the lips to achieve a more harmonious profile. The maxillary anterior segment was well aligned with an appropriate smile arc, so the lower teeth were no longer visible

when smiling. Overall the face and smile line presented a more youthful appearance (*Fig. 9*). The dentition was well aligned with closure of all anterior spaces (*Fig. 10*) and the black triangles were eliminated. However, these favorable corrections significantly decreased the arch circumference of the maxillary anterior segment, so it was necessary to decrease the axial inclination of the lower incisors 22° to compensate for the tooth size problem, in order to achieve a positive overjet (*Fig. 11*). Post-treatment TMJ arthrograms were within normal limits (*Fig. 12*) and there were no signs or symptoms of TMD. The atrophic edentulous spaces were completely closed by protraction of adjacent molars (*Figs. 9, 10 and 13*). The patient was quite satisfied with the result.

Fig. 10:
Post-treatment panoramic radiograph showing adequate alignment and space closure in all four quadrants.

Fig. 11: Post-treatment cephalometric radiograph

The post-treatment panoramic film revealed modest external apical root resorption (*EARR*) as evidenced by slight blunting of the maxillary incisors (*Fig. 10*). This appeared to be an insignificant clinical finding because all affected teeth were still vital and mobility was within normal limits (*WNL*). Long term follow-up was advised to monitor parafunction.

The superimposed cephalometric tracings show that the maxillary molars were protracted (*moved anteriorly*) ~3mm, while the incisors were tipped lingually ~5mm and intruded ~3mm. The mandibular incisors were tipped lingually ~10mm and the second molars were up-righted and protracted to substitute for the missing first molars. Both upper and lower lips were retracted, but no mandibular rotation was noted in the cephalometrics (*Fig. 13*).

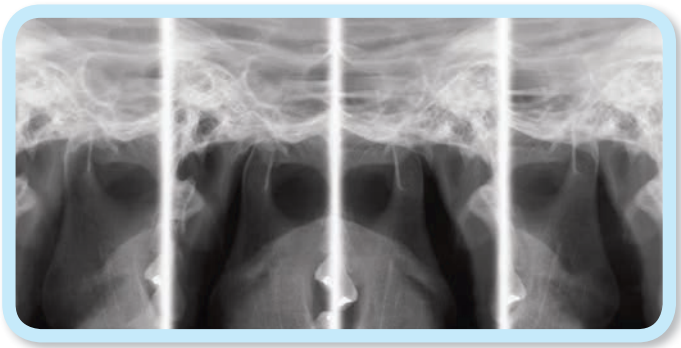

Fig. 12:
Post-treatment TMJ arthrograms in the same sequence as before.

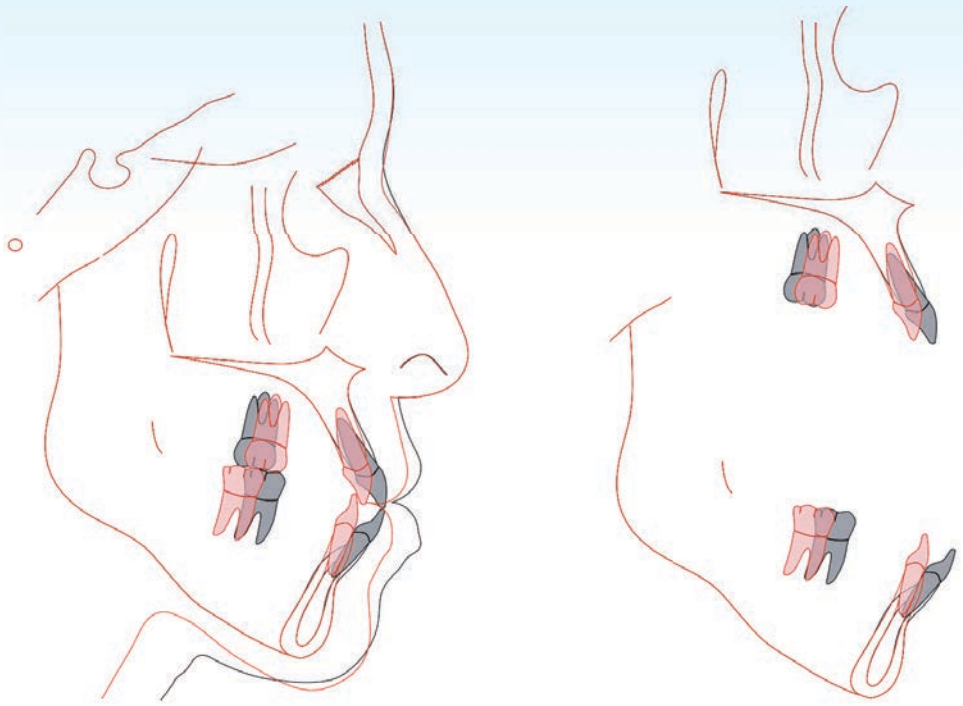

Fig. 13:
Superimposed cephalometric tracings indicate the upper and lower incisors were tipped lingually. The maxillary incisors were also intruded. The lower 2nd molars were up-righted and protracted to substitute for the lower 1st molars. Upper and lower lips have been retracted.

Fig. 14: Post-treatment study models (casts)

The ABO Cast-Radiograph Evaluation (*CRE*) score was 23 points (*Worksheet 2*). The major discrepancy was occlusal contacts. A longer period of finishing treatment with the vertical finishing elastics, in combination with adjustment of occlusal prematurities, was indicated. Judicious adjustment of prematurities in the posterior occlusion allows additional cusp and fossa contacts. The other significant discrepancy was an expected compromise in occlusal relationships (*Class II on the left side*) because of the asymmetric intermaxillary extractions and missing teeth, particularly the lower first molars.

Discussion

1. Early loss of permanent first molars

The current case report is part of a series of >100 challenging clinical cases published in last five years in News and Trends in Orthodontics (*NTO*) and the subsequent publication International Journal of Orthodontics and Implantology (*IJOI*) (*http://iaoi.pro/archive/journal*). The isolated loss of one or both mandibular first molars is a prominent feature in the etiology of complex, acquired malocclusions. Two recent reports in IJOI[1,2] have discussed the critical role of lower first molars in occlusal development, during the late transitional occlusion (*~age 10-12yr*). The present patient (*Fig. 1*) fits the pattern. She presented with a missing lower first molar and demonstrates the signs of unilateral occlusal collapse that occurs in the early permanent dentition: unilateral deep curve of Spee (*Fig. 3*) and mesial tipping of second and third molars into the extraction site (*Fig. 5*).

There is a large literature indicating that the early loss of permanent first molars is associated with a variety of acquired malocclusions[3,4] that occur after the adjacent deciduous second molars exfoliate. Although permanent molars may be lost to caries at any age, there is an emerging recognition that this particular developmental problem is commonly related to as MIH, a worldwide problem with a prevalence of 10-22%.[3,4] MIH is a dental development problem related to enamel defects associated with the illness of a child <3 years of age. Prolonged and sustained fever is a common occurrence for young children afflicted with maladies, such as exanthemata, respiratory infection or otitis media. Clinical data have long been consistent with a deleterious effect on the enamel formation of permanent teeth developing at that time, particularly the permanent central incisors and first molars.[1-4,24] Febrile conditions are known to disrupt enamel formation in mammals both in vivo[24] and in vitro,[25] Enamel defects render the teeth highly susceptible to caries as soon as they erupt (*~age 6-7yr*).

If the incisors are affected, the parents usually notice the problem and seek treatment. However, molar hypomineralization is not usually recognized until the crown of the first molar is destroyed and the child has a toothache. The usual diagnosis is "*bombed-out caries*" and the only viable treatment is extraction of the permanent first molar, leaving second deciduous molar as the sole posterior occlusal stop by ~age 8yr. There are usually no further problems until the late transitional stage of occlusal development when the second deciduous molars are exfoliated. In the absence of the lower first molar, there is an occlusal collapse, because there is no posterior occlusal stop on the affected side. Prior to the eruption of the succedaneous premolar, the dental compensation results in a typical acquired malocclusion: mesially tipped second molars and a deep curve of Spee. The problem may be symmetric or asymmetric and can even result in a functional retrusion of the mandible.[1-4]

Permanent maxillary first molars are also susceptible to MIH, but their isolated early loss is not as damaging to occlusal development, if the ipsilateral lower first molar is still present. In a Class I molar relationship, the early loss of a maxillary first molar

does not eliminate the posterior centric stop because the lower first molar continues to occlude with the maxillary second deciduous molar. By the time the second deciduous molar exfoliates, the maxillary second molar is usually in occlusion because the development of adjacent molars is accelerated by the extraction of the first molar.[26]

Another problem associated with early loss of permanent lower first molars is disuse atrophy of the edentulous space resulting in an atrophic ridge.[5,8] If the periodontium of the adjacent teeth is healthy, atrophic ridges can be closed orthodontically but the biomechanics and anchorage requirements are challenging.[5,8,9]

2. Closing atrophic molar space

The mandibular atrophic ridge is usually described as a "*knife-edge*" ridge on the lingual aspect because the process of disuse atrophy preferentially resorbs the occlusal and buccal aspects of the edentulous ridge.[5] This process results in dense, thin alveolar process that is composed of two relatively thick cortical bone plates, connected with coarse trabecular bone. Lower molars can be protracted through atrophic ridges if the periodontium is healthy,[9,10] but force should be very light, <100cN (~*100g*) to control lateral root resorption where the PDL engages the thin but dense atrophic alveolar ridge.[5] Widening the osseous ridge ahead of a moving tooth requires anabolic, bone modeling in the subperiosteal region,[10] which may be more difficult to achieve with atypical, asymmetric extraction spaces.[11-13] Mandibular molars have wide roots that are very effective for inducing anabolic modeling of a edentulous space, and produce dense cortical bone between the roots of the molars.[14] Despite these challenging tooth movement conditions, several case reports have documented ≥10mm mandibular molar protraction into atrophic first molar spaces with and without TADs for anchorage.[12-15]

For the present patient, the asymmetric extraction spaces, atrophic ridges and differential anchorage requirements (*Figs. 1, 3 and 5*) resulted in variable rates of space closure in each quadrant (*Fig. 8*). Careful management of the mechanics resulted in a relatively symmetrical outcome (*Fig. 9*). Closing space with sliding mechanics on SS rectangular wires was facilitated by balancing lingual and buccal forces to prevent binding of the archwire due to molar mesial-in rotation.[16] As the asymmetric spaces were closed, a lack of progressive archwire coordination was manifest as a tendency for a bilateral posterior cross-bite, which required additional treatment time. In retrospect, it would have been wise to adjust archwire widths and use cross-elastics as soon as the cross-bite tendency was detected.

3. Atypical extraction

Closing asymmetric molar spaces that are also atrophic is a challenge that can result in occlusal canting and midline deviation.[6,7] Maintaining the midlines and avoiding occlusal canting for the present patient was an important accomplishment. Midline discrepancies are among the most complex and difficult problems for orthodontists to manage.[17-20] Effective management requires careful examination, precise diagnosis, and a comprehensive treatment plan.[18-23] Choosing the

most esthetic and functional midline is an important fundamental for achieving adequate symmetry. Precise definitions are required:

- **Symmetry**: equality or correspondence in form of parts, distributed around a center on an axis, at the two extreme of poles, or on the two opposite sides of the body.[27]

- **Facial midline**: clinically, the patient's facial midline is defined by the center of the philtrum and the nadir of the cupid's bow of the upper lip.[23] The orientation of the nose is also an important consideration.

- **Dental midlines**: the location of contact between the mesial surfaces of the central incisors in either arch.[27]

Facial and dental midline coincidence involves skeletal, dental and functional symmetry,[27] and is usually expressed in a pleasing smile.[28] Orthodontists should differentially diagnose the etiology of a midline discrepancy. Skeletal, dental, functional components can be present alone or combination (*Fig. 15*) as defined below:[18,22,23,29]

- **Skeletal problem**: Panoramic radiographs (*Figs. 5 and 10*) and temporomandibular joint (*TMJ*) arthrograms (*Figs. 7 and 12*) compare the condylar shape and morphology as well as measure the difference between the right and left condylar necks, sigmoid notches, and vertical rami. This is a method for diagnosing the morphologic etiology of skeletal asymmetry.[18,22,23] Transverse skeletal problems and occlusal plane canting are evaluated with imaging or face-bow transfers.[23] Trauma that results in asymmetry may have a delayed onset. Minor traumas in childhood may seem insignificant, but they gradually become more evident, especially a deviation of the mandible.[18,23]

- **Dental problem**: Even though the skeletal base is symmetrical, different tooth size proportions for the right compared to the left side may result in a midline discrepancy.[23,29] Extraction of teeth may result in tipping of adjacent teeth, with a dental midline shift toward the extraction side.[29] Furthermore, tooth agenesis, delayed root development and paths of eruption may also result in midline discrepancies.[29,30]

- **Functional problem**: A functional shift is diagnosed when there is a discrepancy between the centric relation and maximum intercuspal position (*Fig. 6*).[22,23] A functional shift may reflect an occlusal problem like premature contacts.[29] Ideally dental midlines should be coincident with their respective skeletal base to minimize occlusal interference.[23] Other functional habits like thumb sucking, asymmetrical or unilateral chewing habits, and/or masticatory muscle hypertrophy can contribute to facial asymmetry and midline problems.[29]

Establishing a realistic treatment plan for the often complex interactions benefits from a problem analysis method such as described in Fig. 15. The varying approaches to the problem(s) were

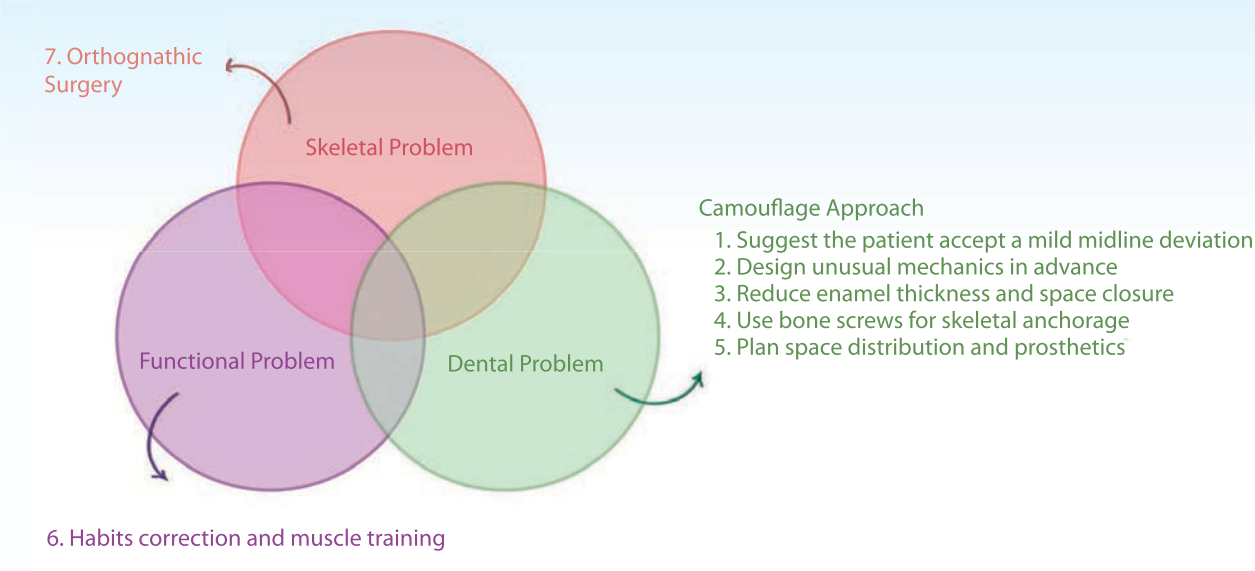

Fig. 15:
As a clinical diagnosis and treatment planning exercise, three circles are partially superimposed to demonstrate the interaction of the skeletal (red) functional (purple), and dental (green) problems. The usual clinical responses are shown for multiple camouflage approaches for the dental problem (No. 1-5 in green), one functional solution (No. 6 in purple), and an additional option for a skeletal problem (No. 7 in red).

discussed with the present patient (*Fig. 1*), prior to formulating the treatment plan.

1. The patient was willing to accept a modest midline deviation

Perfect facial symmetry is a theoretical concept that seldom exists in nature.[23,29] A 4mm dental to facial midline discrepancy is undetectable for most patients.[31,32] Orthodontists should attempt to eliminate midline discrepancies for the optimization of esthetics and as a guide for functional alignment of the dentition and jaws.[33-37] Kokich, et al.[38] asked, is it necessary to correct subtle variations if they are undetectable to the average patient? Insisting on correction of every midline discrepancy is not indicated because it can considerably increase the complexity and duration of treatment. The esthetic impact of the dentition is greater in a mouth-only view compared to a full-facial view,[39] so many previous midline studies are biased. It is important for the patient and the clinician to avoid focusing on the oral view for a deviation that is hardly detectable in the full-facial view. Janson, et al.[40] conducted an systemic review and concluded that up to a 2.2mm midline deviation is usually acceptable. To avoid misunderstandings later it is very important to discuss probable outcomes of treatment to understand the expectations of the patient. Attempting to manage the esthetic concerns of an unreasonable patient poses a high risk for failure. The present patient (*Fig. 1*) was informed that a modest midline discrepancy was likely because of the asymmetric extraction pattern. She accepted this possibility as part of the informed consent to begin treatment.

2. Design asymmetric mechanics in advance

Symmetric mechanics are designed to maintain symmetry, but may result in asymmetry or even worsen the condition. All mechanics should be designed with the potential for modifications, as needed during treatment. Achieving optimal esthetics requires a prospective treatment plan focusing on the defined objectives.[37,40,41] If patients are asymmetric prior to treatment, special mechanics are indicated such as asymmetric arch shape, interarch elastics, archwire adjustments, or differential anchorage.[40-42] Unilateral activation for space closure may be effective for midline control in asymmetrical dental arches.[13,17,29] For the present patient, a good outcome was achieved by differential force control in each quadrant (*Figs. 9-11*). This type of asymmetric mechanics is readily managed in routine clinical practice.

3. Interproximal reduction and intermaxillary elastics

Bilateral tooth size discrepancies can result in a lack of upper and lower midline coincidence.[30] Midline correction is a challenge when no space remains, particularly at the end of the treatment.[40,42-44] Correcting tooth size proportions by interproximal reduction (*IPR*) also creates space for diagonal elastic traction and dark triangle correction.[43,44] It is important to monitor the axial inclinations when planning and performing IPR to make sure the enamel reduction and subsequent space closure will result in roots that are parallel.[32] For the present patient, IPR was effective for both dark triangle and tooth size correction without compromising the axial inclinations of the roots (*Figs. 9-11*).

4. Orthodontic bone screw for anchorage

Skeletal anchorage (*TADs*) can be used as a form of asymmetric mechanics[7-10] as well as to apply intrusive force for controlling the vertical relationships of the dentition. The two main side effects of atypical extraction patterns are midline deviation and canting of the occlusal plane. Both of these potential problems can be corrected using TADs.[45,46] A clinically challenging scenario is when the upper dental midline is coincident with the facial midline, and the asymmetry is isolated in the lower arch. Using a well-positioned upper arch as anchorage for intermaxillary elastics to correct lower arch alignment may result in an esthetic compromise. TADs are effective skeletal anchor units for diagonal elastics, which are effective mechanics for midline alignment, particularly in combination with IPR.[42-46] The present patient agreed to the use of TADs, if needed to offset the effects of asymmetric space closure.

5. Space distribution and prostheses design

Orthodontists should prospectively consider all aspects of the treatment required for a desired restoration of esthetics and function.[29] A well-planned comprehensive treatment plan may involve a digital smile design and/or implant placement. In addition, prosthetic restoration of dental morphology is a critical consideration, in combination with orthodontic space management, for achieving a satisfactory outcome.[15-17]

6. Correcting habits and muscle training

Kondo[47,48] carefully manages the functional aspects of dentofacial orthopedic treatment. Even skeletal asymmetric malocclusions, that usually require orthognathic surgery, can be managed with muscle training. The method is effective for functional shift corrections that enhance the long term stability of Class III open bite malocclusions, treated with and without surgery.[47] Orthodontic treatment can be combined with asymmetric cervical and masticatory muscle corrections, for managing Class III malocclusion with lateral deviation of the mandible, as well as a severely asymmetric condyle and ramus.[48] These reports indicate the importance of effectively managing functional problems for facilitating orthodontic treatment.

7. Orthognathic surgery

There are limitations for orthodontic correction combined with prosthodontic camouflage,[10,15-18] and orthognathic surgery may be indicated for correcting the asymmetry.[49,50] If a patient is focused on a complete correction of complex, asymmetric midline problems, orthognathic surgery may be the only viable option.

Conclusions

This case report demonstrates that a relatively simple application of asymmetric extractions and biomechanics was effective for managing a complex malocclusion with bimaxillary protrusion and atrophic extraction sites. Careful design and monitoring of the asymmetric mechanics resulted in an optimal correction that was satisfying for the patient and the clinician. Midline control was maintained without resorting to TADs. For complex malocclusions, it is wise to plan additional anchorage options with the patient to insure that treatment objectives are met.

Acknowledgment

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 18

OVERJET

0 mm. (edge-to-edge)	=	1 pts.
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 = 1

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 = 4

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 = 0

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 ____ pts.
Beyond Class II or III	=	1 pt. per mm. additional ____ pts.

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 1

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° 0 x 1 pt. = ____

Each degree > 6° ____ x 1 pt. = ____

SN-MP

≥ 38° = 2 pts.

Each degree > 38° 2 x 2 pts. = 4

≤ 26° = 1 pt.

Each degree < 26° ____ x 1 pt. = ____

1 to MP ≥ 99° = 1 pt.

Each degree > 99° 0 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)	2 x 1 pts. =	2
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	2 x 2 pts. =	4

Identify: Atrophic ridge, asymmetric anchorage

Total = 6

IMPLANT SITE

Lip line : Low (0 pt), Medium (1 pt), High (2 pts) = ____

Gingival biotype : Low-scalloped, thick (0 pt), Medium-scalloped, medium-thick (1 pt), High-scalloped, thin (2 pts) = ____

Shape of tooth crowns : Rectangular (0 pt), Triangular (2 pts) = ____

Bone level at adjacent teeth : ≤ 5 mm to contact point (0 pt), 5.5 to 6.5 mm to contact point (1 pt), ≥ 7mm to contact point (2 pts) = ____

Bone anatomy of alveolar crest : H&V sufficient (0 pt), Deficient H, allow simultaneous augment (1 pt), Deficient H, require prior grafting (2 pts), Deficient V or Both H&V (3 pts) = ____

Soft tissue anatomy : Intact (0 pt), Defective (2 pts) = ____

Infection at implant site : None (0 pt), Chronic (1 pt), Acute(2 pts) = ____

Total = ____

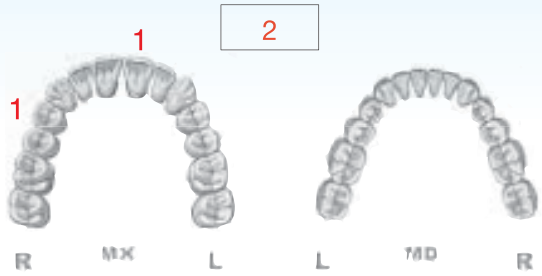
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 23

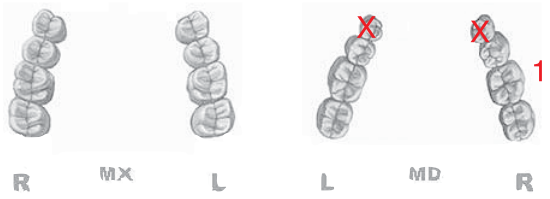
Alignment/Rotations

2



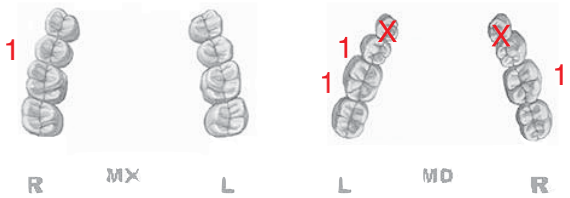
Marginal Ridges

1



Buccolingual Inclination

4

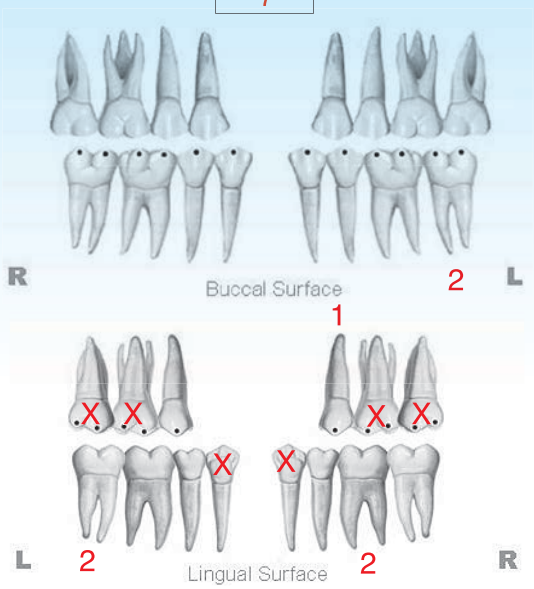


Overjet

1

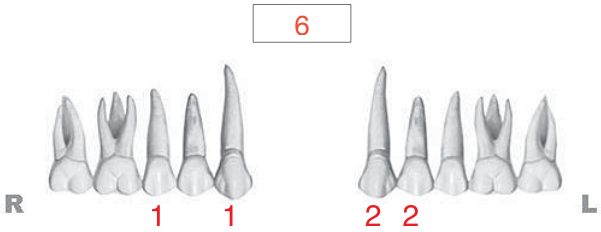
Occlusal Contacts

7



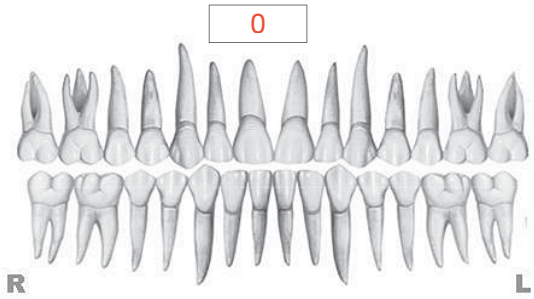
Occlusal Relationships

6



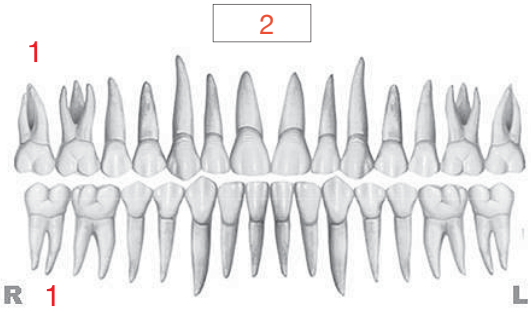
Interproximal Contacts

0



Root Angulation

2



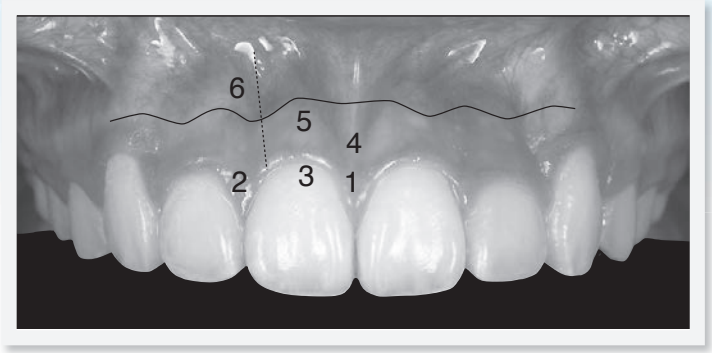
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score (Before Surgical Crown Lengthening)

Total Score: = 2

1. Pink Esthetic Score

Total = 0

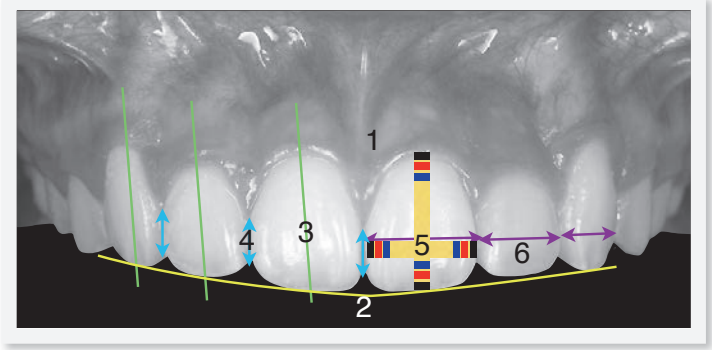


1. M & D Papilla	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

1. M & D Papilla	(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-esthetics)

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 (1:0.8)	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 (1:0.8)	(0)	1	2
6. Tooth to Tooth Proportion	0	(1)	2

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2017年的植牙論壇，課程規劃將再進化：除了美國矯正學會院士張慧男醫師，美國牙周病學會院士邱上珍醫師，台灣矯正植牙學會院士蘇筌瑋醫師將繼續帶領學員進行臨床案例報告與期刊的討論與分析外，也邀請了許多經驗豐富的醫師進行特別演講。其中，特別演講嘉賓包含前台中榮總植牙中心與牙周病科特約主治醫師方鐘鼎醫師，將教導我們仔細分析上顎竇處理的相關議題；還有以嚴謹，細緻治療聞名的中華審美牙醫學會的理事何鳳娟醫師，將指導我們如何精巧的處理軟組織；以及在澎湖開業非常成功的周暘齡醫師，將分享自身成功的經驗，從前端的口掃到後端的CAD-CAM設備、助理的訓練與技師的配合等，帶領我們進入數位牙科的時代。另外，長期指導我們的大家長：前三軍總醫院口腔外科主任、哈佛大學資深研究員的張燕清主任，將繼續提醒我們在植牙領域的種種陷阱和特別考量。

2017年的植牙論壇課程，精采絕倫。希望經由這每月一次的進修，讓您全方位的有效率學習，並在面對各式的臨床案例時，能游刃有餘，得心應手。誠摯的邀請您參與2017年植牙論壇！

03-5735676 #201 陳建名先生

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Alireza Moshaverinia

Ilan Rotstein

Tomaso Vercellotti

Homayoun Zadeh

Early Treatment of Anterior Crossbite Combined with Bilateral Maxillary Labially Impacted Canines

History and Etiology

A 10-year 10-month girl (*Fig. 1*) was referred by her pedodontist for orthodontic evaluation because of multiple problems of frontal teeth: retained deciduous incisors, anterior crossbite, and ectopic eruption of lateral incisors (*Fig. 2*). No contributing medical problems were reported. There was no history of dental trauma, oral habits, or temporomandibular dysfunction. Oral hygiene was acceptable. Clinical examination revealed a mild facial asymmetry with the mandible deviated to the left (*Fig. 1*), Class I buccal segments (*Fig. 3*), a missing mandibular right 2nd molar with retained roots, and caries in both left 2nd deciduous molars. As shown in Figs. 4-6 the malocclusion was corrected to a near ideal result. The pretreatment and posttreatment cephalometric and panoramic radiographs are presented in Figs. 7-8. The panoramic radiograph (*Fig. 7*) revealed that the crowns of both maxillary canines overlap the adjacent lateral incisors, indicating they will be impacted. A conebeam computed tomography (*CBCT*) image confirmed the abnormal labial position of both maxillary canines (*Fig. 9*), and superimpositions of cephalometric tracings document the treatment relative to a challenging growth pattern (*Fig. 10*). The cephalometric measurements are presented in Table 1.

Fig. 1: Pre-treatment facial photographs

Fig. 2: Pre-treatment intraoral photographs

Fig. 3: Pre-treatment study models (casts)

Dr. Wei Lun Peng,
Lecturer, Beethoven Orthodontic Course (Left)

Dr. Chris Chang,
Founder, Beethoven Orthodontic Center
Publisher, International Journal of Orthodontics & Implantology (Center)

Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)

Fig. 4: Post-treatment facial photographs

Fig. 5: Post-treatment intraoral photographs

Fig. 6: Post-treatment study models (casts)

Diagnosis

Skeletal:

- Skeletal Class I (*SNA 80°, SNB 79°, ANB 1°*)

Dental:

- Bilateral Class I molar relationship
- Anterior cross bite of the maxillary left central and both lateral incisors (*#7, 9, 10*)
- Retained deciduous teeth: *Both maxillary lateral incisors (#7d, 10d)*
- Residual roots: *Mandibular right 2nd deciduous molar (#20d)*

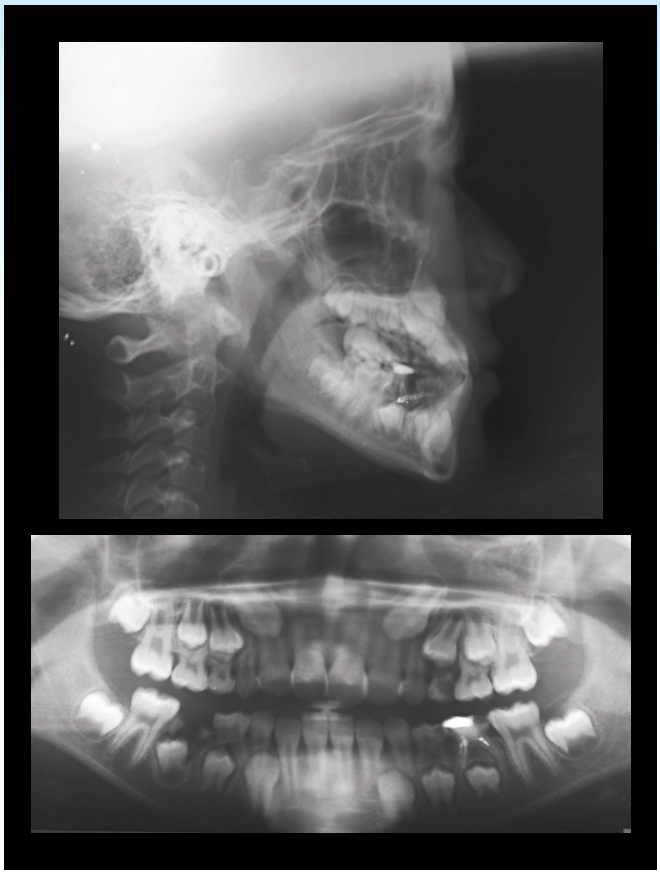
Facial:

- Slight facial asymmetry with the mandible deviated to the left
- Straight profile and lip protrusion were within normal limits (*WNL*)
- Vertical proportion was WNL

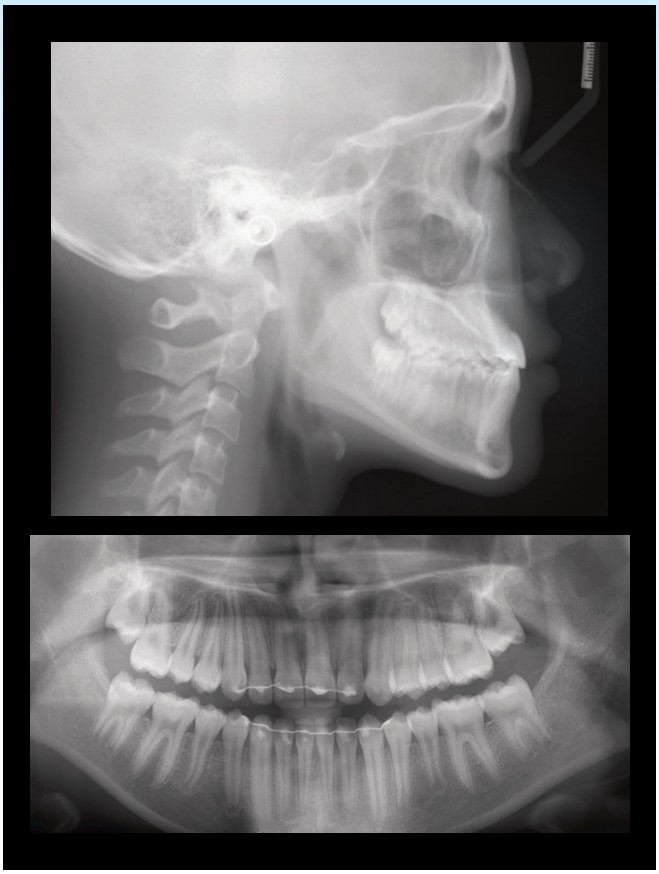
Specific Objectives Of Treatment

Maxilla (*all three planes*):

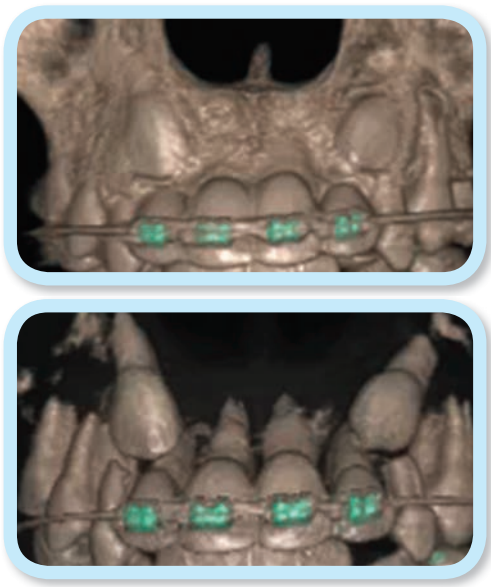
- A - P: *Anterior*
- Vertical: *Maintain*
- Transverse: *Maintain*



■ *Fig. 7:*
Pre-treatment cephalometric and panoramic radiographs



■ *Fig. 8:*
Post-treatment cephalometric and panoramic radiographs



■ *Fig. 9:*
The 3-D image showed the crowns of the labially impacted canines positioned mesially across the roots of the adjacent lateral incisors.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	80°	80°	0°
SNB°	79°	83°	4°
ANB°	1°	-3°	4°
SN-MP°	39°	38°	1°
FMA°	30.5°	29.5°	1°
DENTAL ANALYSIS			
U1 TO NA mm	5 mm	6 mm	1 mm
U1 TO SN°	103°	105°	2°
L1 TO NB mm	3.5 mm	2.5 mm	1 mm
L1 TO MP°	88.5°	76°	12.5°
FACIAL ANALYSIS			
E-LINE UL	0 mm	-1 mm	1 mm
E-LINE LL	2.5 mm	0.5 mm	2 mm

■ Table 1: Cephalometric summary

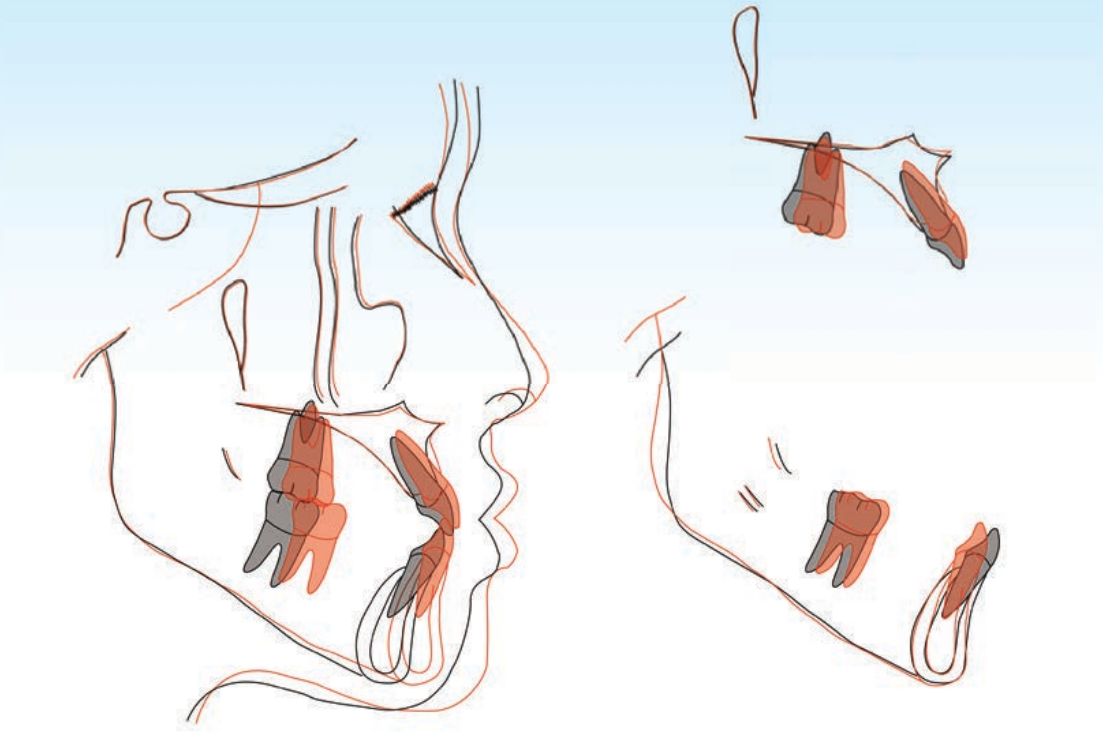


Fig. 10: Superimposed tracings.
Class I molar relationship was retained, and the straight profile was maintained. The ramus and the body of the mandible kept growing and moving forward throughout the treatment. The labially tipped crown of lower incisors were uprighted because anterior cross bite was corrected. But ANB° was changed from 1° to -3° , a tendency of skeletal class III was suspected and should be kept in follow up for its skeletal development.

Mandible (*all three planes*):

- A - P: *Allow for normal expression of growth*
- Vertical: *Allow for normal expression of growth*
- Transverse: *Maintain*

Maxillary Dentition :

- A - P: *Anterior to correct anterior crossbite*
- Vertical: *Maintain*
- Transverse: *Maintain*

Mandibular Dentition:

- A - P: *Retract incisors as needed to correct anterior crossbite*
- Vertical: *Maintain*
- Transverse: *Maintain*

Facial Esthetics:

- Maintain a straight profile and vertical proportion consistent with expression of normal growth

Treatment Plan

Non-extraction treatment in two phases was indicated because of the mild crowding, anterior crossbite and probable maxillary canine impactions. Mixed dentition treatment begins with a maxillary two-by-four fixed appliance and a lower lingual arch. Bite turbos will be applied to the lower dentition to facilitate the space management and correction of the anterior crossbite. After alignment of the maxillary incisors and correction of the anterior crossbite, a CBCT demonstrated that the maxillary

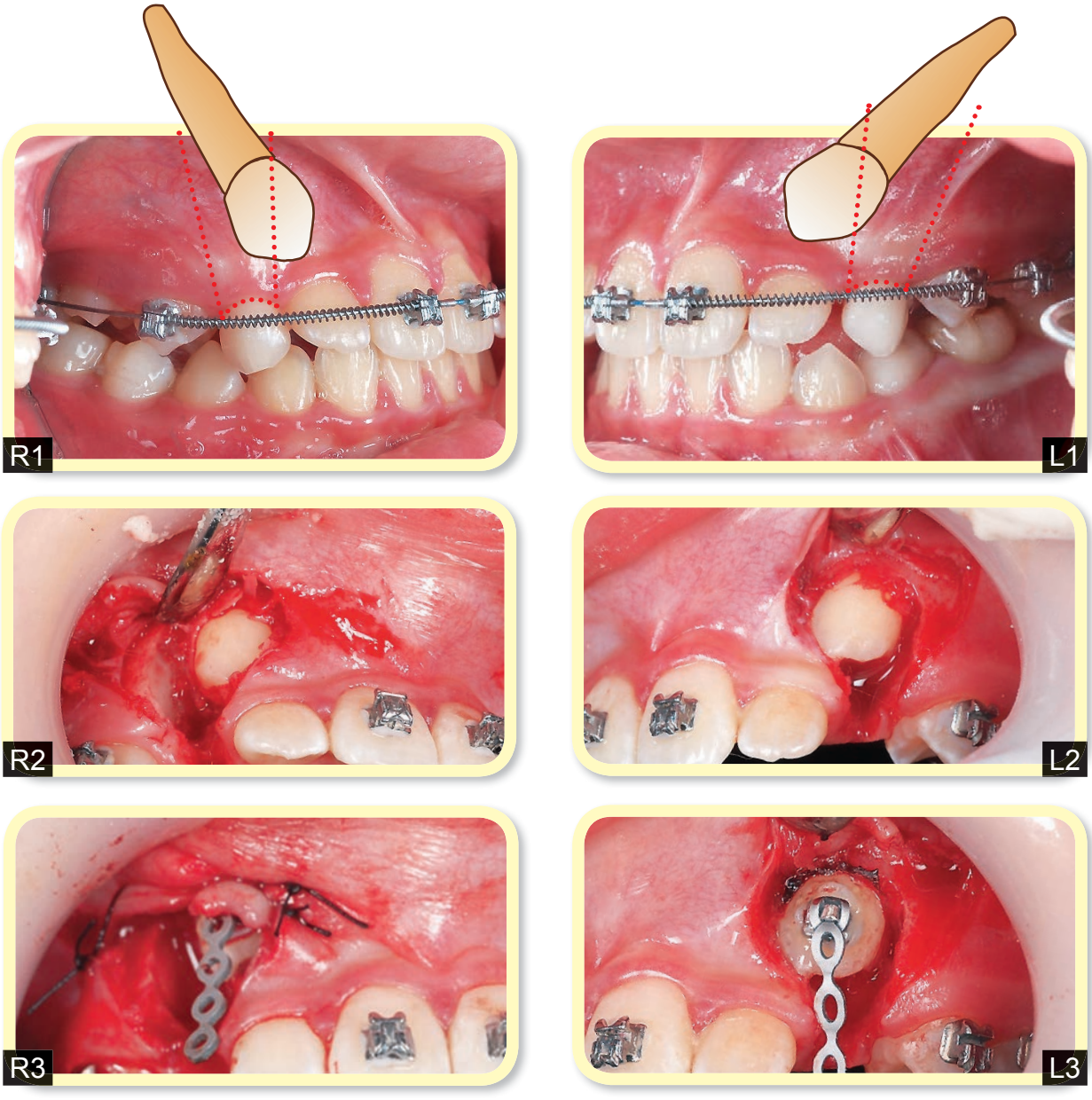
canines were labially impacted. Following eruption of the permanent premolars, phase II treatment with a full fixed appliance was indicated. Open coil springs were inserted between the first premolars and incisors to provide sufficient space for the maxillary canines. If the canines failed to erupt spontaneously, surgical intervention is indicated to expose the crowns and bond attachments for traction. After finishing the treatment, fixed anterior retainers were planned for both the upper and lower arches, with a clear retainer overlay for the upper arch.

Appliances and Treatment Progress

A lower lingual arch were placed to maintain space, and prevent mesial drifting of mandibular first molars. A maxillary two-by-four appliance (*standard .022" twin brackets*), with bite turbos on the mandibular lateral incisors, was used to correct the anterior crossbite. Five months later, the crossbite was corrected and the lower right 2nd premolar had erupted (*Fig. 11*). Once positive overjet was achieved, the bite turbos were removed. The lingual arch and maxillary brackets were removed in the 14th month

Fig. 11:
Intraoral Radiograph - frontal and occlusal view of the initial visit, 1st, 5th month of the treatment. A 2×4 appliance was placed in the upper arch initially and a lingual arch was fabricated for the lower dentition, combined with bite turbos on the lower incisors. In 5 months, the anterior cross bite was correct and #29 erupted into the oral cavity.

of the treatment. In the 16th month, .022" Damon 3 MX® brackets (*Ormco*) were bonded on the upper central incisors and 1st premolars (*Fig. 12*). A .014" CuNiTi arch wire was inserted and open coil springs were placed to create enough space for maxillary canines. The three-dimensional CBCT image (*Fig. 9*) indicated that the maxillary canine crowns were positioned labially and mesially, overlapping the roots of the adjacent lateral incisors. A bilateral apically positioned flap (*APF*) was performed (*Fig. 12*) to expose the labial surface of the impacted cuspids. Eyelet tubes were bonded on the exposed labial surfaces and power chains were attached from the tubes to the arch-wire to extrude the impacted cuspids into the oral cavity. No brackets were placed on the lateral incisors to allow them the freedom to move out of the path of the extruding canines. This "*free body*" approach helps to protect adjacent



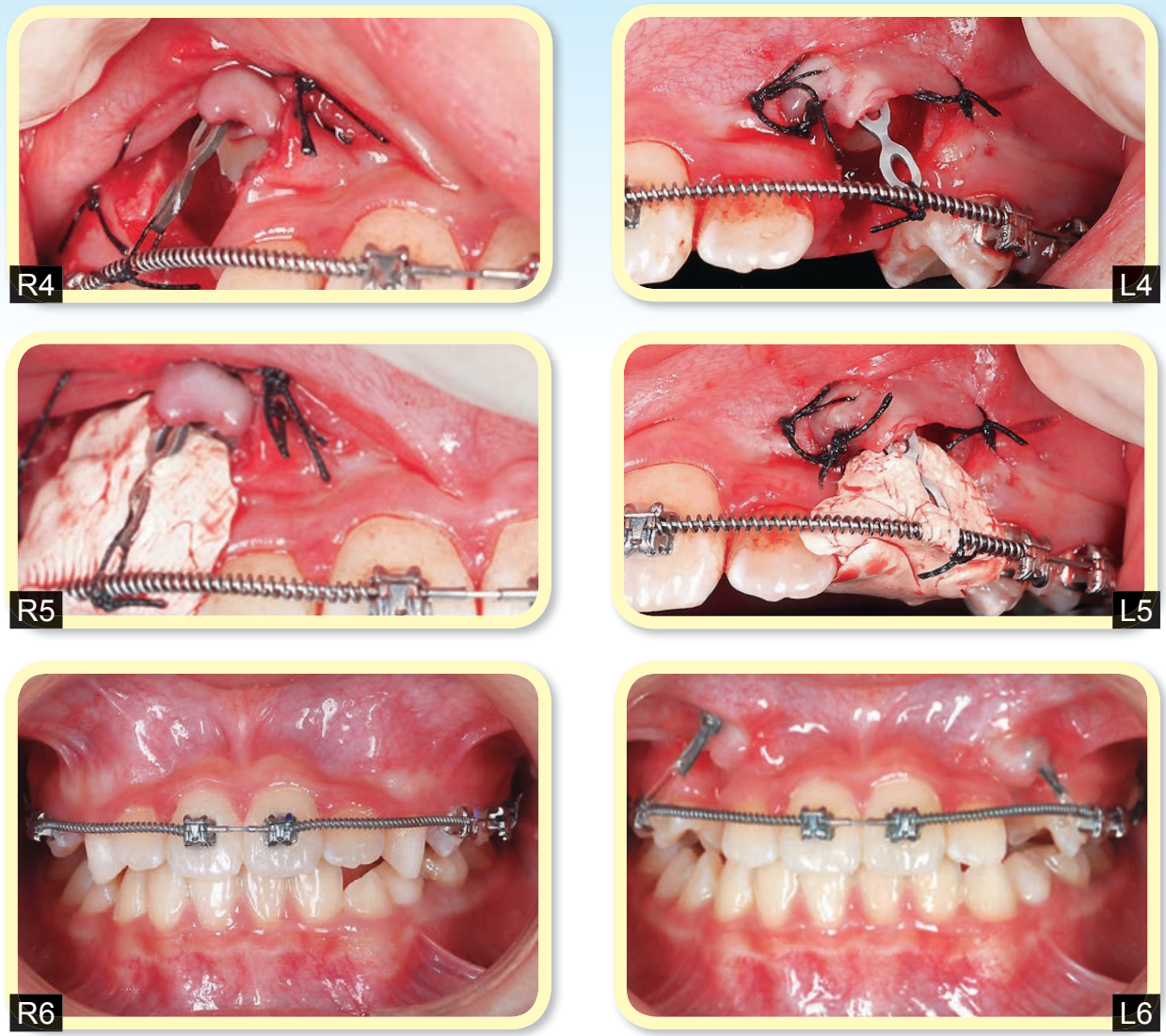


Fig. 12: Surgical procedures

L1, R1: The 3-D radiograph indicated the precise location of the impacted cuspids, both of which were positioned apically to the mucogingival junction. A direct incision line outside of the crown for exposure may result in loss of keratinized gingiva after extruding them into the oral cavity. Therefore, a bilateral apically positioned flap was indicated.

L2, R2: Bone reduction was made to uncover the labial surface of the crowns.

L3, R3: Placing eyelet tubes on each side.

L4, R4: Tied with power chains to the archwire.

L5, R5: Finally, sutured and covered with Coe-Pak® to facilitate wound healing.

L6, R6: 1 month later, keratinized soft tissue formed surrounding the crowns.

teeth as the impaction is moved into the arch. One month postoperatively (*17th month of treatment*), the surgical area was healed and keratinized gingival tissue surrounded the crown of both cuspids. The impacted cuspids continued moving backward and downward during the following 6 months. In the 22nd month of the treatment, both canines were almost fully erupted, so they were bonded with Damon 3 MX® brackets. In the 25th month, .022" Damon 3 MX® brackets were placed on the lower dentition. Both arches were leveled and aligned with .014" CuNiTi wires, followed by .014x.025" NiTi wires.

At the 30th month of treatment, a .017x.025" low friction TMA wire was placed in the upper arch. This wire was adjusted to reduce the torque for the flared lateral incisors. In the 31st month of the treatment, the maxillary canines were not in occlusion, so bilateral triangular elastics were used to improve and settle the occlusion (*Fig. 13*). The route of traction for recovering the maxillary incisors is shown in Fig. 14. The fixed appliances were removed in the 36th month of treatment. Fixed anterior retainers were bonded from the maxillary right 1st premolar to the left lateral incisor (*UR-UL2*), and between the 1st premolars in the mandibular arch (*LR4-LL4*). A clear, overlay retainer was delivered for the upper arch.

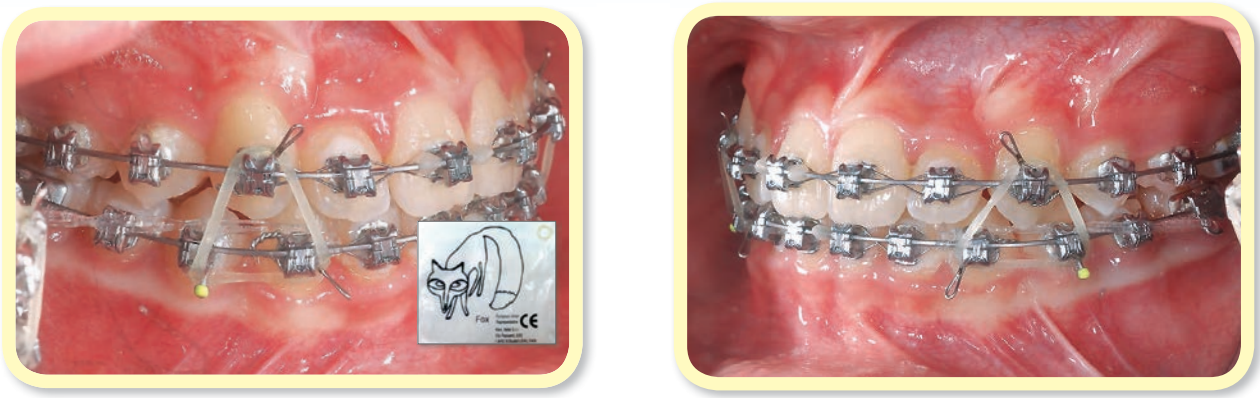


Fig. 13:
31st month of treatment. A bilateral triangular elastic (Fox ¼" 3.5oz, Ormco) was used to improve intermaxillary occlusal contact of canines and premolars.

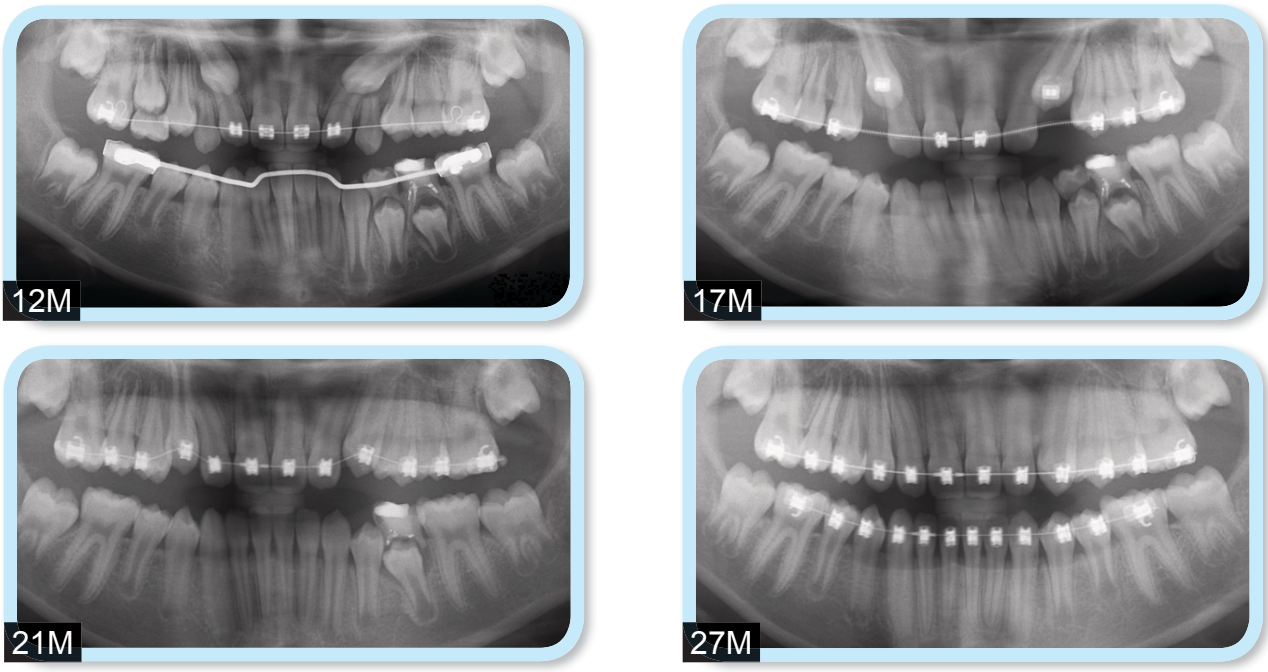


Fig. 14:
Four panoramic radiographs indicated the traction route of two impacted cuspids. The traction route was outward, backward, and downward. Consequentially, these two cuspids could eventually erupt into the oral cavity, and were later leveled and aligned.

Final Evaluation of Treatment

The Cast-Radiograph Evaluation score was 22 points, which was deemed adequate to qualify as a board case report. The major discrepancies were in marginal ridge discrepancies, axial inclination problems, and excessive overjet. The flared upper lateral incisors, which were protracted to correct the anterior crossbite, could have been improved by torquing springs or by bonding brackets upside down. In addition, the brackets on the lower 2nd premolars could have been positioned more gingivally to eliminate marginal ridge discrepancies with the adjacent molars, and also improve intermaxillary occlusal contacts.

As documented by the superimposed tracings, the patient's straight profile was maintained. However, the mandible grew anteriorly during treatment, and continued to grow anteriorly for 2 years after treatment (*Fig. 15*). This tendency toward a skeletal Class III malocclusion will be carefully monitored.

Despite developing into a compensated Class III occlusion after treatment, the smile arc was acceptable (*Fig. 15*), but there was a noticeable decrease in maxillary anterior tooth display. The gingival display of the maxillary anterior region improved without any further treatment (*Fig. 16*). The casts demonstrate that the occlusion remained Class I on a Class III skeletal base. Fig. 18 is a schematic drawing of the recently developed VISTA technique, which would have been a good option for the present patient. Fig. 19 is a profile comparison before treatment, after fixed appliances were removed, and at two-year follow-up. Despite a strong anterior (*Class III*) growth pattern, facial esthetics are acceptable.

Fig. 15: 2-year post-treatment facial photographs

Fig. 16: 2-year post-treatment intraoral photographs

Fig. 17: 2-year post-treatment study models

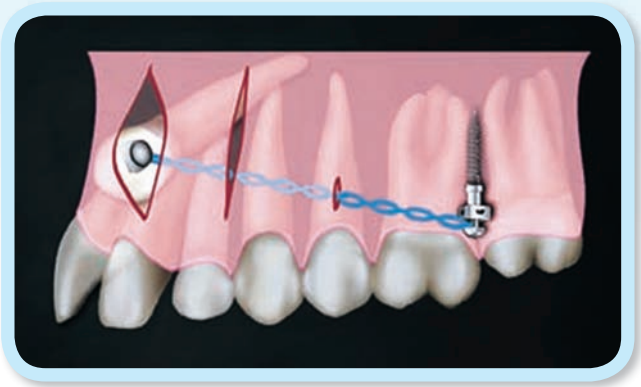


Fig. 18:
Vertical Incision Subperiosteal Tunnel Access (VISTA), a minimally invasive technique, combined with bone screws, is also indicated in labially impacted cuspids.

	E	APF	CE
B-L position (if surrounding bone wrapped the surface of crown)	×	×	○
Crown apical to MGJ	×	○	○
The mount of attached gingiva < 2-3mm	×	○	×
M-D position (if the crown's position overlapped with the root of lateral incisor)	×	○	×

E: excisional uncovering; **APF**: apically positioned flap; **CE**: closed eruption technique; **MGJ**: mucogingical junction

Table 2: Surgical considerations for labially impacted cuspids

Fig. 19:
Comparison of pre-treatment, post-treatment, and 2-year post-treatment cephalometric and lateral facial photographs. Straight profile was maintained, but the continuous mandibular development which might result in Class III molar relationship may require future treatment intervention.

Discussion

Anterior Crossbite

Anterior crossbite is defined as a lingual maxillary incisor and/or canine position relation to the mandibular arch.[1] Traumatic occlusion, associated with a crossbite, may result in dehiscence, gingival recession, and labial attrition of maxillary incisor. Early treatment to correct this malocclusion is indicated to facilitate the eruption of the canines and premolars into a Class I relationship, as well as to eliminate traumatic occlusion to the incisors, and improve expression of a normal growth pattern.

Before correcting anterior crossbite, it is important to analyze the following data:[2]

- cephalometric/skeletal analysis
- patient's profile
- the dental relationship of molars and cuspids
- dental arch width and length
- extent of the anterior crossbite
- stage of tooth eruption
- axial inclination and rotation of anterior teeth

There are several treatment options for correcting an anterior crossbite:[2, 3]

1. tongue blade therapy
2. reverse orientation a stainless steel crown
3. fixed or removable mandibular inclined plane made of acrylic
4. two-by-four appliance
5. full mouth fixed appliance, etc

The first three types of treatment are most appropriate for single tooth anterior crossbites in the mixed dentition.[2] In the present case, there are three upper incisors involved in the anterior crossbite. Moreover, the suspected impacted maxillary canines and the mild crowding must also be taken into consideration. Therefore, mixed dentition treatment with a two-by-four appliance, combined with anterior bite turbos, was the optimal approach, selected for the present patient.

Labially impacted canine

The etiology of impacted canine is often attributed to abnormal position of tooth buds, associated with an arch length and/or width deficiency. The three methods for diagnosing impacted canines are inspection, palpation, and radiography. Inspection and intraoral palpation of the canine bulge are useful for determining the general location of the impacted canine.[4] However, three-dimensional CBCT images are the standard of care for providing the most accurate information about the location of the impaction relative to its adjacent teeth.

Treatment modalities of labially impacted canine

For impacted canines, non-extraction treatment is indicated unless there are other complications, such as severe crowding, ankylosis, uncontrolled infection, internal or external root resorption, severe root dilacerations, and/or pathology that may compromise adjacent teeth during or after orthodontic treatment.[5]

Non-surgical approach:

According to the Williams[6] study in 1981, selective removal of deciduous cuspids is a suggested interceptive measure in Class I uncrowded malocclusions. Olive[7] concluded that creating space for the impacted canine with fixed appliances, and waiting for spontaneous eruption, is an effective option.

Surgical approach:

Many impacted canines cannot be treated with non-surgical methods. If impacted canines do not erupt after a year of treatment, then surgical intervention is indicated. Kokich[8] summarized three techniques for treating labially impacted maxillary canines, including excisional uncovering, apical positioned flap, and the closed eruption technique. Their indications and contraindications are shown in Table 2. In the present case, both impacted canines were tilted mesially and positioned across the middle of the root of the adjacent lateral incisors. In addition, there was no bone covering the crowns. Therefore, an apical positioned flap was chosen to uncover two impacted cuspids to allow for traction.

For less scar formation, particularly in the esthetic zone, the Vertical Incision Subperiosteal Tunnel Access (*VISTA*) technique (*Fig. 18*), provides an minimally invasive alternative for the surgical treatment of labial impactions.[9, 10]

Conclusion

Anterior cross bite and impacted cuspids are commonly found in young children in Taiwan. Both of which can be detected at the age of 8. The earlier the signs and symptoms are noted and treated, the less complication will occur later.

There are several effective treatment options for anterior crossbite. When the problem involves multiple teeth and other complications, such as crowding or impaction, a two-by-four appliance is usually recommended.

The three steps for effectively managing impacted canines include (1) use of three dimensional radiographic imaging, (2) a proper design for surgical intervention, and (3) precise mechanics of force system design.

Acknowledgements

Special thanks to Dr. Yu Lin Hsu and Ms. Tzu Han Huang for proofreading this article.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 20

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 = 10

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 = 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 = 2

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 _____ pts.
Beyond Class II or III	=	1 pt. per mm. additional _____ pts.

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

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° 1 x 2 pts. = 2

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

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

Total = 4

OTHER (See Instructions)

Supernumerary teeth	_____ x 1 pt. =	_____
Ankylosis of perm. teeth	_____ x 2 pts. =	_____
Anomalous morphology	_____ x 2 pts. =	_____
Impaction (except 3rd molars)	2 x 2 pts. =	4
Midline discrepancy (≥3mm)	@ 2 pts. =	_____
Missing teeth (except 3rd molars)	_____ x 1 pts. =	_____
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 = 4

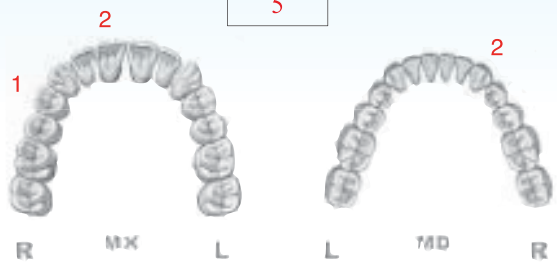
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 22

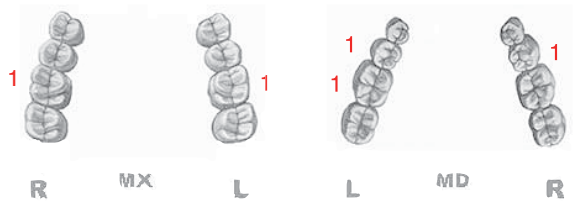
Alignment/Rotations

5



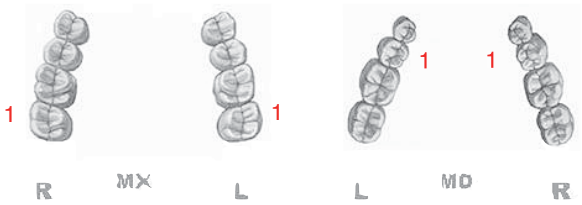
Marginal Ridges

5



Buccolingual Inclination

4

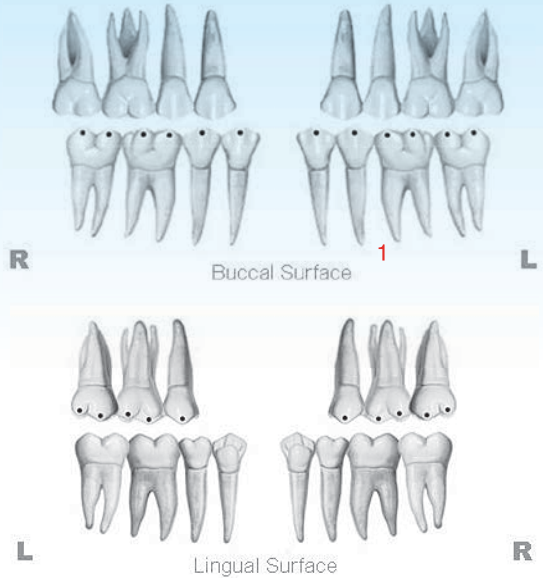


Overjet

5

Occlusal Contacts

1

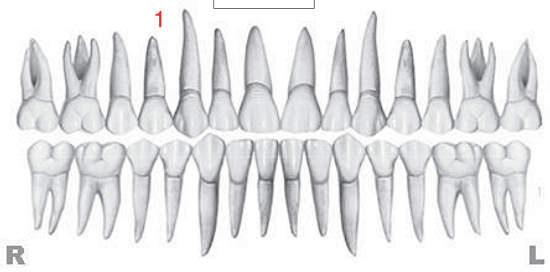


Occlusal Relationships

0

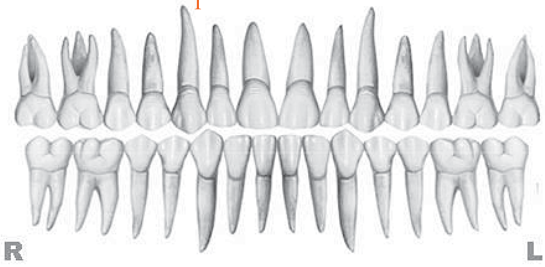
Interproximal Contacts

1



Root Angulation

1



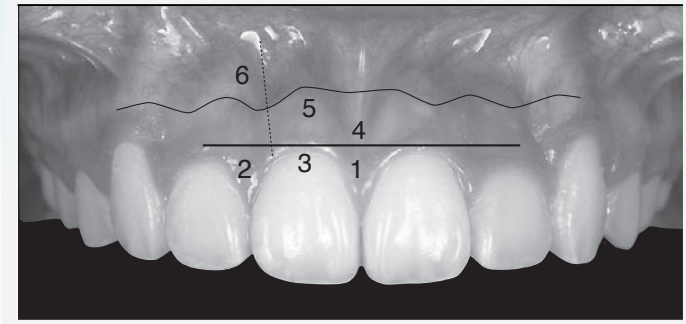
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score (Before Surgical Crown Lengthening)

Total Score: = 7

1. Pink Esthetic Score

Total = 5

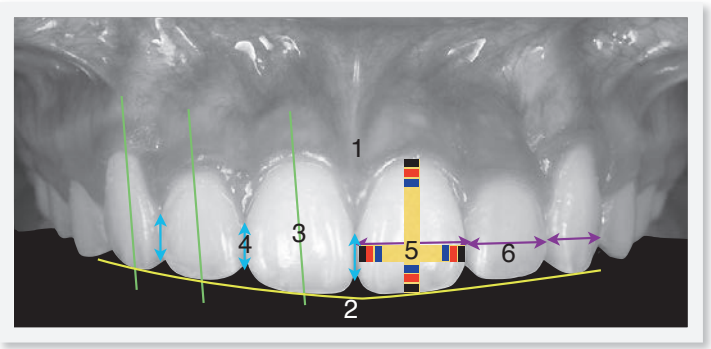


1. Mesial Papilla	0	1	2
2. Distal Papilla	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

1. M & D Papilla	(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-esthetics)

Total = 2



1. Tooth Form	0	1	2
2. Mesial & Distal Outline	0	1	2
3. Crown Margin	0	1	2
4. Translucency (Incisal thrid)	0	1	2
5. Hue & Value (Middle third)	0	1	2
6. 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 (1:0.8)	(0)	1	2
6. Tooth to Tooth Proportion	(0)	1	2

Animation & Illustration

Advanced Keynote Workshop

2017 12/2-4 (Sat-Mon) 09:00-17:00

Effective dental presentation in today's digital world requires not only clear clinical photos but also diagrams and animation to engage the audience. Moreover, these visual tools are excellent aids to make your presentation unique and memorable. In this workshop Dr. Rungsi will share his dental illustration experiences and demonstrate step by step how to create an illustration from an initial sketch to a finished piece. Active participation and completion of workshop assignments are required for workshop participants.

Topics:

1. Design illustration in Keynote.
2. Showcase your own drawing with stunning animation in Keynote.
3. Animation composition.

Lecturer:
Dr. Rungsi Thavarungkul,
Thailand

Early Bird

by 2017/10/02

Newton's A course@newtonsa.com.tw

Requirements: Mac computer with OSX 10.11.X; Keynote 6.X (the latest)

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The charging dock features a built-in, easy-to-use radiometer with LED indicators that instantly communicate the curing light system's power status

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The handpiece's lightweight, ergonomic design and 360° rotating tip invite a wide range of comfortable hand positions to help minimize hand and arm fatigue

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The sealed, ventless handpiece and docking station are engineered to simplify cleaning and to help extend service life

System specifications		Handpiece with LED light attachment	Charging dock
Size		10.5" x 1.3"	5.8" x 3.2" x 3.0"
Weight		7.3 oz	15.9 oz
Wavelength	450–470 nm		
Curing modes	5, 10, and 20 seconds		
LED light attachment	8mm with 60° angle, non-autoclavable		
Warranty	3 years		

Correction of Anomalous Tooth Form Prior to Bonding Preadjusted Orthodontic Brackets

Abstract

Orthodontics is an art as well as a science. All preadjusted (straight-wire) appliances require precision bracket placement to efficiently achieve the desired functional and esthetic result. The geometric center of a bracket base is ideally positioned over the facial axis (FA) point, which is in the middle of the labial surface of a clinical crown, and in line with the long axis of the tooth. Prospective (pretreatment) tooth contouring may be necessary to optimally position brackets for facilitating the function and esthetics of the final alignment. A step-by-step procedure is described for reshaping anomalous tooth form to reliably bond a bracket at the desired FA point to help achieve an optimal result. (Int J Orthod Implantol 2016;44:64-71)

Introduction

Aesthetics and esthetics are synonymous terms that are associated with desired orthodontic outcomes. Although ideal occlusion is an important outcome for orthodontists, the public usually focuses on facial appearance, particularly the smile. The critical consideration is the maxillary anterior segment: The Esthetic Zone. Shape and alignment of the incisors and canines are premier objectives for patients and their families.

Pitts[1] emphasizes recontouring of teeth before bonding to enhance dental esthetics, improve the fit of the brackets, and to achieve an attractive smile arc. Macroenamel recontouring (*enameloplasty*) is carefully planned with a careful clinical examination and a detailed study of stone casts.

Objectives

The aim of enameloplasty is to enhance the interarch alignment and appearance of individual teeth to achieve optimal function and an attractive smile. The goal of this article is to highlight the usefulness of small anatomical corrections and cosmetic contouring for enhancing orthodontic outcomes.

Armamentarium

A high speed handpiece with fine diamond burs (*ellipical and end-cutting*), as well as rotary instrumentation with a sandpaper disc was used to trim teeth and smooth rough edges. Adjusted areas were polished with a white stone bur or a sandpaper finishing strip, and fluoride was applied to the finished surface. With modest anatomical corrections, there is little risk of complications.

Dr. Linda Tseng,
Lecturer, Beethoven Orthodontic Course (Left)

Dr. Chris Chang,
Founder, Beethoven Orthodontic Center
Publisher, International Journal of Orthodontics & Implantology (Center)

Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)

However, if teeth do become sensitive, it is usually due to excessive enamel removal and/or a prominent pulp. A thin layer of restorative composite or laser desensitization is usually effective for managing sensitivity.

Case 1

A young female beginning her orthodontic treatment had central incisors with numerous esthetic deficiencies:

1. Square shape: height to width ratios of about 1:1 (*Fig. 1*)

2. Greater width in the contact area than at the incisal edge (*inverted taper*)

3. Excessive incisal embrasures result in apically positioned, relatively narrow contact areas: connector <50% (*Fig. 2*).

4. Prominent mesial and distal marginal ridges on the labial surface (*double shoveling*) (*Fig. 3*).

5. Irregular incisal edges (*Fig. 4*).

Enameloplasty Step By Step

Step 1: Periapical radiograph(s) reveal the long axis of the tooth (*teeth*) to be trimmed. Only well aligned teeth are good candidates for enameloplasty. Reshaping malposed teeth is not recommended because it is difficult to visualize the appropriate tooth shape that will result in a desired final

Fig. 1:
Large, square-shaped maxillary central incisors are unattractive because: 1. height/width ratio of 1:1, 2. interproxial contact area is gingivally positioned, and 3. width of the tooth is greater in the middle aspect of the crown than at the incisal edge.

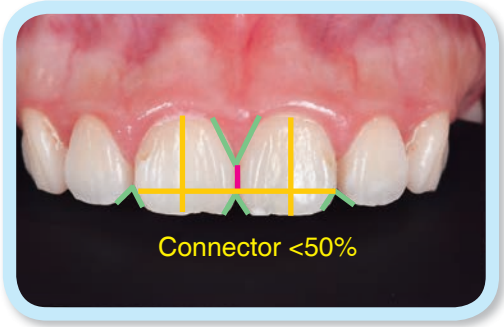

Fig. 2:
Additional unattractive features of the central incisors are excessive incisal embrasures (green inverted Vs), short connector (<50%) as shown by the pink line, and a hyperplastic midline papilla (green V).

Fig. 3:
Prominent mesial and distal marginal ridges, delineated by a back contour line on the labial surface of the central incisors, was diagnosed as the double shoveling trait.

Fig. 4:
Incisor edges of the central incisors were irregular (yellow lines).

alignment. Adjusting enamel contours, out of context with adjacent teeth, can result in irreparable damage.[3-7]

Step 2: IPR (*interproximal reduction*) of enamel is performed to reduce the width of the two central incisors (*Fig. 5*). The procedure begins by reshaping the connector between the central incisors using a fine diamond fissure bur. The enamel reduction should be no more than 0.5mm (*0.25mm each side*) per tooth.

Step 3: Prominent marginal ridges (*double shoveling*) were smoothed with a flat-end high speed diamond

Fig. 5:
Interproximal reduction (IPR) of the enamel (bold yellow lines) was performed to reduce the width of the incisors. The thin yellow lines are references for the axial inclination and width of each labial surface as defined in Fig. 1.

Fig. 6:
The prominent marginal ridges were smoothed with a flat-end diamond bur and polished with a white stone as illustrated with the textured gray lines.

Fig. 7:
The incisor edges were smoothed and leveled with a fine sandpaper disc.

bur, and then the adjusted surface was polished with a white stone (*Fig. 6*).

Step 4: The incisor edges were smoothed with a sandpaper disk (*Fig. 7*).

Step 5: All line angles were rounded and smoothed with sandpaper strips.

Result Achieved

The width to height ratio was about 0.8, and the connector length between central incisors was increased to the ideal of ~50%. A soft tissue laser was used to improve crown height as well as to reshape gingival contours and relocate the gingival zenith relative to the interdental papillae (*Fig. 8*). From the occlusal view (*Fig. 9*), the labial surface of the central incisors was smooth after marginal ridge recontouring, but the palatal contours required more reduction to avoid interfering with the overbite, overjet and interproximal alignment. All the reshaped contours were thoroughly inspected from multiple perspectives and polished with a white finishing stone.

Fig. 8:
After enameloplasty relative to the yellow reference lines, the width to height ratio was ~0.8, and the length of the interproximal connector was ~50% of crown height. The curved black line at the free gingival margin shows that gingival recontouring is required to increase the clinical crown height, and to relocate the gingival zenith.

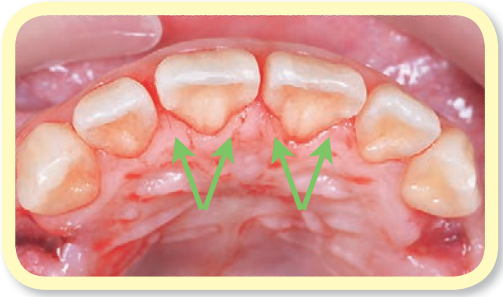

Fig. 9:
After IPR to reduce crown width, the prominent marginal ridges (green arrows) require recontouring to create optimal palatal embrasures, and to prevent occlusal interferences with the antagonist incisors.

Case 2

An extra cusp (*protostylid*) in the middle of the buccal surface of the lower second molar impeded bracket placement (*Figs. 10 and 11*). Protostylids are relatively common anomalies (*deviations from what is standard, normal, or expected*) in Asian populations, as well as their descendants, the natives of the Americas.[2] The most common protostylid is a supernumerary cusp protruding from the buccal surface of upper and/or lower permanent molars. In the usual (*normal*) configuration, the buccal groove is on or near the the facial axis (*FA*) point on lower molars. During development, a protostylid can separate the mesial

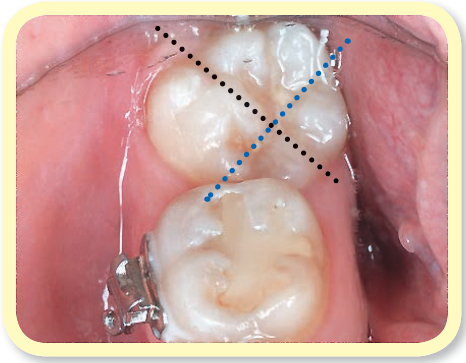

Fig. 10:
The buccal groove is typically the FA point of the lower molars, but a protostylid has grossly distorted normal morphology. The blue dotted line, with a perpendicular black dotted line, demonstrates the distortion of the buccolingual and mesiodistal dimensions, respectively. Reduction of protostylid is indicated. However, care must be exercised to not penetrate the enamel.

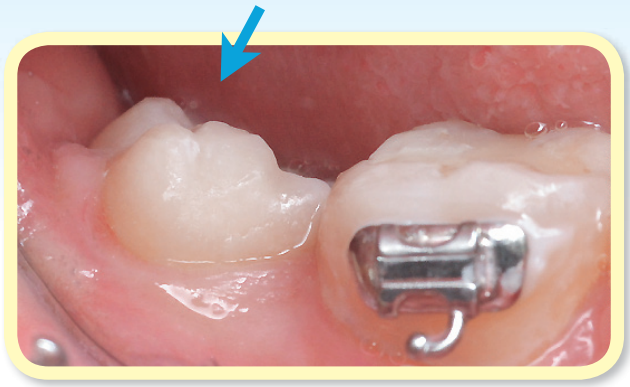

Fig. 11:
The protostylid impeded the placement of the bracket. Recontouring the labial surface of the affected molar was indicated to obtain an enamel profile that was compatible with the base of the bracket.

and distal cusps, resulting in three cusps on the facial surface (*Fig. 10*). Obliteration of the buccal groove and FA point precluded precise bonding of a preadjusted bracket (*Figs. 10 and 11*).

A high speed handpiece with a diamond bur was used to remove the bulging supernumerary cusp. Then the adjusted area was polished with a white stone bur (*Figs. 12, 13*). In this instance, an acceptable labial surface was achieved, so the bracket was bonded in the optimal position (*Fig. 14*).

Discussion

The criteria for dental esthetics include (*1*) tooth proportionality, (*2*) contacts, connectors and embrasures, and (*3*) gingival characteristics.[3-7] As shown in Fig. 15, the ideal maxillary central incisor width to height proportion is ~0.8. The most occlusal aspect of the contact area between the central incisors (*connector*) is progressively positioned higher (*more apical*), compared to the incisal edges or marginal ridges, for central incisors lateral incisors and canines, respectively (*Fig. 16*). Connector length between the maxillary anterior teeth progressively decreases from ~50 to 40 to 30% of crown height, from the central incisors to the

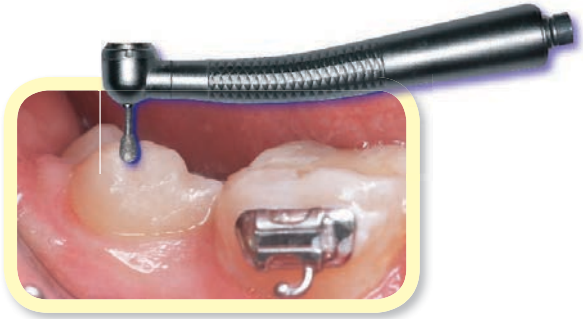

Fig. 12:
A high speed handpiece with an elliptical diamond bur was used to adjust the bulging cusp.

Fig. 13:
The adjusted area was polished with a white stone bur.

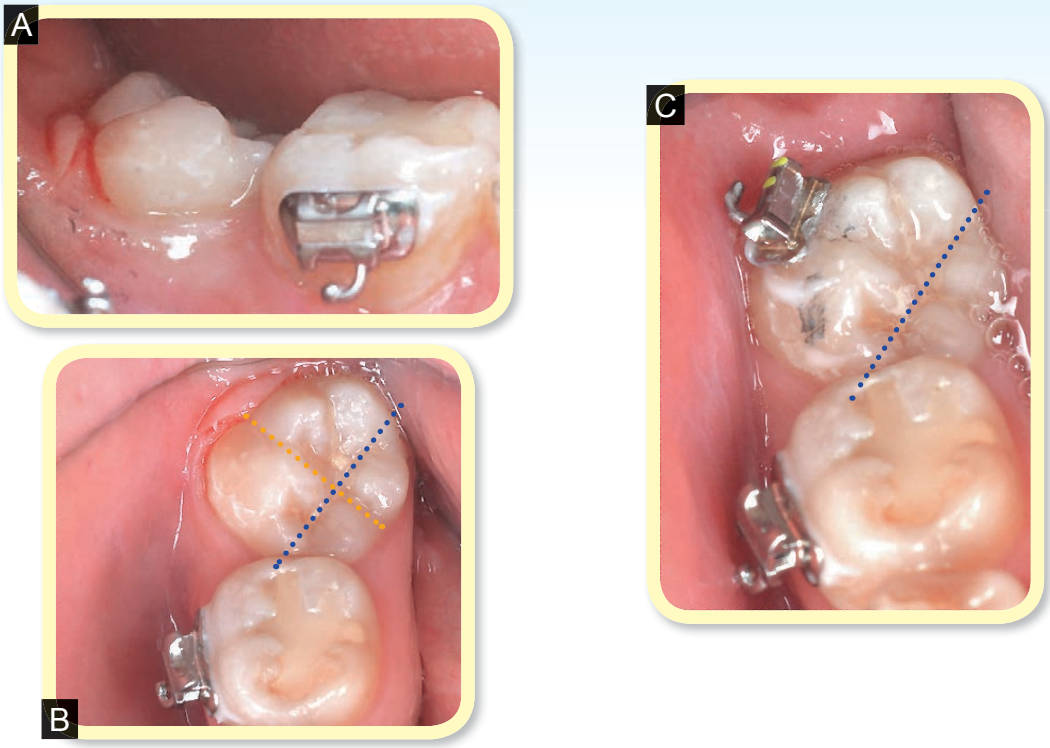

Fig 14:
A suitable curvature was achieved (A) for bonding the tube along the FA, as defined by the orange dotted line (B), which is perpendicular to the central groove, as defined by the blue dotted line (C).

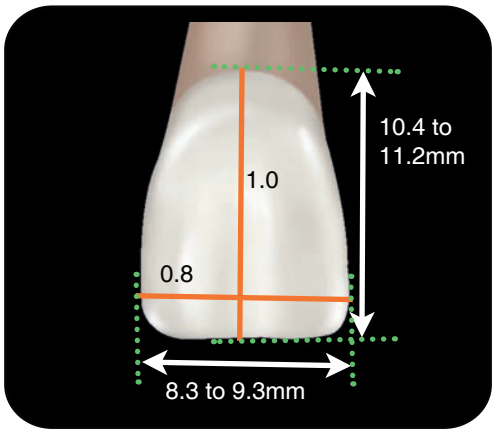

Fig. 15:
As shown, the normal variation (between the green dotted lines) for the height and width of a central incisor crown varies considerably, but the most esthetic ratio is a constant: ~0.8.

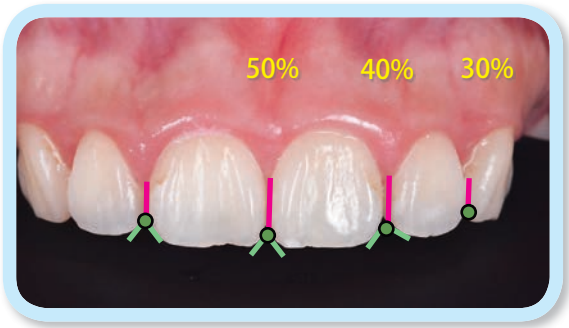

Fig. 16:
As shown, there is a descending order for the connector height from maxillary central incisor to the canines, bilaterally. The ideal connector, compared to crown height, on the mesial surface in the maxillary anterior segment is 50, 40 and 30% for centrals, laterals and canines, respectively. The most superior margin of the connectors (green dots) are the base of the embrasures (green lines).

canines. Embrasure depth, coronal to the connector, shows an ascending pattern from the midline to the canines (*Fig. 16*). Gingival esthetics depends on both shape and contour of the attached mucosa. Shape is typically defined as the curvature of the free gingival margin. Maxillary central incisors and canines are most esthetic with an elliptical profile of the free gingival margin, but the lateral incisors benefit from a compressed half-oval shape, that is symmetrical. Gingival contour is determined by the soft tissue zenith, i.e. the most apical curvature of the free gingival margin. It is located distal to the long axis of the central incisors and canines, but is coincident with the long axis of the lateral incisors (*Fig. 17*).

If the palatal marginal ridges on maxillary central incisors are particularly prominent and enclose a deep fossa, the shape of the palatal surface of the incisor resembles a shovel or a scoop. When shovel-shaped incisors also feature prominent marginal ridges on the mesial and distal aspects of the labial surface, the anatomical variation is deemed double shoveling.[2,3] These features are Asian characteristics that are also expressed in native Americans,[2] but are rare or absent in African and European populations.[3] Hyperplasia of the upper incisors, resulting in an excessive mesiodistal dimension, that is directly related to the shovel-shape morphology. Although males usually have larger teeth than females, the anomalous large, shovel and double shovel teeth are more common in females.[2,3] These anomalies are unesthetic and may interfere with occlusion, overjet, and overbite, as well as soft tissue contours (*Fig. 9*).[4-7]

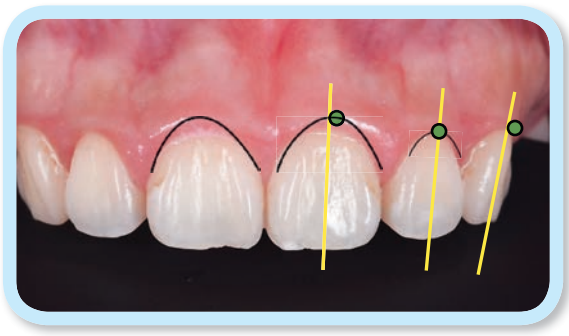

Fig. 17:
Esthetic soft tissue contours in the maxillary anterior segment are defined by a smooth margin (black lines) of the free gingiva, associated with a properly positioned zenith (green dot). The gingival zenith is slightly distal to the tooth long axis (yellow lines) for central incisors and canines, but it is on the long axis for lateral incisors.

Pitts[1] routinely corrects dental contours as needed before bonding a fixed appliance to optimize the fit of the bracket bases. This pretreatment preparation is designed to enhance esthetics, improve interproximal contacts, and optimize occlusion. The relationship of the bracket base to the tooth surface is particularly important for expressing proper torque.[1,3] Cusp and fossa adjustments are helpful for minimizing occlusal interferences.[5,6] Dental esthetics are improved by smoothing incisal edges and facial enamel. Optimizing the canine cusp position is important for protecting the smile arc, and facilitating the correction of Class II and III malocclusions with intermaxillary elastics.[1]

With respect to preadjusted brackets for a straight wire appliance (*SWA*), the design of the bracket base must be properly contoured to aid the orthodontist achieving optimal bracket placement. It follows that the most important factor in achieving an efficient, high quality outcome is bracket position. Brackets are designed to be placed according to the FA point, which is the middle of the clinical crown for all teeth

throughout the arch. Anomalies that interfere with the normal curvature of the labial surface should be adjusted prior to bonding. The objective of the enameloplasty is to restore normal anatomy, if at all possible.

Protostylids are highly variable anomalies that commonly affect the labial surface of lower molars. The defect may range from a pit or pearl in the buccal groove, to a furrow or a prominent cusp that substantially distorts the normal labial contour. Some form of the protosylid anomaly is present in up to 40% of susceptible populations.[2,3] The example shown in *Case 2* was a bulging cusp (*protostylid*) that displaced the buccal groove to the distal and obliterated the normal FA point (*Fig. 14*). The defect preempted normal bracket placement, so it was adjusted to permit reliable bonding of the bracket designed for the tooth. Although enameloplasty permits routine treatment of an anomalous molar, it is almost always necessary to correct the final alignment with detailing bends.

Conclusion

Fixed appliance systems are designed to fit the average (*most common*) dental morphology, but normal tooth form is commonly altered by genetic and environmental anomalies. If abnormal enamel contours impede precise bracket placement, tooth reshaping is necessary to achieve optimal occlusion and an esthetic smile line. Contemporary orthodontic diagnosis and treatment planning requires careful assessment of tooth shape and form, as part of the comprehensive evaluation. Enameloplasty is an important aspect of patient preparation for routinely achieving desirable outcomes.

Acknowledgement

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1. Excellent finishing & case report demo
2. Retention & relapse: case demo
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1. Orthodontic biomechanics & diagnostic analysis
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Practice: Clinical photography

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2. Upper impaction
3. Lower impaction
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Literature review: Bracket placement; Impacted canines

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1. Missing teeth: Anterior vs. Posterior
2. Crossbite: Anterior vs. Posterior
3. Case consultation & discussion

Literature review: Canine substitution; Missing 2nd premolar

Module 3 - **12/7**
1. Open bite- High angle & Deep bite - Low angle
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3. Case consultation & discussion

Literature review: DI & CRE review

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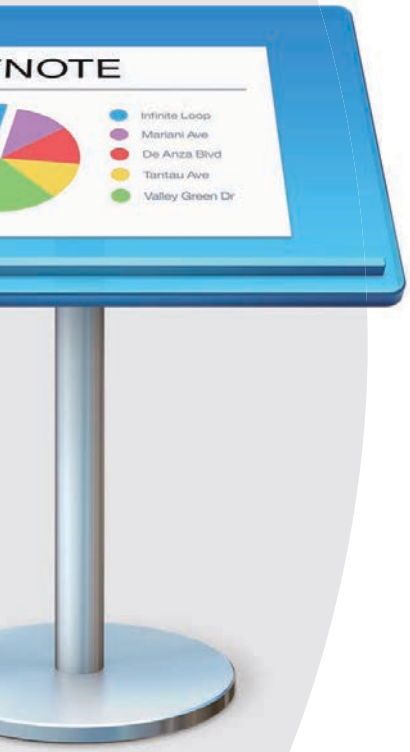

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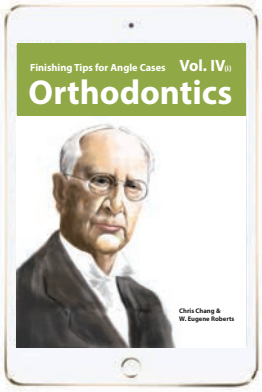

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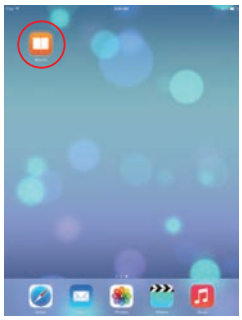

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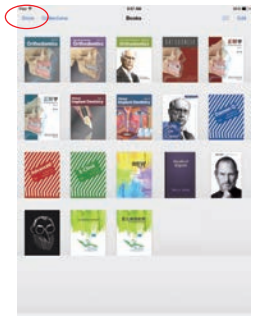

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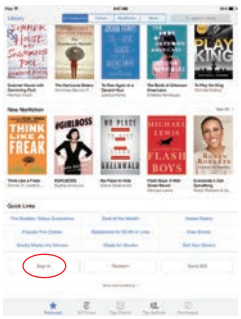

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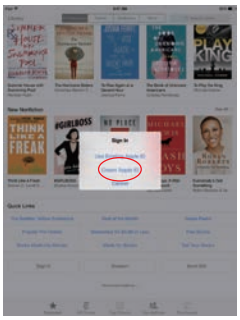

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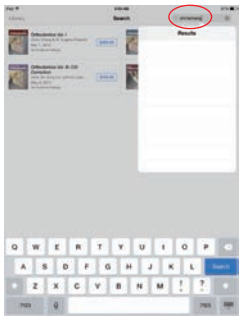

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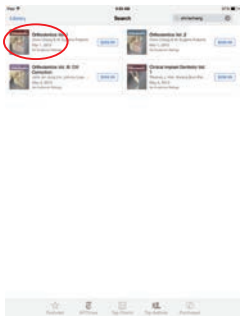

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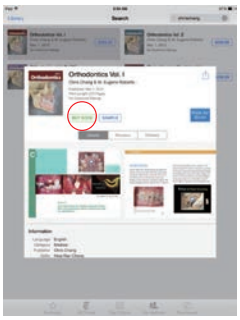

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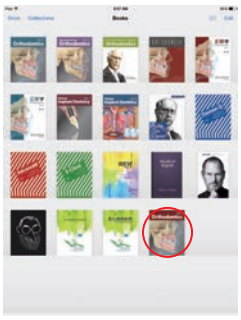

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Extraction vs. Non-Extraction Therapy: Statistics and Retrospective Study

Abstract

***Objective**: Since 1970 there has been a progressive trend in Western countries toward non-extraction management for comprehensive orthodontic problems because of advances in clinical technology. It is hypothesized that extractions are rare in an Asian group practice using advanced technology, including self-ligating brackets (SLB) and extra-alveolar temporary anchorage devices (E-A TADs).*

***Materials and Methods**: 200 consecutive patient files were drawn on October 31, 2015, from the Beethoven Orthodontic Center in Hsinchu City, Taiwan, to determine if teeth were extracted as part of a comprehensive treatment plan. Third molar extractions were not included if their removal was unrelated to the treatment of the malocclusion.*

***Results**: The chief complaint (CC) for 47% of the patients in the sample was lip protrusion. Other concerns were prognathic (Class III) occlusion (15%), a perceived need for interdisciplinary treatment (10%), impaction(s) (7%), and other problems (20%). In evaluating the labial profile for the patients with a CC of lip protrusion, 39% of upper and 55% of lower lips protruded beyond the Ricketts E-line. Sixty-five percent of the lip protrusion patients accepted a treatment plan involving extractions. Eighty-five percent of the extractions were performed to reduce protrusion, and maintain lip balance to the E-line. Forty percent of the patients had crowding >7mm. Twenty percent of the extractions were for compromised dental health such as caries, failed root canal treatment, fracture, and prostheses.*

***Conclusions:** The hypothesis is rejected that advanced clinical technology has markedly decreased the extraction rate for Asians. Patients affected by lip protrusion and/or severe crowding readily accept a treatment plan to reduce the number of permanent teeth. A desirable soft tissue profile with optimal lip esthetics is a significant factor in the decision for extractions. Additionally, extractions and space closure treatment were perceived as the most efficient approach for correcting asymmetry, as well as for avoiding prostheses and/or implants. Despite the pros and cons for extraction treatment, patient expectations and treatment preference remain the most crucial factor for implementing an extraction treatment plan. (Int J Orthod Implantol 2016;44:76-86)*

Key words:
Extraction vs non-extraction treatment, patient treatment preference, E-line, retrospective analysis, Asian facial preference, lip protrusion, severe crowding, patient expectations

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Introduction

Extractions for orthodontic purposes has always been controversial. Angle believed that "*a correct treatment*" could achieve ideal occlusion and esthetics without extractions, Case, Tweed, and Begg argued that extractions were essential for a stable resolution of protrusion and/or severe crowding.[1,2] After the death of Angle (*1930*) extractions were increasingly more prevalent until the middle 1960s.[3,4] For the last four decades, there has been a progressive trend toward non-extraction therapy once brackets could be reliably bonded directly on teeth. A landmark malpractice decision in 1987 suggested temporomandibular disorder (*TMD*) was associated with first premolar extraction and the use of headgear to retract maxillary incisors.[1,2] The lawsuit claimed that the extractions along with the use of headgear were the proximate cause for temporomandibular disorder (*TMD*). Despite little or no scientific support for extractions as an etiology for TMD, this litigation led to more conservative, non-extraction treatment to avoid malpractice liability.[1,3]

Overall, the prevalence of orthodontic extractions in the United States peaked around 80% in the mid 1960s and fell to 15-20% in the 1990s.[1-4] For the past two decades, there has been a continuing decrease in extraction treatment associated with the introduction of modern appliances, increased tolerance for arch expansion, TAD anchorage, and the use of aligners.[1-6]

Considering the non-extraction trend in Western practices, it was of interest to investigate the current extraction experience in a progressive Asian practice that uses a number of technologies that appear to be limiting extractions in the West.[1-6]

Materials and Methods

200 consecutive patient files, retrospective to October 31, 2015, were drawn from the records of the Beethoven Orthodontic Center. The sample was composed of 132 females and 68 males, ranging in age from 8-52 years old. The largest group (*47%*) was 18-30 years of age, followed by 40% ranging

from 10-17 years, 13% were over age 30 years, and <1% were less than 10 years old. Lip protrusion was assessed with Ricketts E-line method.[7]

Results

Extractions were advised for 68% of the entire sample, and all patients concurred except for 3% who preferred a non-extraction approach. Thus, the extraction prevalence was 65% for all patients in the four age groups (*Fig. 1*), and the non-extraction group (*35%*) was subdivided into 89% for which non-extraction treatment was recommended, and 11% who insisted on no extractions despite the professional recommendation to the contrary (*Fig. 2*). Most individuals were concerned about some form of facial protrusion (*22+25=47%*); however, the less prevalent patient/parent concerns were prognathic (*Class III*) malocclusion (*15%*), perceived need for interdisciplinary treatment (*IDT*) (*10%*), impaction(*s*) (*7%*), and other problems (*20%*) (*Fig. 3*). Ten percent of the extractions were to take advantage of 3rd molar substitution for compromised or missing 1st and 2nd molars (*Fig. 10*).

The most frequent chief complaint (*CC*) was facial protrusion (*47%*), which was the sum of lip (*22%*) and bimaxillary protrusion (*25%*) (*Fig. 4*). Thirty-eight percent of upper lips in the sample were protrusive to the E-line (*Fig. 5*), and the corresponding figure for lower lip protrusion was 55% (*Fig. 6*). Eighty-five percent of the extractions were to improve or maintain lip protrusion to the E-Line (*Fig. 7*). Forty percent of patients approved extractions to relieve crowding of >7mm (*Fig. 8*). Twenty percent of the extractions were related to advanced caries, compromised root canal treatment (*RCT*), tooth

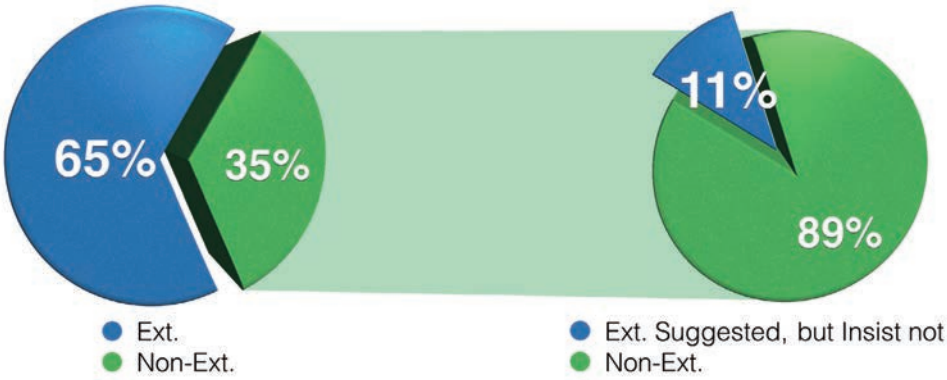

Fig. 1:
The extraction percentage for the Beethoven Orthodontic Center was 65%. Although 68% of the patients were advised to have extractions, all but 3% accepted the recommendation.

Fig. 2:
The nonextraction fraction was 35%, and 89% of that group had accepted the non-extraction advise of the clinician. However, 11% of the non-extraction patients had previously declined the recommendation for extractions, so they were being treated non-extraction based on their personal preference.

fracture, and prosthetic problems (*Fig. 9*). Ten percent of patients preferred extraction of compromised teeth to take advantage of 3rd molar substitution to restore missing units in the arch (*Fig. 10*). Eighty percent of the extractions were 1st premolars (*Fig. 11*).

Discussion

The hypothesis is rejected because a majority of patients in the current Asian sample pursued comprehensive orthodontic treatment that included extractions. Despite technical advances providing additional non-extraction options, 65% of patients seeking treatment for protrusion problems (*47% of all patients*) preferred extraction therapy. About 3% of patients were adamantly opposed to extractions for orthodontics, but most patients for whom extractions were recommended readily accepted the option. It was clear to all concerned that extractions were the most expedient approach for controlling lip protrusion, particularly when severe crowding must be corrected in the lower arch. The most frequently extracted teeth (*80%*) were 1st premolars (*Fig. 11*), which was widely perceived to be a rational mechanical and esthetic approach to the problem.

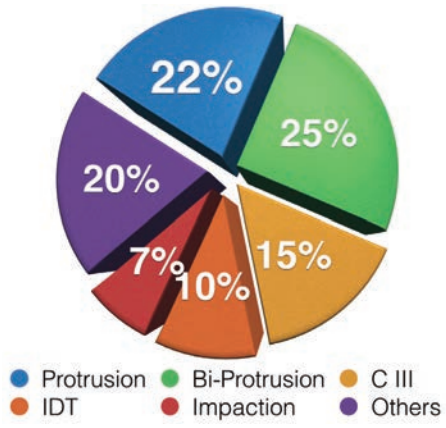

Fig. 3:
The chief complaint for the orthodontics consultation was 22% lip protrusion (Protrusion); 25% bimaxillary-protrusion (Bi-Protrusion); 15% Class III; 10% interdisciplinary treatment; 7% impactions; 20% other problems.

The decision to extract for a particular patient was based on a collective evaluation of the profile, mandibular plane angle, axial inclination of the incisors, crowding, and decayed or missing teeth (*Table 1*). Patient compliance with the recommendation for extractions appeared to be largely based on their personal opinion about the procedure. The present data are consistent with patients having a preconceived acceptance or rejection of extractions. There was no indication that a patient's decision to reject extractions was based on perceived outcomes. They were either compliant (*OK*) with extractions or they were not (*Table 1*).[3,7,8]

Asian patients are concerned about facial esthetics (*Fig. 12*), particularly lip protrusion relative to the facial profile (*Figs. 4-6*). The applicable beauty standard favors a straight profile with a prominent nose and retruded lips.[9-11] There is also an emphasis on the chin and lower lip areas, as was pointed out by Soh et al.[9] in a study of facial profile preferences by oral surgeons, orthodontists, and the lay public. Overall, East Asians prefer a straight profile (*Fig. 12*) for both males and females that is considered normal or minimally retrusive by Western standards.[9,10]

Fig. 4:
Protrusion of the lower face was the chief complaint for 47% of the patients (22 plus 25% according to Figure 4). These patients wanted to establish or maintain a straight lower facial profile.

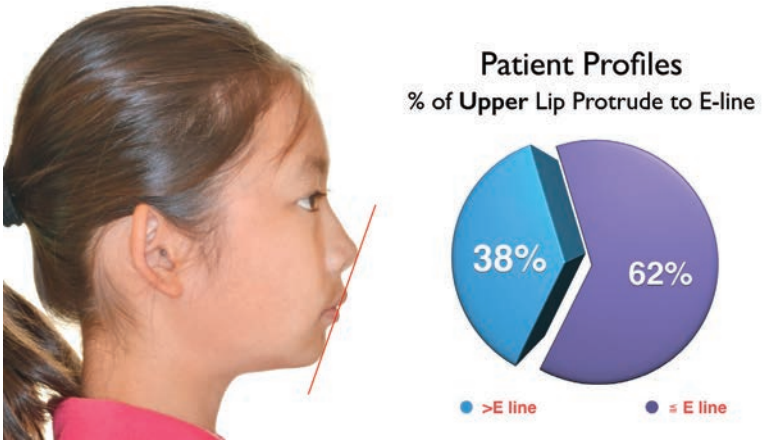

Fig. 5: Upper lip protrusion to the E-line was the principal problem for 38% of the patients, with a perceived profile problem.

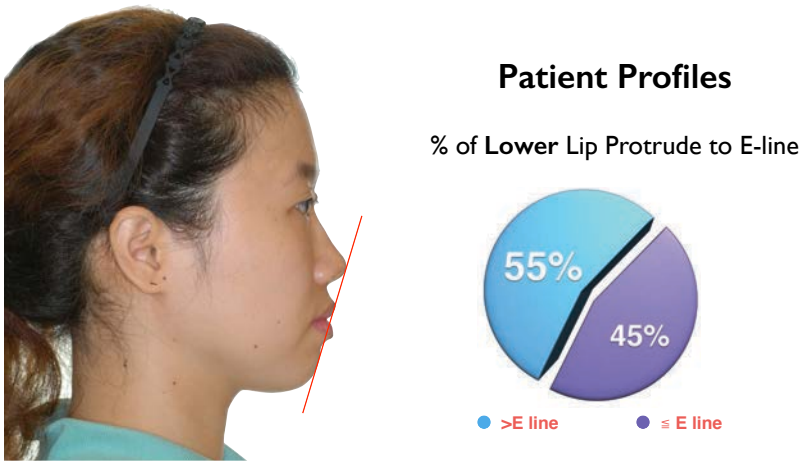

Fig. 6: Lower lip protrusion to the E-line was the principal problem for 55% of the patients, with a perceived profile problem.

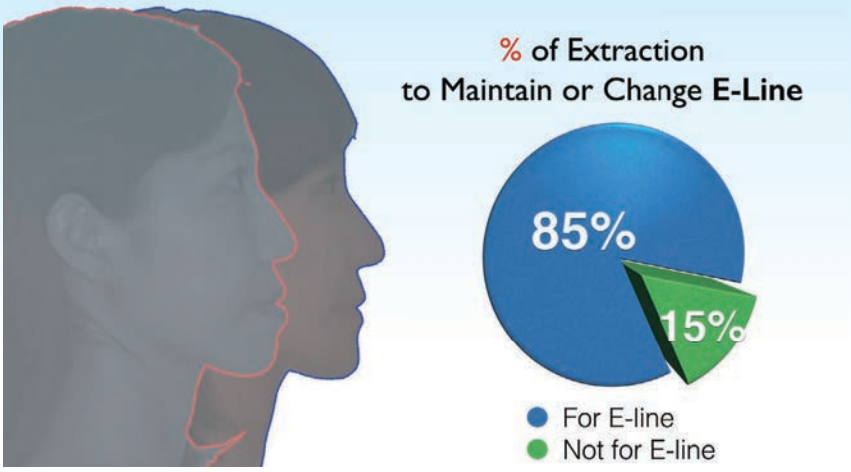

Fig. 7:
To maintain or correct the lip profile to the E-line was the goal for 85% of the extraction patients. The remaining 15% had extractions that were not related to the lip profile.

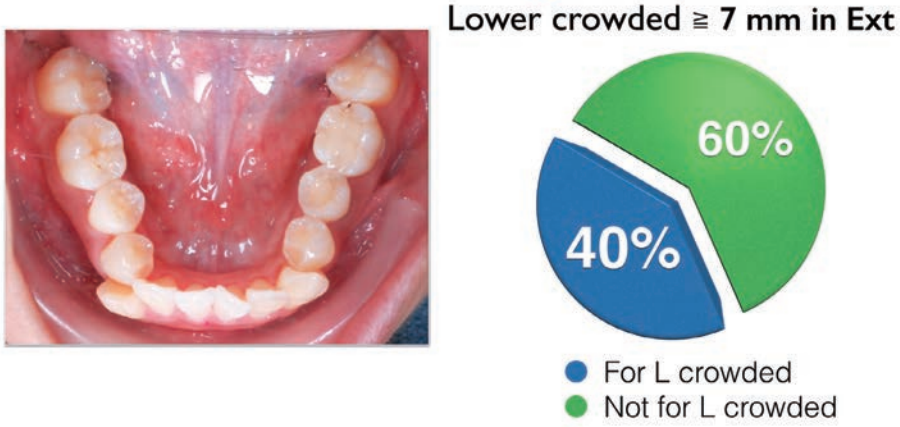

Fig. 8: Forty percent of the extraction patients had lower arch crowding of 7mm or more.

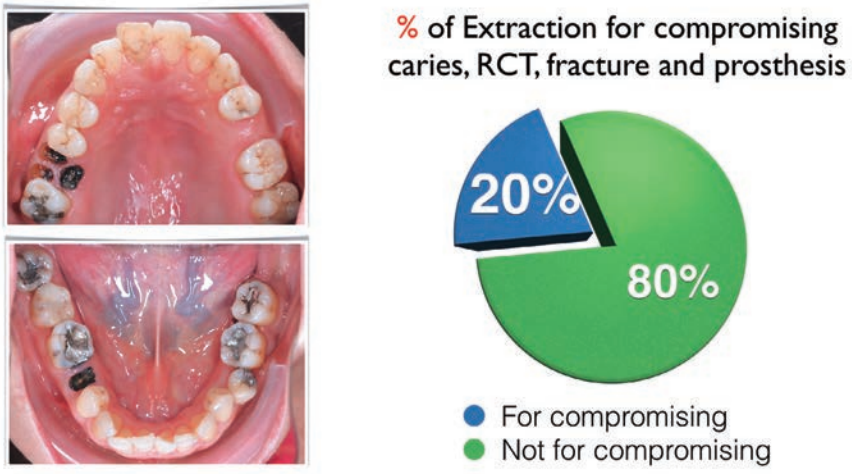

Fig. 9: Twenty percent of the extraction patients had teeth removed because of other compromising dental problems.

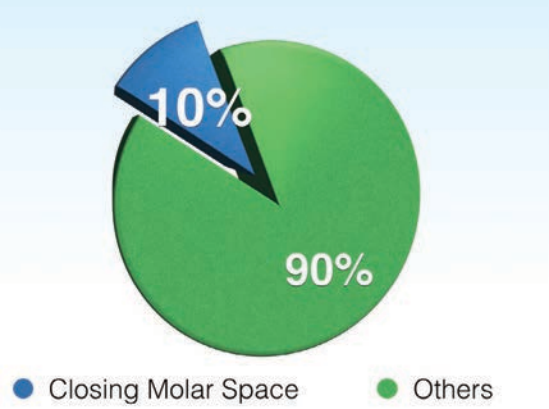

Fig. 10 :
Ten percent of the extractions required closing molar spaces and 3rd molar substitution.

	Ext.	Not
1. Profile	Protrusive	Straight
2. Md. angle	High	Low
3. Bite	Open	Deep
4. Ant. inclination	Flaring	Flat
5. Crowding	> 7mm	None
6. Decay/missing	Present	????
7. P't perception	OK	No

Table 1:
The seven clinical factors involved in an extraction treatment plan are listed in the left column. An assessment favoring extractions is listed in the middle column, and factors favoring a non-extraction approach are listed in the right column.

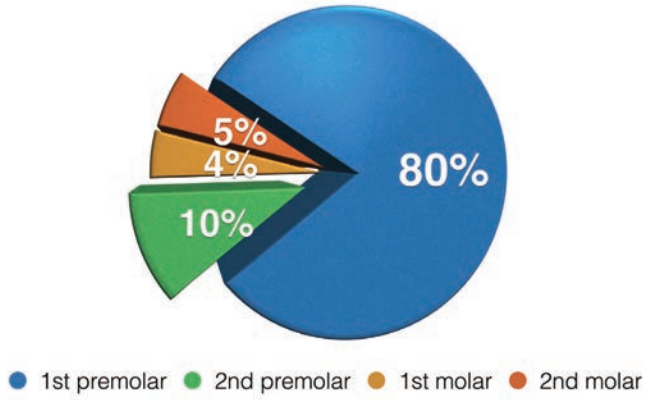

Fig. 11:
Eighty percent of the extractions were 1st premolars, followed by 2nd premolars (10%), 1st molars (4%), and 2nd molars (5%).

Lateral profile assessment is subjective for an analyst, so an objective index is preferable. Rickett's E-line[7] for the current study provided an objective measure of lip protrusion, relative to prominence of the chin and nose, that was readily appreciated by the patients. For most of the patients concerned about lip prominence (*47% of the entire sample*), the E-line was a convincing tool for demonstrating the need for extractions if that was the clinician's judgement. Furthermore, Xu et al.[9] found that Chinese clinicians favored borderline patient profiles who had teeth extractions versus those who did not. Other studies[11,12] demonstrated the importance of ethnicity and sex in the perception of profile esthetics. Overall, both clinicians and patients agree that extractions can have a beneficial impact on the soft tissue profile that is favored in East Asia.

Another reason for the high extraction rate was related to dental health. Many patients presenting at the Beethoven Orthodontic Center were referred by other orthodontists, so there was a high probability of a complex malocclusion that required interdisciplinary treatment (*IDT*). Extractions followed by orthodontic space closure was often indicated for compromised and asymmetric dentitions to minimize the prosthetic and implant requirements. When edentulous areas are asymmetric in the arches, there may be complex anchorage requirements that require extra-alveolar (*E-A*) temporary anchorage devices (*TADs*).

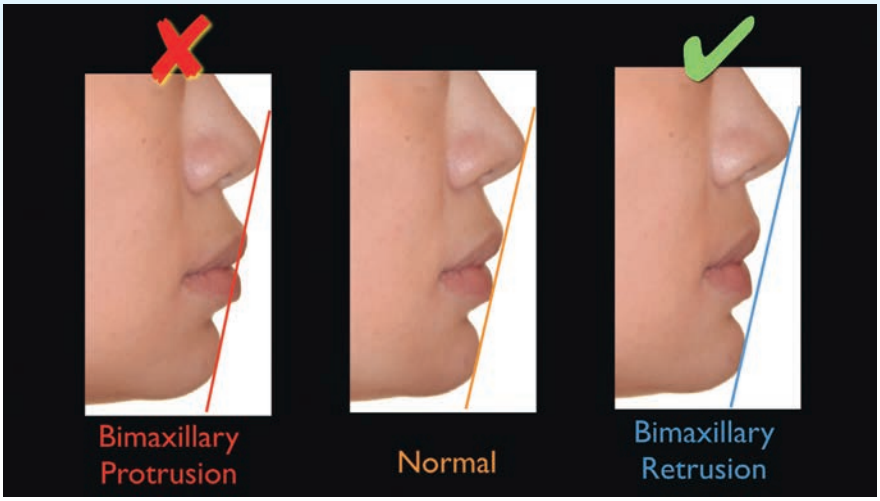

Fig. 12: Bimaxillary retrusion is an attractive facial form for most East Asians, according to Soh J et al. 2005.

A small fraction of patients (~3%) insisted on non-extraction treatment, despite a recommendation for extractions (*Figs. 1 and 2*). It was possible to achieve the desired result with modern appliances, but the course of treatment was likely to be complex and lengthy (*Figs. 13-16*). Leveling and alignment of severe crowding may produce bimaxillary protrusion and anterior openbite (*Fig. 14*). E-A TADs were required to retract both arches to correct the incisal relationship to basal bone, and lip protrusion to the E-line (*Fig. 15*). Although a stable result was documented with follow-up evaluations three and four years after treatment (*Fig. 16*), extractions would have been a more expedient choice to meet the patient's esthetic requirements. However, the lengthy complex treatment met the patient's preconceived need for non-extraction treatment and should be presented as an option (*Figs. 13-16*).

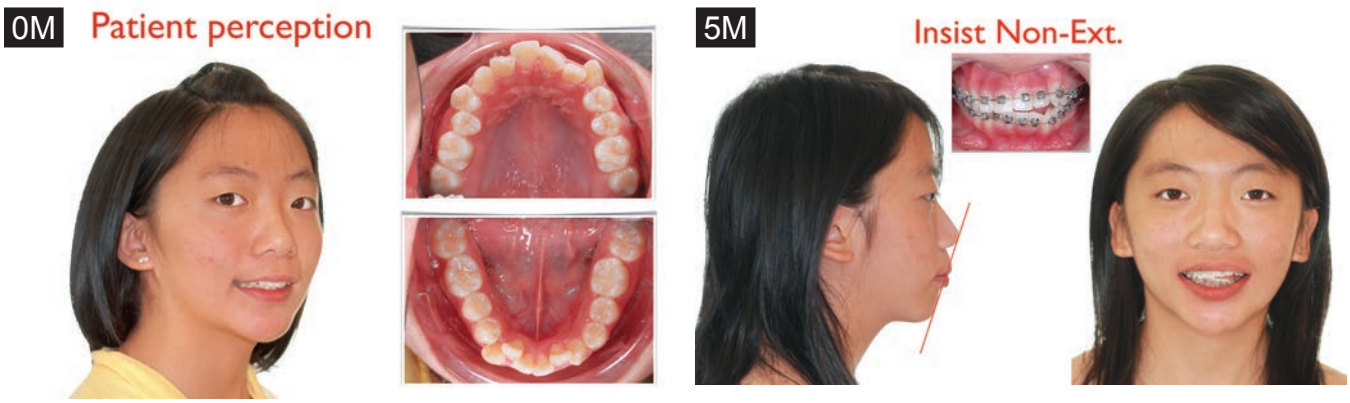

Fig. 13:
Despite a professional recommendation for extractions, the patient insisted on non-extraction treatment. After 5 months of leveling and alignment, both upper and lower lips were protrusive and an asymmetric anterior open bite was noted.

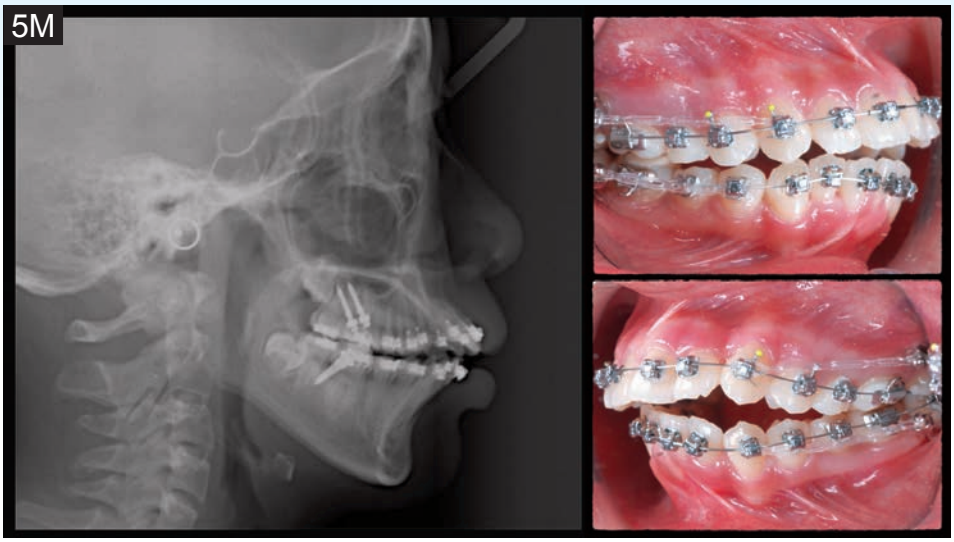

Fig. 14:
Five months into treatment, EA-TADs were placed in the infrazygomatic crests and mandibular buccal shelves bilaterally. A lateral cephalometric radiograph (left) shows the positions of the TADs, and bilateral intraoral photographs of the buccal segments show the TAD-anchored mechanics for retracting both arches.

Fig. 15:
With TAD anchorage placed in all four posterior quadrants five months (5M) into treatment, both arches were bodily retracted by 15 months (15M) into treatment, and the open bite was closed. Active treatment was completed in 20 months (20M), and both lips were aligned along the E-line (red and blue lines).

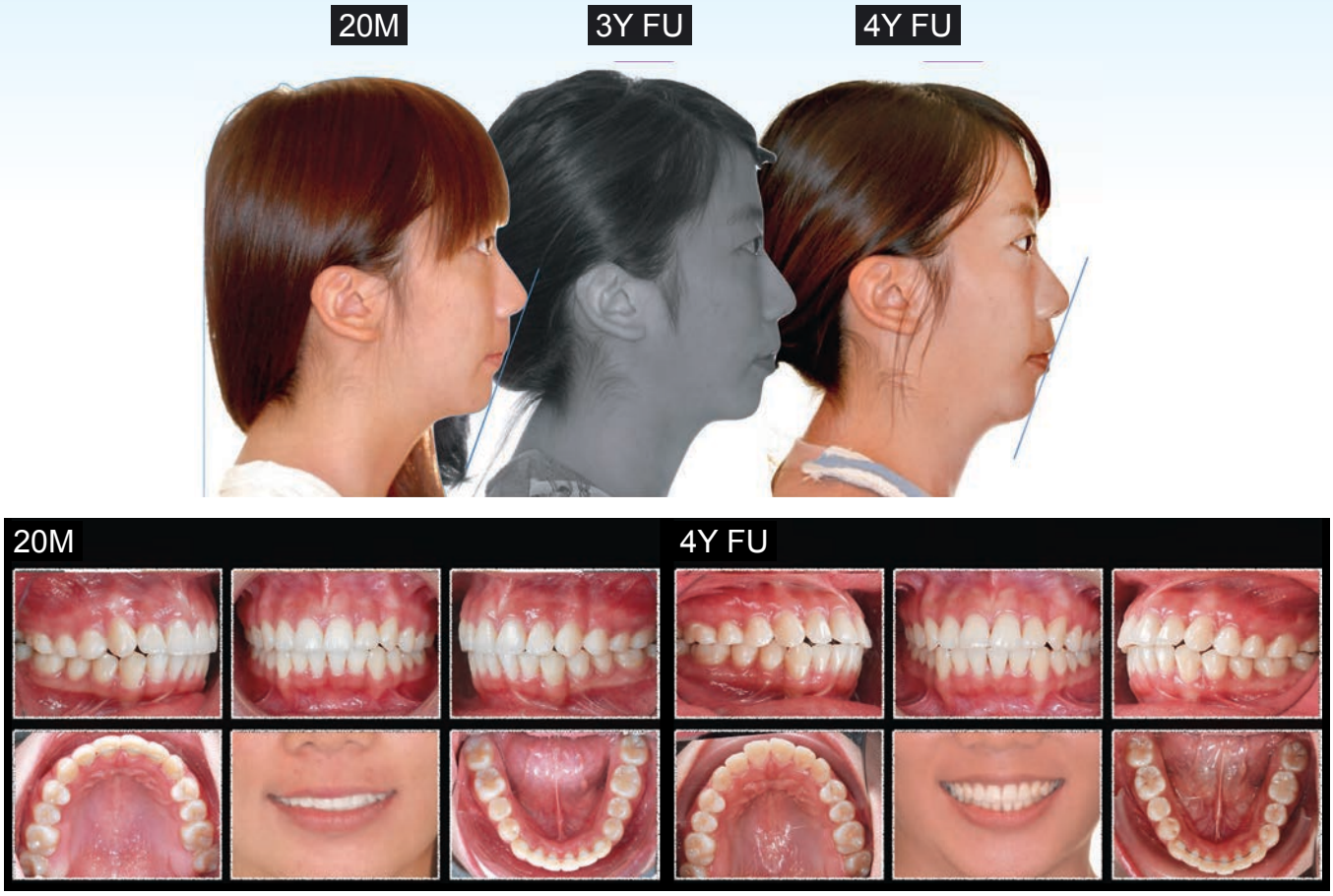

Fig. 16:
Comparison of the finish at 20 months (20M) to three (3YFU) and four year (4YFU) follow-up reveals a stable dental and facial result to the E-line (blue lines).

Conclusion

Patients prefer to control lip prominence and eliminate crowding with the most efficient approach, which was deemed to be extractions for 65% of the present sample. Extractions were also the treatment of choice for compromised teeth, resolution of asymmetry, and minimizing implants and prosthetics. Utilizing modern technology, most complex malocclusions can be managed without extractions, but the treatment may be complex and lengthy. Patient preference is the major factor for utilizing extractions. In general, patients prefer the most expedient and cost-effective approach, so extractions continue to be a popular option. However, informed consent for the extractions should be based on a thorough discussion of all the treatment options.

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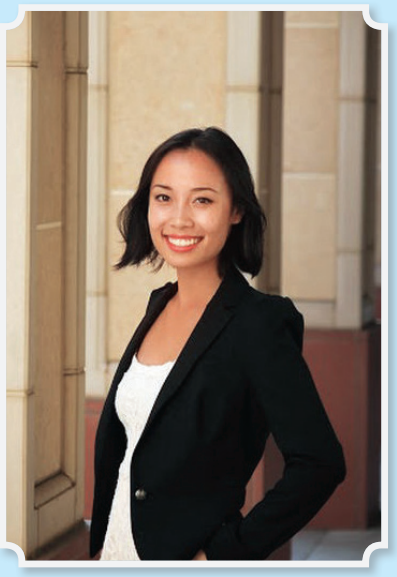
Feedback from the world

Hi Dr. Chang and Shufen at Beethoven,

I hope you are both doing well! This is Kristen Zung (戎詩丹) from volunteering at the Beethoven clinic in 2012. It has been a long time since we have been in contact and I wanted to reach out again to give you a quick update and sincerely thank both of you for opening your practice to me.

I am in my 3rd year of college now at USC and am applying to dental school this cycle. As I wrote my personal statement for the application, I reflected on my experiences at the Beethoven office and how they kept my interest in dentistry alive today. I have since joined a laboratory at USC that examines periodontitis-causing bacteria and a club full of pre-dental students who host dental hygiene classes with young students in the surrounding neighborhoods.

Throughout my journey I have met many types of patients of all ages and socioeconomic backgrounds. Regardless of their differences, there is a universal rule I learned at the Beethoven clinic and have since grown great appreciation for: The best healthcare personalizes a treatment plan to accommodate a patient's varying needs on a holistic level. Specifically, taking into account a patient's schedule, financial situation, aesthetic desires, and medical situation. At Beethoven I really felt that each patient was taken great care of; they were always comfortable and the staff did a fantastic job of explaining the "why"s and "how"s of a treatment plan. The service is incredibly optimized and of course, unparalleled! I will no doubt carry that lesson with me into the future. I am so excited to apply to dental school, and hope that we meet again soon in the future.



Sincerely,

戎詩丹 Kristen Zung

University of Southern California '17

I'm very happy to have met Si-Fu, the master to so many respected dental surgeons in Malaysia and around the world. Dr. Chris Chang from Taiwan is someone who is not afraid to share his knowledge with others. His hands-on series of courses are an informative and fun experience for me.

Dr. Kamsiah Haider,
Klinik Pakar Pergigian Dr. Kam

It was a great course delivered by an excellent teacher and we had wonderful learning companions amongst the friendly Malaysian dentists. Thank you for the dinner treat, Dr. & Mrs. Chang and your heartfelt story of how you came to become an orthodontist, Dr. Chris!

Louisa Lee, *DP Dental*

這次參與馬國班助教過程中，最讓我感到驚訝的就是馬國醫師們的學習精神，加上陳依虹醫師和梁醫師班長的積極和學習熱情，而這些都是我應該好好學習的。

第一天：Keynote lecture + workshop

Keynote 課中有些從來沒有碰過 Mac 電腦的醫師們，迫切地想學會張醫師教的 Keynote 技巧。因為完全是從零開始，連觸控板都不會使用，所以只要一進入實作時間，馬上舉起手叫我 “Dr. Lin, please....., I'm sorry, can you.....”。在台灣，若要一位前輩醫師很客氣地、甚至一直 “Sorry, sorry” 地問我問題，真的需要很大的熱誠和很強的求知慾吧！

當天下課後也被許多醫師們要求留下來，要我把所有上課中沒跟上、沒聽懂的部分補足。重新講過還不夠，有的醫師甚至要求我看著她操作一次，以確定她真的懂了；所以，下課後的45分鐘，被5~6個醫師包圍，不希望錯過任何學習的機會，只為了學好 Keynote。直到第一天的晚宴同桌交換名片時才知道，這位認真的醫師是某間大醫院的 Prosthodontist 的主治醫師……，我真是失敬啊！

第二天：Mini-residency program

這天的的學員更多更「可怕」，更多的年輕醫師，也有許多較年長的醫師們，當然昨天的主治醫師等級的也在場，讓我再次覺得馬國醫師真的求知若渴；張醫師每段課程本來就不會冷場，再加上醫師們不斷地發問，打破砂鍋問到底的精神，使得課程更加豐富了！

下課時也一直圍著我們的攤位，問這個、問那個，問明年的課程還能不能報（該課程開放報名後，30分鐘內全部名額秒殺，候補名單中有50-60多人後補）；畫 Ceph 時，更是認真地要我和黃育新醫師幫他們確認每 個點的位置是否正確，有沒有什麼建議，不僅如此，還常被要求第二、三次的「再次」確認，真的很需要一直小跑步才趕得上醫師們提問的速度啊！

當天課程結束後，又被圍起來詢問所有上課中來不及發問的問題，例如：Bite Turbo 用在哪裡啊？怎麼用？什麼時候拿掉？ Elastics 用什麼動物？什麼力量？長度？怎麼用？ Stop 放在哪顆牙好呢？為什麼啊？……，然後50分鐘又過去了！

最後留了 E-mail 聯絡方式後，蓋上電腦，準備落跑前，卻因馬國的一位醫師的一句話，讓我又再留了一會兒，希望能為他們多回答一些問題……

那位醫師說：
「你能跟在張醫師身邊學習，真幸福！」

老婆兩天都有來聽一會兒張醫師的演講，也說了一樣的話：「你能跟在張醫師身邊學習，真幸福！」是啊！好幸福！心中默默地說：謝謝高老師，謝謝張醫師！

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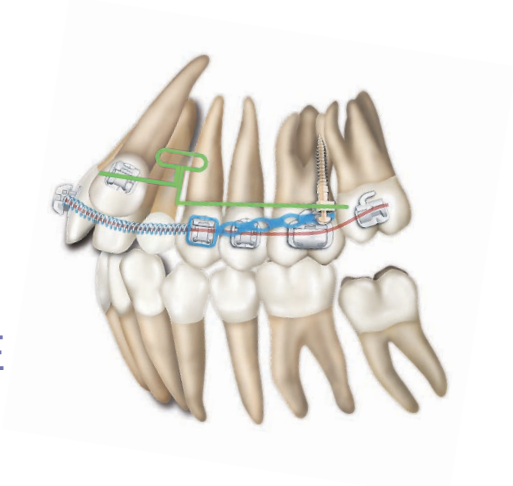

讲师： Dr. Rungsi Thavarungkul

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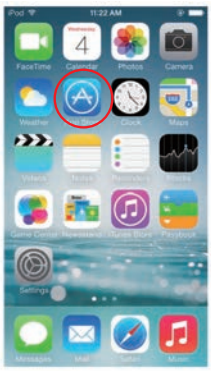
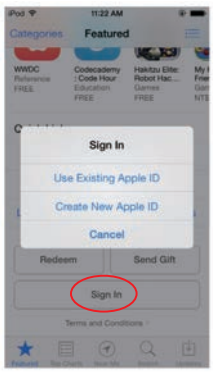
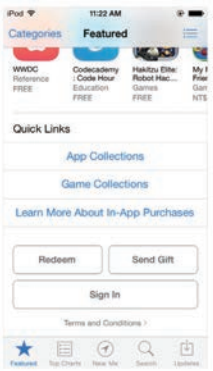


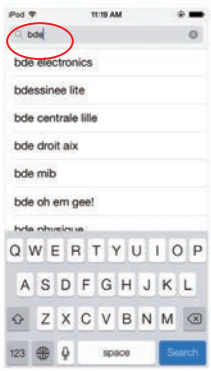
1. Go to App Store on your device.



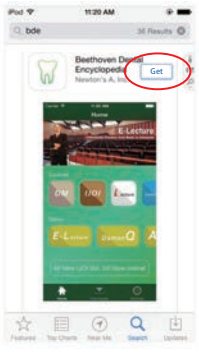
2. "Sign in" with your Apple ID.



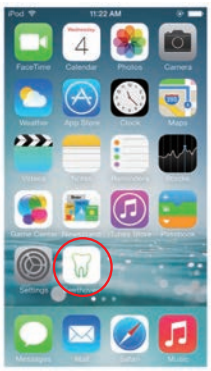
3. "Create Apple ID" if you don't have one.



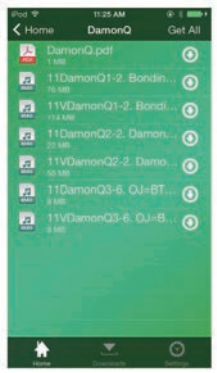
4. Search for "BDE."



5. Click "FREE" and "INSTALL APP."



6. Download completed!



7. Once downloaded, click "BDE" to launch the app.

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日期

練習賽：2016年12月29日
預　賽：2016年12月30、31日
決　賽：2017年元旦

地點

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（新竹縣湖口鄉再興路350號）

資格

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12/11日前向新竹市體育會高爾夫委員會報名。
電話：03-5385155；傳真：03-5380951
E-mail：chunhong@mail.ypu.edu.tw

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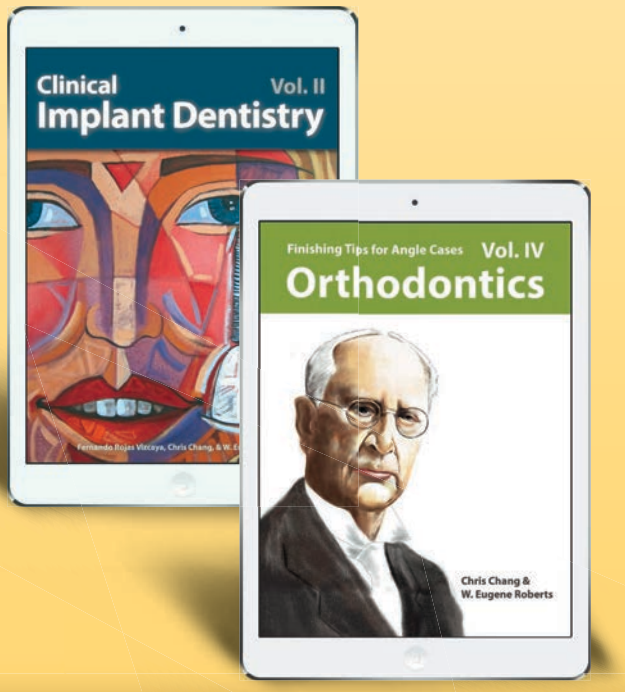

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The 2016 iAOI annual symposium and ALIAS hands-on workshop on July 31-August 2, 2016. Participants took photos with the keynote speaker, Dr. Giuseppe Scuzzo (center left) and Dr. Chris Chang (center right) with their certificate at Beethoven Orthodontic Center, Hsinchu, Taiwan.

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