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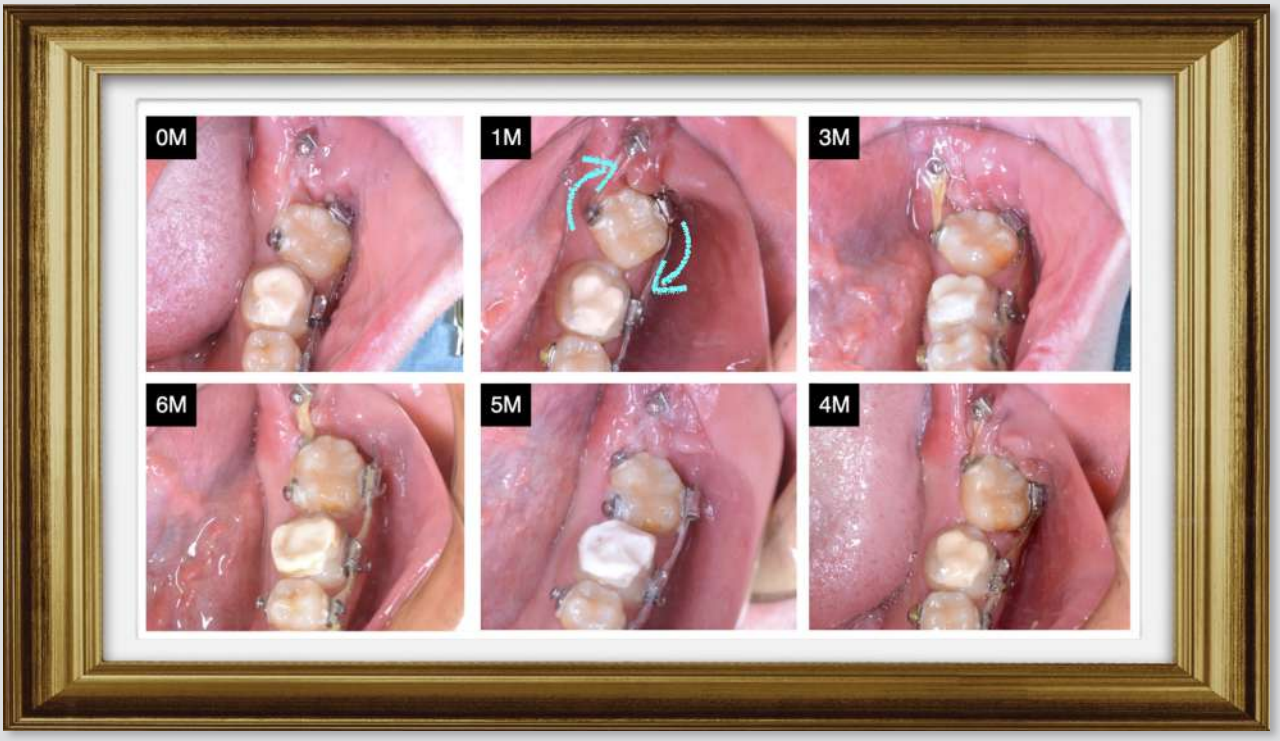

As pretreatment prior to aligner therapy, a segmental fixed appliance was bonded from LL4 to LL7, and a 2x14-mm OrthoBoneScrew® (OBS) was placed in the left ramus. With force activated by powerchains applied on the segmental appliance, as well as from LL7 to the OBS, a clockwise moment was created, correcting the severely rotated LL7.

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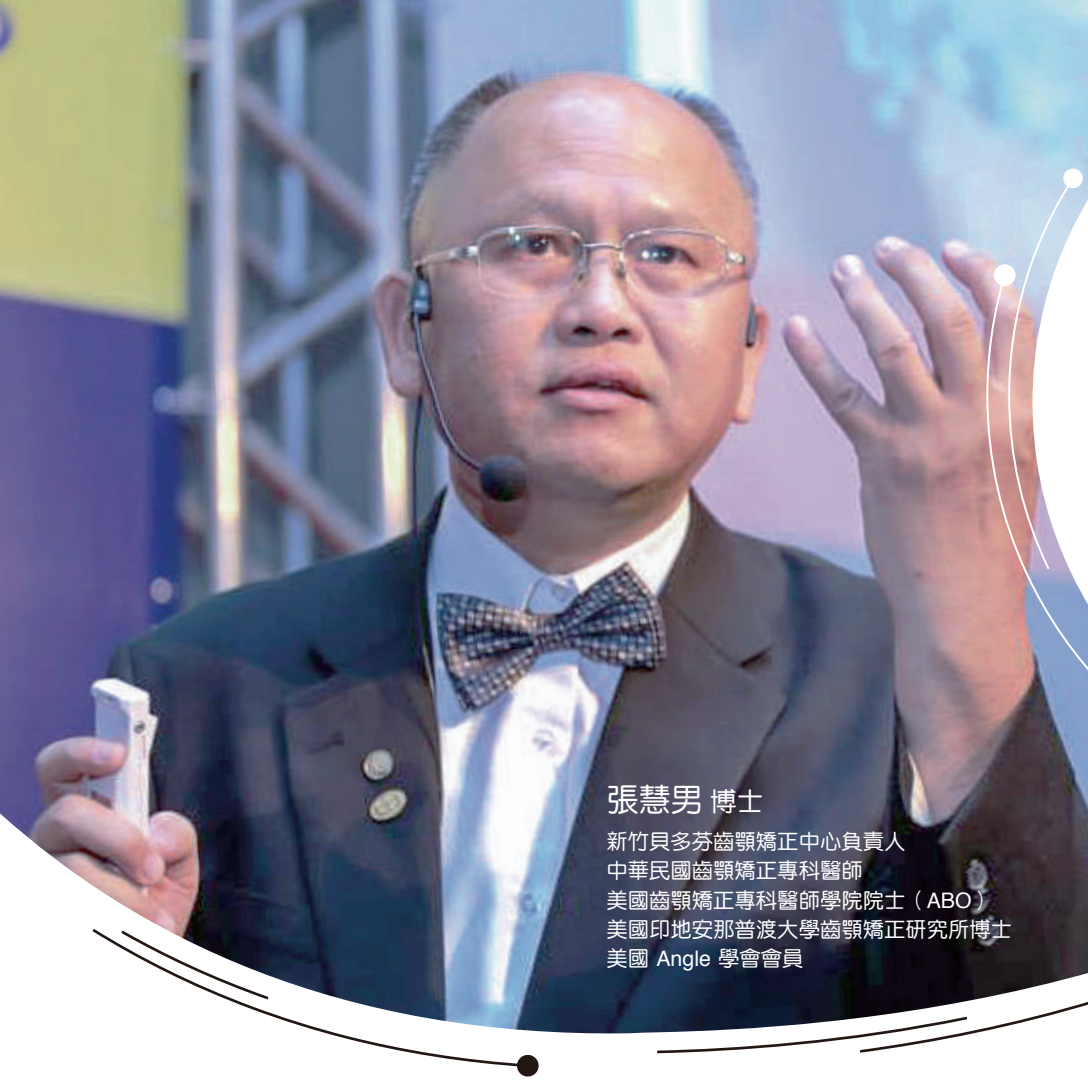


2021-22
熱愛學矯正

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

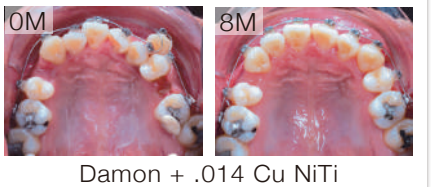
新竹貝多芬齒顎矯正中心負責人
中華民國齒顎矯正專科醫師
美國齒顎矯正專科醫師學院院士（ABO）
美國印地安那普渡大學齒顎矯正研究所博士
美國 Angle 學會會員

Damon Master

(Thu) 9:00-5:00 中文授課

The 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 andresult 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.

2021	A班	B班		A班	B班
Module 1 -	4/22	7/29	Module 7 -	9/9	12/9
Module 2 -	5/13	8/12	Module 8 -	9/16	12/30
Module 3 -	5/27	9/30	Module 9 -	10/21	1/20/22'
Module 4 -	6/17	10/14	Module 10 -	11/11	2/24
Module 5 -	7/8	11/4	Module 11 -	12/23	3/10
Module 6 -	8/5	11/25			



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 XIII

Module 1 -	6/8	Module 7 -	12/14
Module 2 -	7/13	Module 8 -	1/11/22'
Module 3 -	8/24	Module 9 -	2/15
Module 4 -	9/14	Module 10 -	3/15
Module 5 -	10/19	Module 11 -	4/12
Module 6 -	11/9		

Damon Clear

International Workshop

(Digital Orthodontics, OBS & VISTA)

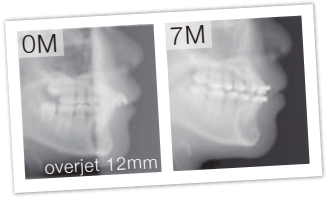
English Class

The workshop provides a 3 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 Annie

2021

~~Class 1 - May 18-21~~
Class 2 - Dec 07-10



Damon + Bite Turbo +
Early Light Short Elastic

每次上課請依最新一期 JDO 公告為主

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Writing – the key to orthodontic thinking

Most people agree that orthodontics is a thinking game. As Warren Buffet said, "*There is nothing better to get your thoughts straight than writing.*" Therefore following his logic, the best way to train doctors of the young generations is by writing. In my opinion, if there were to be any shortcut to training doctors, that shortcut would be case report writing.

I started to learn and appreciate this idea 12 years ago at the 2009 AAO meeting. My Orthodontic Grandfather, Dr. Charlie Burstone, had listened to my lecture on impaction, and I could tell he liked the new approach which I had addressed in that meeting. From then on, our relationship became closer until one day I asked him a question, to which he gave a short but not sweet answer – **This issue has been documented.**

I learnt two things that day. The first was to read and understand published articles, and with that I realized the importance of documenting things. The second was about keeping a distance to retain respect from students. I think Charlie probably learnt this from Dr. Angle, who was well-known for keeping a distance from his students and for his poker face! This, due to my personality, I find very difficult to do, which means that I will never reach the prolific status achieved by Dr. Angle and Dr. Burstone!

In Beethoven, we always emphasize the importance of documentation, and we encourage our new doctors to study, report on, present, and write case reports. It has proven to be very successful. I am very proud that two rookies, Drs. Lily and Vicky, have successfully published their first case reports in this issue, under the guidance of their personal coach, Dr. Bear Chen, who not so long ago was himself a rookie but has now finished his tenth publication and became an iAOI Ambassador. Congratulations to the three of them. Also contributing to this issue is Dr. Joy Cheng's report on a two-phase clear aligner therapy. I hope this article will impact you as much as we impacted Charlie Burstone 12 years ago.

Our Taiwanese lifestyle series continues with a special report on birdwatching and how a small investment can yield a marvelous return of enormous pleasure, without having to travel anywhere and waste time in the hope of spotting any of our feathered friends.

I hope this ornithological distraction won't cause any deviations as we continue along our path to glory.

Stay well and keep safe.

Chris Chang PhD, ABO Certified, Publisher of JDO

A Two-Phase Clear Aligner Therapy for Bimaxillary Protrusion with Severe Rotation of Lower Left Second Molar

Abstract

History: *A 24yr-1mo-old male presented with a chief complaint (CC) of crooked teeth.*

Diagnosis: *The patient was diagnosed with bimaxillary protrusion combined with severe mesial-out rotation of LL7, and lingual crossbite of UL7. The Discrepancy Index (DI) was 9.*

Treatment: *Segmental fixed appliance combined with a ramus screw were installed to correct the severely rotated LL7 during the 6-month pre-aligner treatment. After the therapy, the rotation was successfully corrected. However, the side effect was extrusion of LL7, which resulted in poor occlusal contact that evolved into a posterior open bite during aligner treatment. Three stages of aligners (43, 18, and 15 sets respectively) were used to correct the bimaxillary protrusion, posterior open bite, and lingual crossbite of UL7.*

Results*: After 31 months of active treatment, this malocclusion, with a Discrepancy Index of 9 points, was treated to a Cast-Radiograph Evaluation (CRE) score of 6 points and a Pink and White esthetic score of 2 points. The patient was pleased with the treatment outcome.*

Conclusions*: Hybrid mechanics combining the strengths of fixed appliances and clear aligner therapy are effective in correcting bimaxillary protrusion and severe rotation of molars. (J Digital Orthod 2021;64:4-22)*

Key words:

Clear aligner therapy (CAT), segmental braces, clear aligner, ramus screws, bimaxillary protrusion, non-extraction, temporary skeletal anchorage devices (TSADs)

Introduction

Bimaxillary protrusion is a condition characterized by protrusive and proclined upper and lower incisors in addition to an increased procumbency of the lips. This type of malocclusion can occur in almost every ethnic group, although it is more prevalent in African American[1-4] and Asian[5-7] populations.[8]

The treatment of bimaxillary protrusion can be satisfactorily corrected by orthodontic or surgical treatment, or a combination of both. Orthodontic treatment involves retraction of the anterior teeth by extraction of the first premolar and placement of infrazygomatic crest (*IZC*) screws if necessary.[9]

With regard to mild or moderate bimaxillary protrusion, the space required to retract incisors is less than the size of a premolar, and this can result in inefficient use of the extraction space. Clinically, the space distal to the second molars can be used to retract the entire dentition with the aid of skeletal anchorage. The infrazygomatic crest in the maxilla and the buccal shelf area in the mandible are recommended sites for placing temporary skeletal anchorage devices (*TSADs*).[10]

The Invisalign® system, introduced by Align Technology Inc. (*Santa Clara, Calif*) in 1999, involves moving teeth in increments with a series of removable clear polyurethane trays (*aligners*).[11] The

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Lecturer, Beethoven Orthodontic Center (Left)
Chris H. Chang,
Founder, Beethoven Orthodontic Center
Publisher, Journal of Digital Orthodontics (Center)
W. Eugene Roberts,
Editor-in-Chief, Journal of Digital Orthodontics (Right)

manufacturer claims that Invisalign can effectively perform the following orthodontic movements: alignment after interproximal reduction, dental expansion, flaring, and distalization.[12-14] Therefore, for mild protrusion, clear aligners can perform anterior retraction without miniscrews or extraction.

On the other hand, the weakness of tooth movement with clear aligners includes rotation and extrusion, especially in the posterior teeth; fixed appliances and auxiliary miniscrews are an effective adjunct for clear aligner therapy.

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

This case report documents treatment for a 24-year-old male with a Class I skeletal pattern, moderate bimaxillary protrusion, severe rotation of LL7, and lingual crossbite of UL7. This malocclusion was successfully corrected by combining fixed appliances, a ramus screw, and clear aligner therapy.

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

Diagnosis and Etiology

A 24-year-old male sought consultation for orthodontic treatment with a chief complaint of crooked teeth. The pre-treatment intraoral photographs, dental models, and radiographs are shown in Figs. 1-4. Clinical examinations showed a 3mm overjet and 2mm overbite. Bilateral canine and molar Class I relationships were also noted. Furthermore, there was minor crowding in anterior areas bimaxillarily.

Most importantly, a 60˚ mesial-out rotation of LL7 and lingual crossbite of UL7 were noted (*Fig. 5*). A panoramic radiograph revealed that there was a mesial-tilting, impacted LR8 (*Fig. 4*). Pre- and post-treatment lateral cephalometric measurements are presented in Table 1.

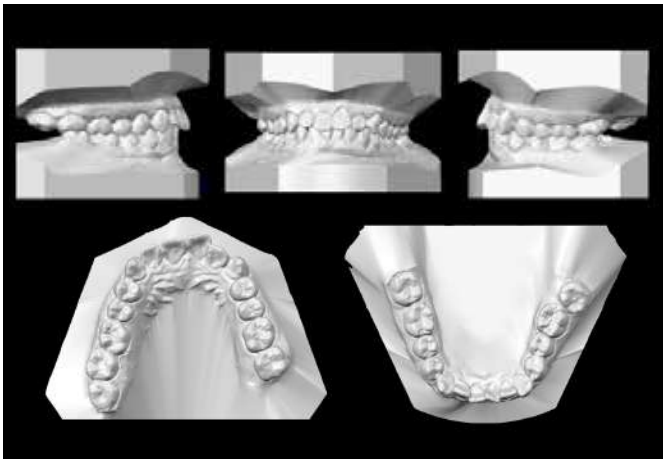


Fig. 2: *Pre-treatment study models (casts)*

Fig. 3: *Pre-treatment panoramic radiograph*

Fig.4: *Pre-treatment cephalometric radiograph*

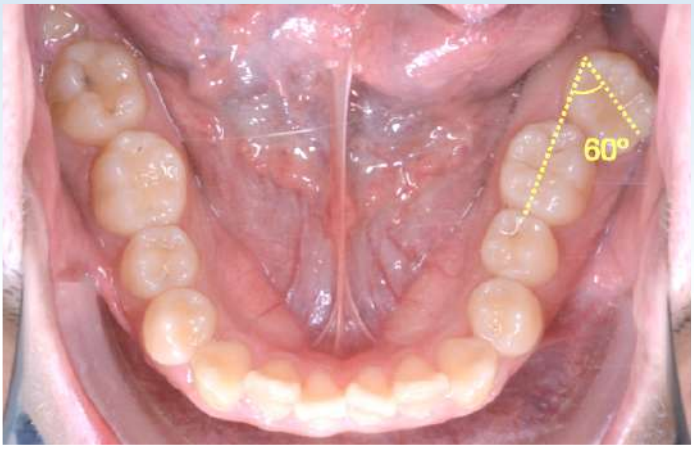


Fig. 5: *A 60˚ mesial-out rotation of LL7 and lingual cross bite of UL7 were shown in the occlusal and buccal views.*

The pre-treatment data indicated a facial pattern of the skeletal Class I jaw relationship (*SNA 90˚, SNB 86˚, ANB 4˚*), a low mandibular plane angle (*26˚*), and mildly protrusive upper and lower lips (*2mm and 3mm to the E-Line*). The bimaxillary incisors increased axial inclination (*U1-to-SN 120˚ and L1-to-MP 100˚*). The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 9 as shown in the subsequent worksheet.

Treatment Objectives

The treatment objectives were to improve the patient's facial and dental esthetics, obtain an optimal inclination of his anterior teeth, obtain normal overjet and overbite, and maintain Class I molar and canine relationships.

Treatment alternatives

Based on facial and dental analysis, proclined and crowded incisors combined with mild facial protrusion were diagnosed. The patient was more concerned about dental than facial esthetics. Thus, a

CEPHALOMETRIC SUMMARY

SKELETAL ANALYSIS	PRE-TX	POST-TX	DIFF.
SNA˚ (82˚)	90˚	90˚	0˚
SNB˚ (80˚)	86˚	86˚	0˚
ANB˚ (2˚)	4˚	4˚	0˚
SN-MP˚ (32˚)	26˚	26˚	0˚
FMA˚ (27˚)	19˚	19˚	0˚
DENTAL ANALYSIS			
U1 TO NA mm (4mm)	7	5	2
U1 TO SN˚ (104˚)	120˚	108˚	12˚
L1 TO NB mm (4mm)	8	6	2
L1 TO MP˚ (90˚)	100˚	95˚	5˚
FACIAL ANALYSIS			
E-LINE UL (-1mm)	2	1	1
E-LINE LL (0 mm)	3	2	1
%FH: Na-ANS-Gn (56%)	55%	56%	1%
Convexity: G-Sn-Pg (13˚)	5˚	4˚	1˚

Table 1: *Cephalometric Summary*

non-extraction treatment approach was considered optimal. The orthodontic treatment indicated was a two-phase approach. In the first phase, a segmental fixed appliance would be bonded from LL4 to LL7 and a 2x14-mm OrthoBoneScrew® (*OBS, iNewton, Inc., Hsinchu City, Taiwan*) would be placed in the left ramus to correct severely rotated LL7. In the second phase, clear aligners (*Invisalign®, Align Technology, Inc., San Jose, CA, USA*) would be used to correct the remaining dental problems.

Treatment Progress

Phase 1: Fixed appliance

After UR8 and LR8 were removed, LL4 to LL7 were bonded with conventional ligation brackets and a 0.014-in copper-nickel-titanium archwire was placed. A 2x14-mm OBS was inserted in the left ramus. One

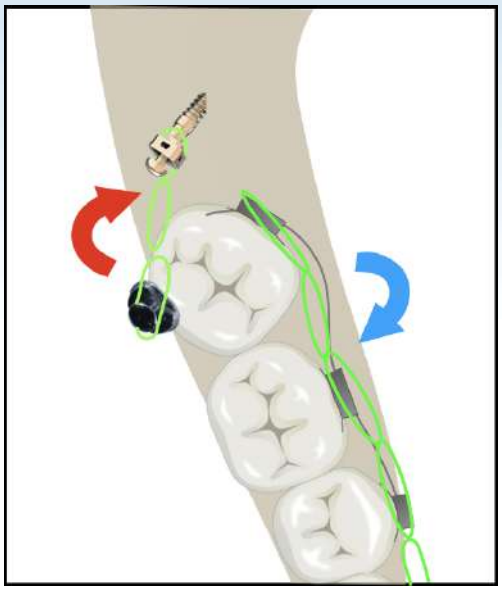


Fig. 6: *The red arrow shows the power chain force retracted from the button on the lingual surface of LL7 to the ramus screw, which distalized the LL7. The blue arrow shows the power chain force, retracted from LL4 to LL7, which provided protraction. The red and blue forces resulted in clockwise rotation of LL7.*

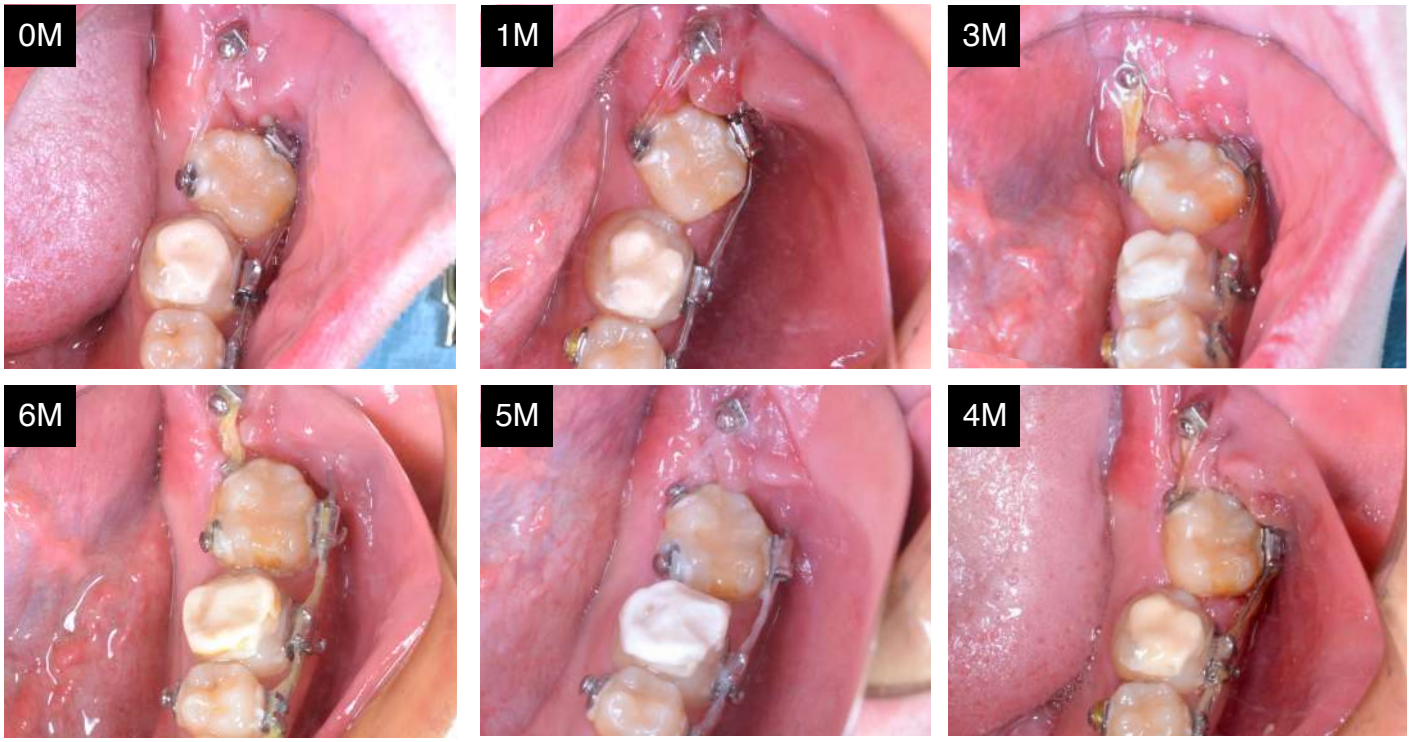


Fig.7: *Treatment progress in months (M) showing in six occlusal views arranged in clockwise order*

Fig. 8: Intraoral photos after phase 1 treatment

button was bonded on the lingual side of LL7. The rotation mechanics are shown in Fig. 6. The treatment progress is shown in Fig. 7. After 6 months of active treatment, the rotated LL7 was successfully corrected, but it resulted in extrusion and tipping that resulted in an occlusal prematurity of the lingual cusp of LL7. Therefore, a posterior open contact was noted (*Fig. 8*).

Phase 2: Clear aligner stage

Protocols of clear aligner

iTero Element® intraoral scans (*Align Technology, Inc., San Jose, CA, USA*) provided a 3D dataset. The ClinCheck® system (*Align Technology, Inc., San Jose, CA, USA*) was used to plan the treatment and project the outcome. A complete treatment simulation is described below.[12] All posterior teeth were moved 1mm distally in sequential retraction (*Fig. 9*), and arch expansion was set at 0.3mm. During stage 18, Inter-

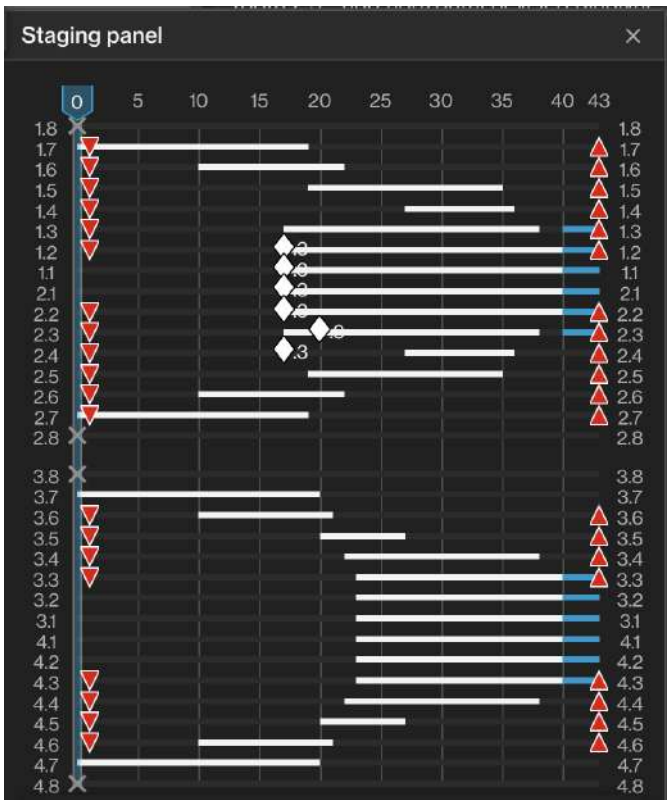


Fig. 9: Staging panel showing increments of aligner activation

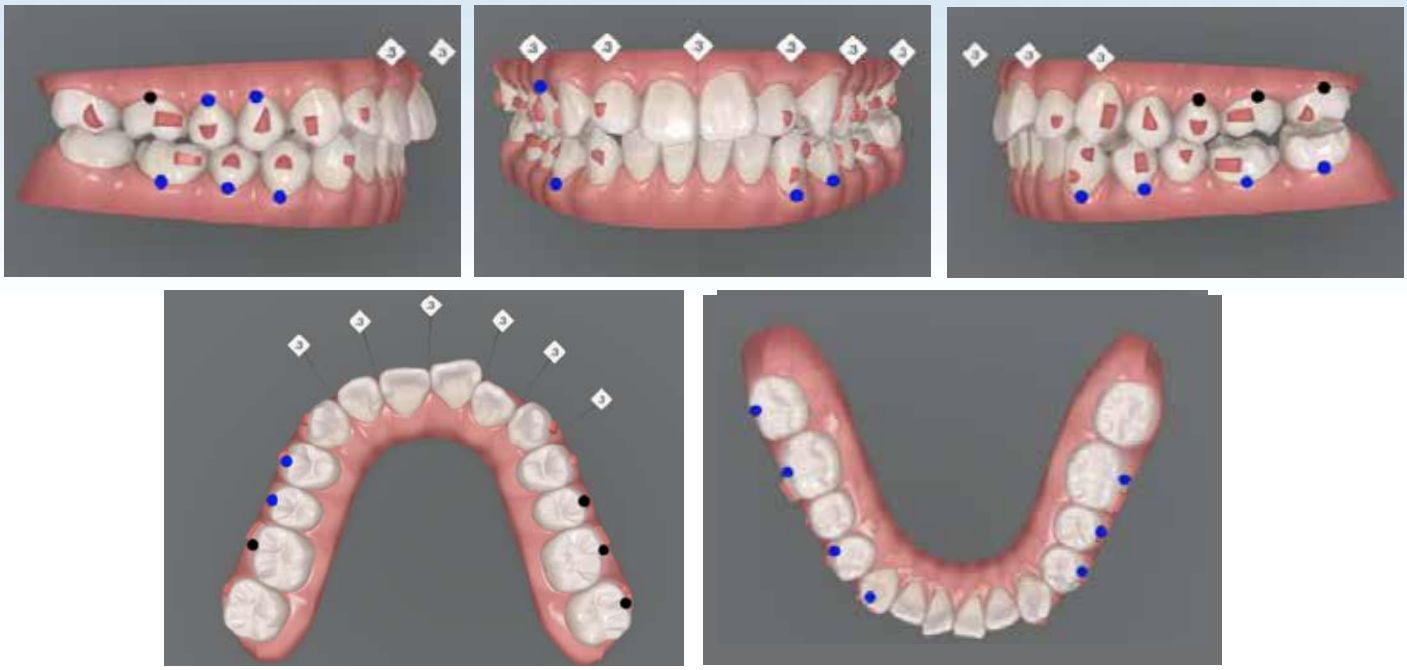


Fig. 10:
Prescribed optimized attachments, conventional attachments, and IPR are shown in five views of the arches. Blue dots indicate variably predictable tooth movements, and black dots indicate less predictable tooth movements. See text for details.

proximal reduction (*IPR*) was performed on all the upper anterior teeth to create space for anterior retraction. Both prescribed optimized attachments and conventional attachments were applied in sequential staging, and the predictable difficulty of tooth movement is shown in Fig. 10. Blue dots indicate variably predictable tooth movement and black dots indicate less predictable tooth movement. UR6 and UL5-UL7 were extrusions of more than 1mm. UR4, UR5, LL4, LL6, and LR4-LR6 were extrusions between 0.5 to 1mm. LL7 was an intrusion between 0.5 to 1mm. LL3 was root movement between 4 to 6mm.

Treatment Progress of Clear Aligner

In the aligner stage, sequential distalization, arch expansion, and IPR were performed to resolve the crowding and bimaxillary proclination. 0.3mm IPR was carried out in stage 18. After 15 months and 43 sets of aligners, the first stage was completed and the arch was well expanded. However, the UL1 was not rotated perfectly, and there was still posterior open contact from LL3 to LL7. Therefore, additional aligner therapy was required (*Fig. 11*).

In the second stage, which lasted 4 months and involved 18 sets of aligners, the UL1 was rotated correctly and the arch was slightly expanded. 0.1mm IPR was performed between LL1 and LL2, and from LR1 to LR3. At the 15th set of aligners during the second stage, posterior open contact was still noted on the left side (*Fig. 12*). In order to fix this problem, buttons were bonded on the buccal surfaces of UL4-UL6, LL5, and LL6. Short elastics (*Chipmunk 1/8-in, 3.5-oz*) were retracted from UL4 to LL5, UL5 to LL6,

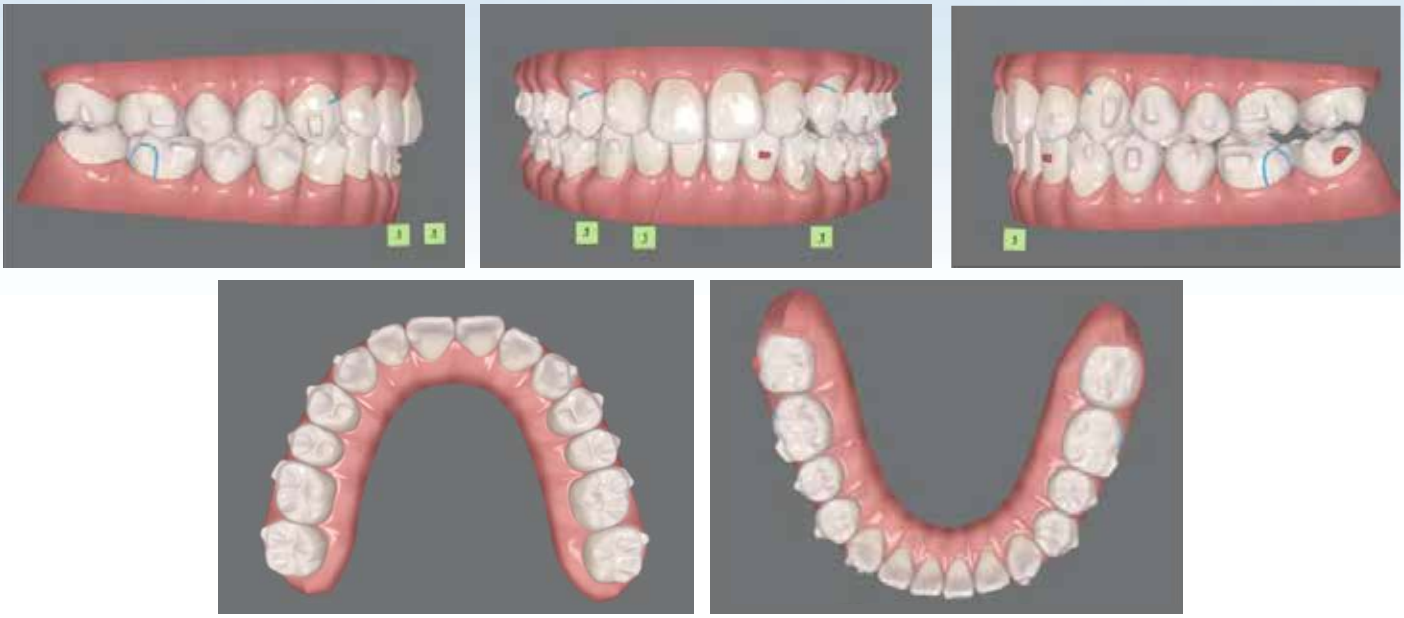


Fig. 11: *The first aligner of the second stage*

Fig. 12: *The 15th aligner of the second stage*

and UL6 to LL6. After 2 weeks, the open contact of UL4 and UL5 was improved. The remaining problems were posterior open contact on LR7, LL6, and LL7. Hence, additional therapy was necessary (*Fig. 13*).

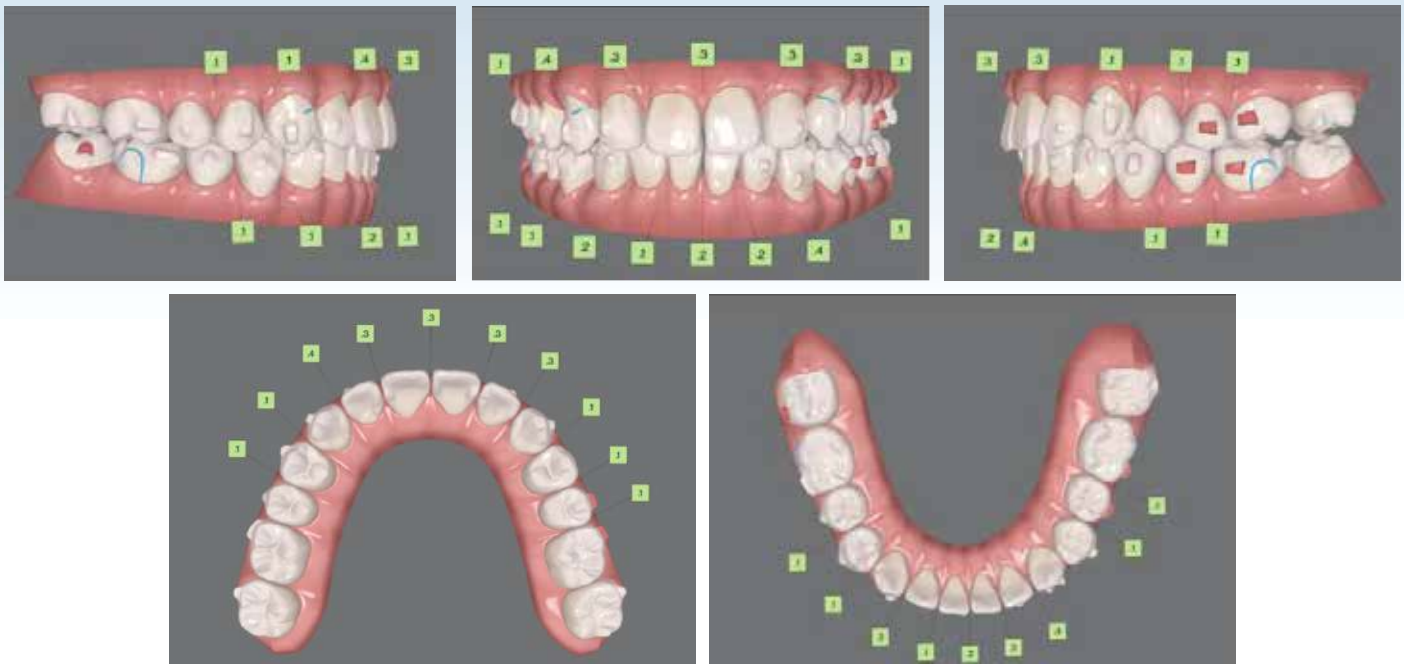


Fig. 13: *The first aligner of the third stage*

In the third stage, 15 sets of aligners were used in 3 months. 0.1-0.3mm IPR was performed to resolve bilateral canine Class II relationship and occlusal fittings. Details are displayed in Fig. 12.

The patient went through 3 stages and used 76 (*43+18+15*) sets of aligners in 23 months. After 29 months of treatment, all attachments and auxiliaries were removed. Essix retainers *(Densply Sirona, Charlotte, NC, USA)* were delivered for both arches. The patient was instructed to wear them full time for the first month, and only while sleeping thereafter.

Treatment Results

The treatment results for this patient were excellent. All teeth were aligned in their proper positions (*Figs. 14 and 15*). Bilateral occlusions are Class I with a normal overjet and overbite. All treatment objectives were achieved. A panoramic radiograph revealed good root parallelism (*Fig. 16*). The cephalometric measurements (*Table 1*) and the cephalometric superimposition (*Figs. 17 and 18*) showed the maxillary incisors were retroclined by 12 degrees, and the mandibular incisors were retroclined by 5 degrees. The maxillary and mandibular molars were slightly uprighted. The CRE score was 6 points as shown in the subsequent Worksheet 2. Most points were for the compromised occlusal contact of LL6, LL7, and LR7. The Pink and White esthetic score was 2 points, as documented in Worksheet 3 at the end of this report. The patient was satisfied with his teeth and profile.

Fig. 14: *Post-treatment facial and intraoral photographs*

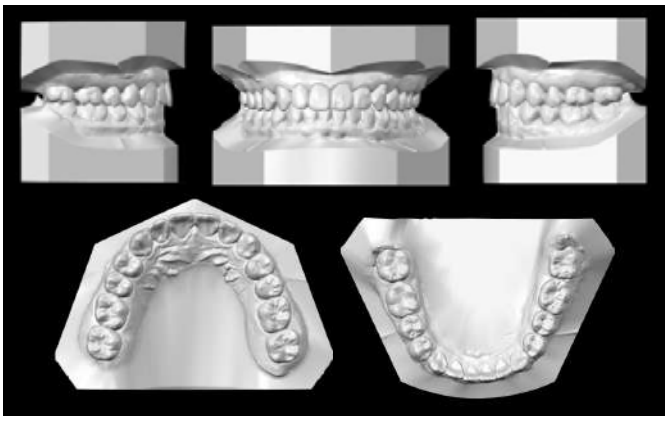


Fig. 15: *Post-treatment study models (casts)*

Fig. 16: *Post-treatment panoramic radiograph*

Fig. 17: *Post-treatment cephalometric radiograph*

Discussion

Mild Bimaxillary Protrusion Protocol: Using Clear Aligner Therapy

Patients with bimaxillary protrusion generally have Class I molar and canine relationships, which generally result in good oral function. Careful and complete skeletal, dental, and soft tissue evaluations are necessary before treatment planning. The treatment methods should be selected according to patient's chief complaint(*s*) and clinical diagnosis.[10] For the current patient, the upper and lower lips were beyond the E-line 2mm and 3mm respectively. His profile was classified as mild to moderate bimaxillary protrusion, so a non-extraction orthodontic treatment was feasible. The molars

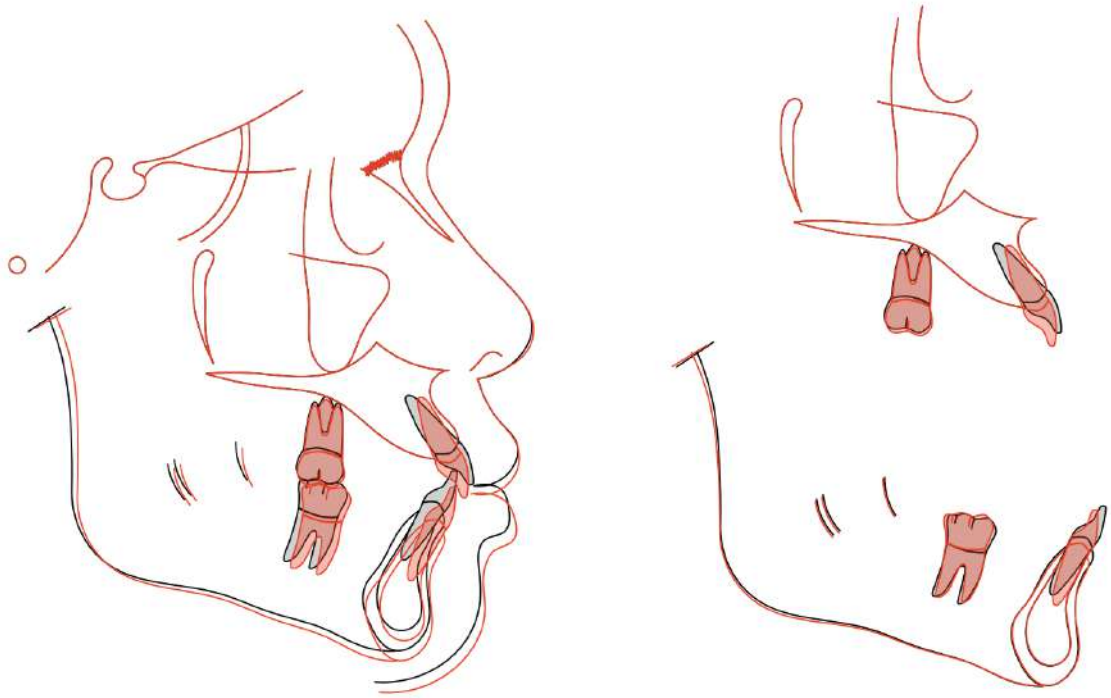


Fig. 18: *Superimposition of pre-treatment (black) and post-treatment (red) cephalometric tracings*

could be retracted using skeletal anchorage to gain the extra space required to perform anterior tooth retraction and resolve both the anterior crowding as well as proclination.[10]

With the development of clear aligners, molar retraction, arch transverse expansion, and IPR were all successful in gaining space for incisal retraction and relieving crowding. In this present case, 1mm of retraction, 2-3mm of arch expansion, and multiple IPR adjustments were set in all four quadrants during the three stages of aligner therapy. As a result, bimaxillary incisors were retroclined and retrusive. There are studies which compared the ratios of dental movement to soft tissue movement - most commonly the amount of upper incisor retraction to upper lip retraction - in an attempt to establish guidelines for clinical management. A 2.2:1 upper lip-to-upper incisor ratio (*5.2mm of upper incisor retraction to 2.4mm of upper lip retraction*) was reported in these studies.[1,15,16]

The amount of incisor retraction in this case was only 2mm, and it resulted in 1mm of lip retraction. The clear aligner therapy improved the inclination of the anterior incisors and aligned the dentition successfully, but change in the profile was not significant. Since the patient cared more about dental than facial esthetics, he was still satisfied with the treatment outcome.

	Green	Blue	Black
Surgery	No	No	Yes
Extraction	No	Incisor extraction	Premolar extraction
Distalization	< 2 mm	2-4 mm	> 4 mm
Mesialization	No	< 2 mm	> 2 mm
Crowding	< 6 mm	6-8 mm	> 8 mm
Spacing	< 4 mm	4-8 mm	> 8 mm
Expansion per quadrant	< 2 mm	2-4 mm	> 4 mm
Anterior Crossbite	Involving 1 tooth	Involving 2 bilateral teeth	Involving multiple teeth
Anterior Intrusion	< 2.5 mm	2.5-3 mm	> 3 mm
Posterior Intrusion	No	< 1 mm	> 1 mm
Anterior Extrusion	< 2.5 mm	2.5-3 mm	> 3 mm
Posterior Extrusion	No	< 1 mm	> 1 mm

Table 2: *Complexity evaluation chart for clear aligner therapy from Invisalign®.[17] See text for details.*

Limitation of Clear Aligners

Table 2 from the Invisalign® website[17] is a useful tool to evaluate the degree of complexity in treating a specific patient with clear aligner therapy.

1. If all items are in the Green column, then a Green protocol should be followed, indicating a simple and/or more predictable treatment approach.

2. If at least one item is in in the Blue column and none in the Black column, then a Blue protocol should be followed, indicating a moderate and/or variably predictable treatment approach.

3. If at least one item is in the Black column, then a Black protocol should be followed, which means the treatment will be more complex and/or less predictable.

In addition, Invisalign® asserts that, without the use of additional techniques, aligners can resolve rotations of 40˚ in the upper and lower central incisors, 45˚ in canines and premolars, 30˚ in lateral incisors, and 20˚ in molars. Radicular movements of 4mm and 2mm can be achieved in the anterior and posterior teeth respectively.[18]

Although the SmartTrack features automatically-placed optimized attachments for rotational movements greater than 5 degrees, rounded teeth are not gripped well by the aligners. Despite the relatively low accuracy of rotation, the progress of the maxillary incisors and canines was encouraging.[19]

According to Haouili,[19] the least accurate tooth movement was rotation (*46%*), and this movement was particularly challenging for canines, premolars, and molars. Due to poor aligner grip around the shorter clinical crown and the decreased forces on the terminal tooth within the aligner, the second molars are difficult to rotate. Similar findings were observed by Simon et al.[20] and Charalampakis.[21]

In the present case, rotation of 60˚ for LL7 was noted. It is almost impossible to correct severe rotation like this with clear aligner therapy, without an extremely long treatment period. Utilizing TSADs and traditional fixed appliances, the severe LL7 rotation was corrected in 6 months.

Extrusion of Posterior Teeth: Can Clear Aligner Therapy Fix It?

According to the findings from Haouili,[19] maxillary incisor extrusion (*55%*) has the highest accuracy, whereas extrusion of the maxillary and mandibular molars (*40%*) has the lowest accuracy. The higher accuracy of incisor extrusion and molar intrusion, as well as the low accuracy of incisor intrusion and molar extrusion, would suggest that Invisalign® is more effective in bite closure, rather than bite opening.

Although the rotation of LL7 was resolved by a fixed appliance and a ramus screw, the extrusion and tipping side effects on the LL7 resulted in open contacts in the whole arch.

As can be seen in Table 2, extrusions and intrusions of more than 1mm are less predictable in the posterior teeth. According to ClinCheck®, UR6 and UL5-UL7 were difficult extrusion (*>1mm*), UR4, UR5, LL4, LL6, LL7 as well as LR4-LR6 were moderate extrusion (*0.5-1mm*), and LL7 was moderate intrusion (*0.5-1mm*) in the first stage.

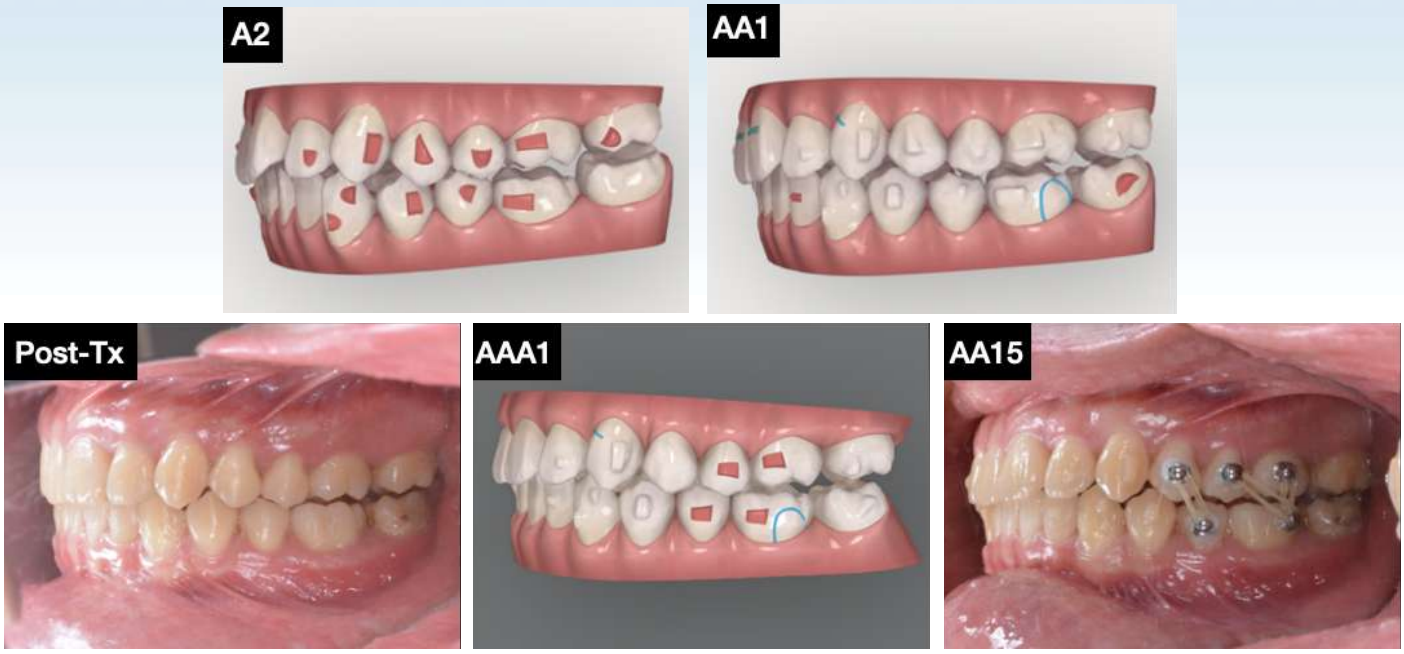


Fig. 19:
The treatment progress to correct left posterior second molar occlusal contact is shown in clockwise order. ***A2:*** *the second aligner of the first stage.* ***AA1:*** *the first aligner of the second stage.* ***AA15:*** *the 15th aligner of the second stage.* ***AAA1:*** *the first aligner of the third stage.*

After the first stage of clear aligner therapy, LL7 was difficult extrusion (*>1mm*), and UL4-UL7 as well as LL4-LL7 were moderate extrusion (*0.5-1mm*) as detected in ClinCheck® of the second stage.

After completing the second stage, left side posterior open contact was still noted. To resolve this posterior open contact, buttons were bonded on UL4-UL6, LL5, and LL6. Short elastics (*Chipmunk 1/8-in, 3.5-oz*) were applied for two weeks as shown (*Fig. 19*). UL6, UL7 and LL7 were detected as moderate extrusion (*0.5-1mm*) in the third stage ClinCheck®.

After a 2-phase orthodontic treatment, slight posterior open bite was still found on LL6, LL7, and LR7. The treatment progress for the correction of this left posterior open contact is shown in Fig. 19. According to the above information, the open contact was improved progressively but slowly. Although Invisalign admits that significant extrusion is hard to achieve, it is still possible even though aligners are more helpful for retraction. If this case were re-treated, elastics for occlusal fitting could be indicated after the first stage to perform extrusion. The second stage of clear aligner therapy should be delayed until the posterior open bite is reduced to less than 0.5mm space.

Conclusions

1. The use of clear aligners is an innovative orthodontic modality. Molar retraction, arch expansion, and IPR can solve moderate crowding

and protrusion without the assistance of extraction or TSADs.

2. However, clear aligner therapy has its limitations. For this patient, LL7 was rotated severely by 60 degrees. Clear aligner therapy is unlikely to resolve this challenging problem in a reasonable period of time. TSADs and elastic retraction are indicated to prepare the dentition for aligner resolution of the malocclusion.

3. Hence, traditional fixed appliances and innovative clear aligner therapy are combined to resolve severe malocclusion. These two treatment approaches cannot replace each other, so a hybrid treatment method is indicated to achieve desired outcomes more efficiently and effectively.[17]

References

1. Scott SH, Johnston LE. The perceived impact of extraction and nonextraction treatments on matched samples of African American patients. Am J Orthod Dentofac Orthop 1999;116:352–358.

2. Farrow AK, Zarrinnia K, Azizi K. Bimaxillary protrusion in black Americans—an esthetic evaluation and the treatment considerations. Am J Orthod Dentofac Orthop 1993;104:240–250.

3. Fonseca RJ, Klein WD. A cephalometric evaluation of American Negro women. Am J Orthod 1978;73:152–160.

4. Rosa RA, Arvystas BA. An epidemiologic survey of malocclusions among American Negroes and American Hispanics. Am J Orthod 1978;73:258–273.

5. Lew K. Profile changes following orthodontic treatment of bi-maxillary protrusion in adults with the Begg appliance. Eur J Orthod 1989;11:375–381.

6. Tan TJ. Profile changes following orthodontic correction of bi-maxillary protrusion with a preadjusted edgewise appliance. Int J Adult Orthod Orthog Surg 1996;11:239–251.

7. Lamberton CM, Reichart PA, Triratananimit P. Bimaxillary protrusion as a pathologic problem in the Thai. Am J Orthod Dentofac Orthop 1980;77:320–329.

8. Bills DA, Handelman CS, BeGole EA. Bimaxillary dentoalveolar protrusion: traits and orthodontic correction. Angle Orthod 2005;75:333-9.

9. Kook YA, Park JH, Bayome M, Sa'Aed NL. Correction of severe bimaxillary protrusion with first premolar extractions and total arch distalization with palatal anchorage plates. Am J Orthod Dentofac Orthop 2015;148(2):310-320.

10. Chen G, Teng F, Xu TM. Distalization of the maxillary and mandibular dentitions with miniscrew anchorage in a patient with moderate Class i bimaxillary dentoalveolar protrusion. Am J Orthod Dentofac Orthop 2016;149(3).

11. Kravitz ND, Kusnoto B, BeGole E, Obrez A, Agran B. How well does Invisalign work? A prospective clinical study evaluating the efficacy of tooth movement with Invisalign. Am J Orthod Dentofac Orthop 2009;135(1):27–35.

12. Chang S, Schupp S, Haubrich J, Yeh WC, Tsai MS. Aligner therapy in treating bimaxillary dentoalveolar protrusion. J Aligner Orthod 2019;3(4):277–301.

13. Lapenaite E, Lopatiene K. Interproximal enamel reduction as a part of orthodontic treatment. Stomatologija 2014;16(1):19–24.

14. Germec-Cakan D, Taner TU, Akan S. Arch-width and perimeter changes in patients with borderline Class I malocclusion treated with extractions or without extractions with air-rotor stripping. Am J Orthod Dentofac Orthop 2010; 173:734 e1-e7

15. Chiasson RC. Soft tissue changes in black orthodontic patients. Chicago, Ill: University of Illinois at Chicago;1996.

16. Hershey HG. Incisor tooth retraction and subsequent profile change in preadolescent female patients. Am J Orthod 1972;61:45–54.

17. Invisalign® Doctor Site. Available at: https://learn.invisalign.com/digital-treatment-planning/clincheck-pro. Last accessed: 2020 Dec 28.

18. Galan-Lopez L, Barcia-Gonzalez J, Plasencia E. A systematic review of the accuracy and efficiency of dental movements with Invisalign®. Korean J Orthodox 2019;49(3):140–9.

19. Haouili N, Kravitz ND, Vaid NR, Ferguson DJ, Makki L. Has Invisalign improved? A prospective follow-up study on the efficacy of tooth movement with Invisalign. Am J Orthod Dentofac Orthop 2020;158(3):420-425.

20. Simon M, Keilig L, Schwarze J, Jung BA, Bourauel C. Treatment outcome and efficacy of an aligner technique—regarding incisor torque, premolar derotation and molar distalization. BMC Oral Health 2014;14(1):1-7.

21. Charalampakis O, Iliadi A, Ueno H, Oliver DR, Kim KB. Accuracy of clear aligners: a retrospective study of patients who needed refinement. Am J Orthod Dentofac Orthop 2018;154:47-54.

Discrepancy Index Worksheet

TOTAL D.I. SCORE: 9

OVREJET

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 = 2

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 = 1

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° _____ x 1 pt. = _____

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

SN-MP

≥ 38° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

Each degree > 99° 1 x 1 pt. = 1

Total = 3

OTHER (See Instructions)

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

Identify: Severe rotation of LL7

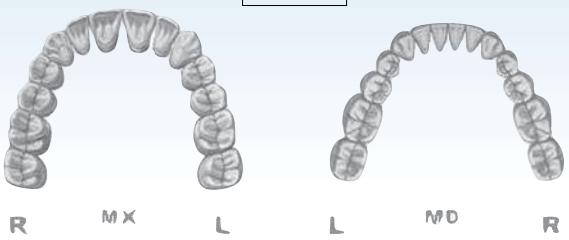
Total = 2

Cast-Radiograph Evaluation

Total Score: 6

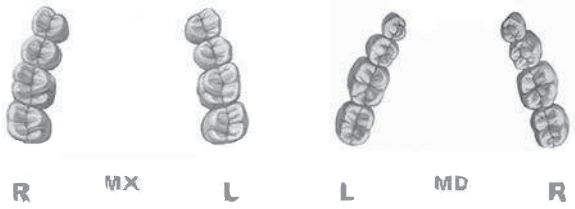
Alignment/Rotations

0



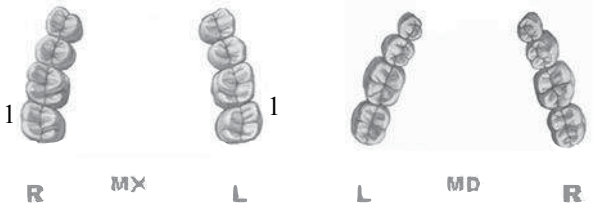
Marginal Ridges

0



Buccolingual Inclination

2

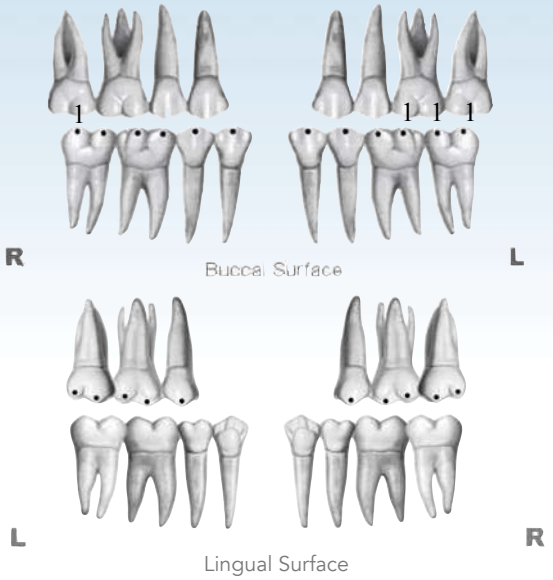


Overjet

0

Occlusal Contacts

4

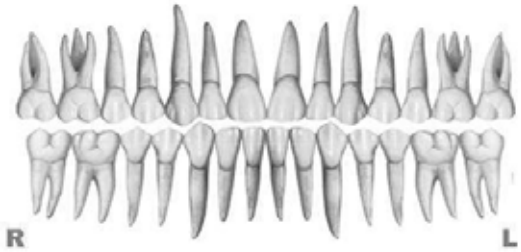


Occlusal Relationships

0

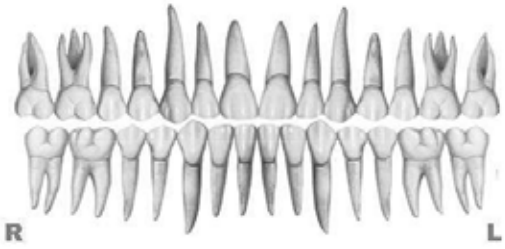
Interproximal Contacts

0



Root Angulation

0



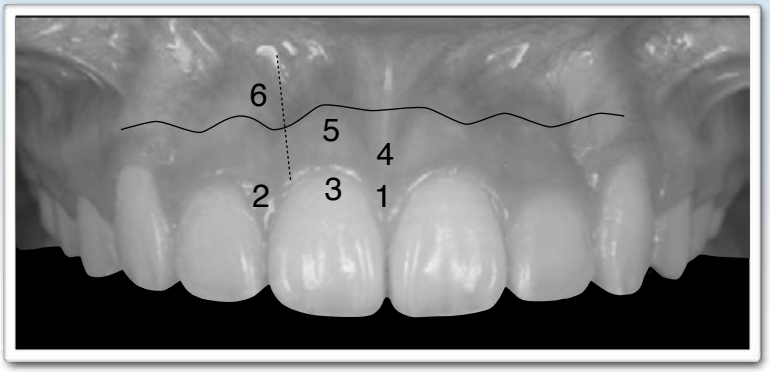
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 2

1. Pink Esthetic Score

Total = 0

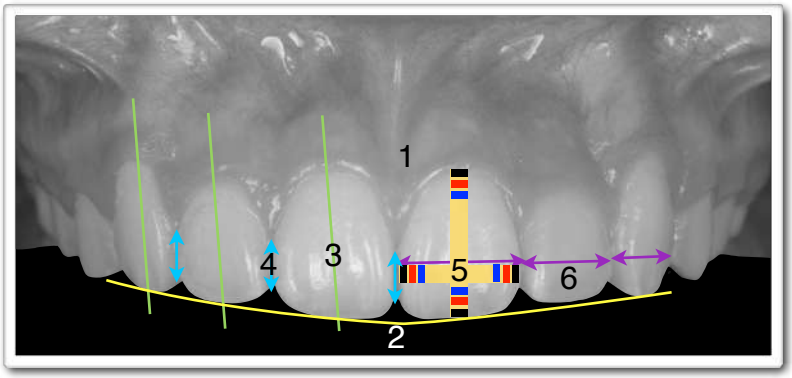


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

2. White Esthetic Score (for Micro-esthetic)

Total = 2



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

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

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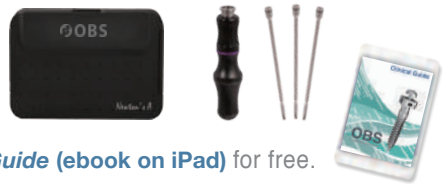
2.7 | 2.0x14mm (with holes)



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

** The overall success rate of 93.7% indicates that both SS and TiA are clinically acceptable for IZC BSs.
Reference: Failure rates for stainless steel versus titanium alloy infrazygomatic crest bone screws: A single-center, randomized double-blind clinical trial (Angle Orthod 2019;89(1):40-46)

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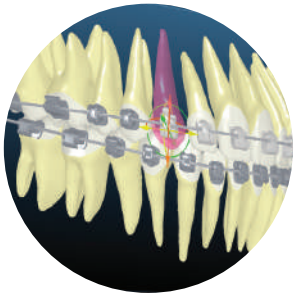

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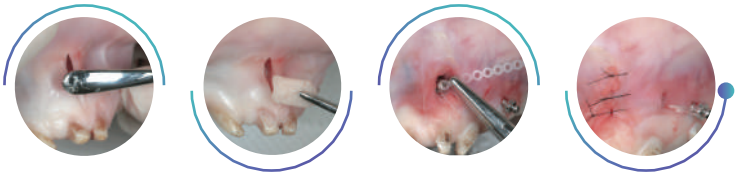

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Chris' Lecture:
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Day 3 **VISTA Lecture & workshop**

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KEYNOTE

THE LECTURER

Dr. Chris Chang

CEO, Beethoven Orthodontic and Implant Group. He received his PhD in bone physiology and Certificate in Orthodontics from Indiana University in 1996. As publisher of Journal of Digital Orthodontics-*A journal for Interdisciplinary dental treatment*, he has been actively involved in the design and application of orthodontic bone screws.

Asymmetrical Extraction Mechanism to Treat Class III Malocclusion with Anterior Crossbite and Midline Deviation

Abstract

Introduction: *A 19yr-10mo-old male presented with a chief complaint of poor dental esthetics.*

Diagnosis: *Cephalometric analysis revealed a skeletal Class III relationship (SNA 85˚, SNB 87˚, ANB -2˚), as well as reduced facial convexity (-10˚) and proclined upper incisors. An intraoral assessment revealed bilateral Class III malocclusion with anterior crossbite (UR1, UL2, and UL3), and the midline was deviated 3mm to the left. Mild crowding appeared in the lower anterior dentition, and a gummy smile was apparent when the patient smiled. The Discrepancy Index (DI) was 27.*

Treatment: *A Damon® system appliance with passive self-ligating brackets was applied to correct the dental malocclusion after extracting four premolars (UR5, UL5, LR4, and LL5). Asymmetric extraction was carried out due to midline deviation. Posterior bite turbos and early light short Class III elastics were used to correct the anterior crossbite. Space closing and midline correction were also accomplished with elastics. The active treatment was 20 months. Gingivectomy and frenectomy were then performed afterwards to correct soft tissue contour.*

Results: *Improved dentofacial esthetics and occlusal function were achieved after treatment. The Cast-Radiograph Evaluation (CRE) was 10, and the Pink and White esthetic score was 3. Neither significant root resorption nor periodontal problems were noted. There were two discrepancies: non-parallel root axis of UL6 and UL7, as well as less-than-ideal interproximal contact between LL4 and LL6.*

Conclusions: *This case report demonstrates the use of passive self-ligating appliances to resolve skeletal and dental Class III malocclusion without the intervention of orthognathic surgery. (J Digital Orthod 2021;64:26-42)*

Key words:

Skeletal Class III, full-cusp Class III, anterior crossbite, midline deviation, passive self-ligating brackets, asymmetrical mechanics, gingivectomy, frenectomy

Introduction

The dental nomenclature for this case report is a modified Palmer notation with four quadrants: upper right (*UR*), upper left (*UL*), lower right (*LR*), and lower left (*LL*). Teeth are numbered 1-8 from the midline in each quadrant.

Class III patients are often challenging for clinicians since a correct diagnosis with proper treatment timings and methods can be further complicated when it is related to skeletal problems. Camouflage treatment and orthognathic surgery are two dominant treatment options for this type of patient. It is still being debated which treatment is a better option.[1] Orthognathic surgery was once the only treatment approach for correcting skeletal Class III. However, the high risk of surgical complications and massive financial expenses put off patients from accepting the treatment. Therefore, camouflage treatment was introduced to proceed with the correction.[2] The technique of camouflage treatment involves extraction to compensate for the skeletal discrepancy. Studies show an increase in the ANB

Vicky T. Huang,
Clerk, Beethoven Orthodontic Center (Left)
Bear C. Chen,
Association Director, Beethoven Orthodontic Center (Center left)
Chris H. Chang,
Founder, Beethoven Orthodontic Center
Publisher, Journal of Digital Orthodontics (Center right)
W. Eugene Roberts,
Editor-in-Chief, Journal of Digital Orthodontics (Right)

angle, slight or no modification in the vertical dimension, and decreased concavity of the facial profile after Class III camouflage treatments.[3-9] This case report demonstrates a non-surgical treatment of a slight Class III jaw relationship with Class III molar relationship. With a thorough stepwise diagnosis and Chang's extraction decision table (*Table 3*), this challenging case was completed with a satisfying result.

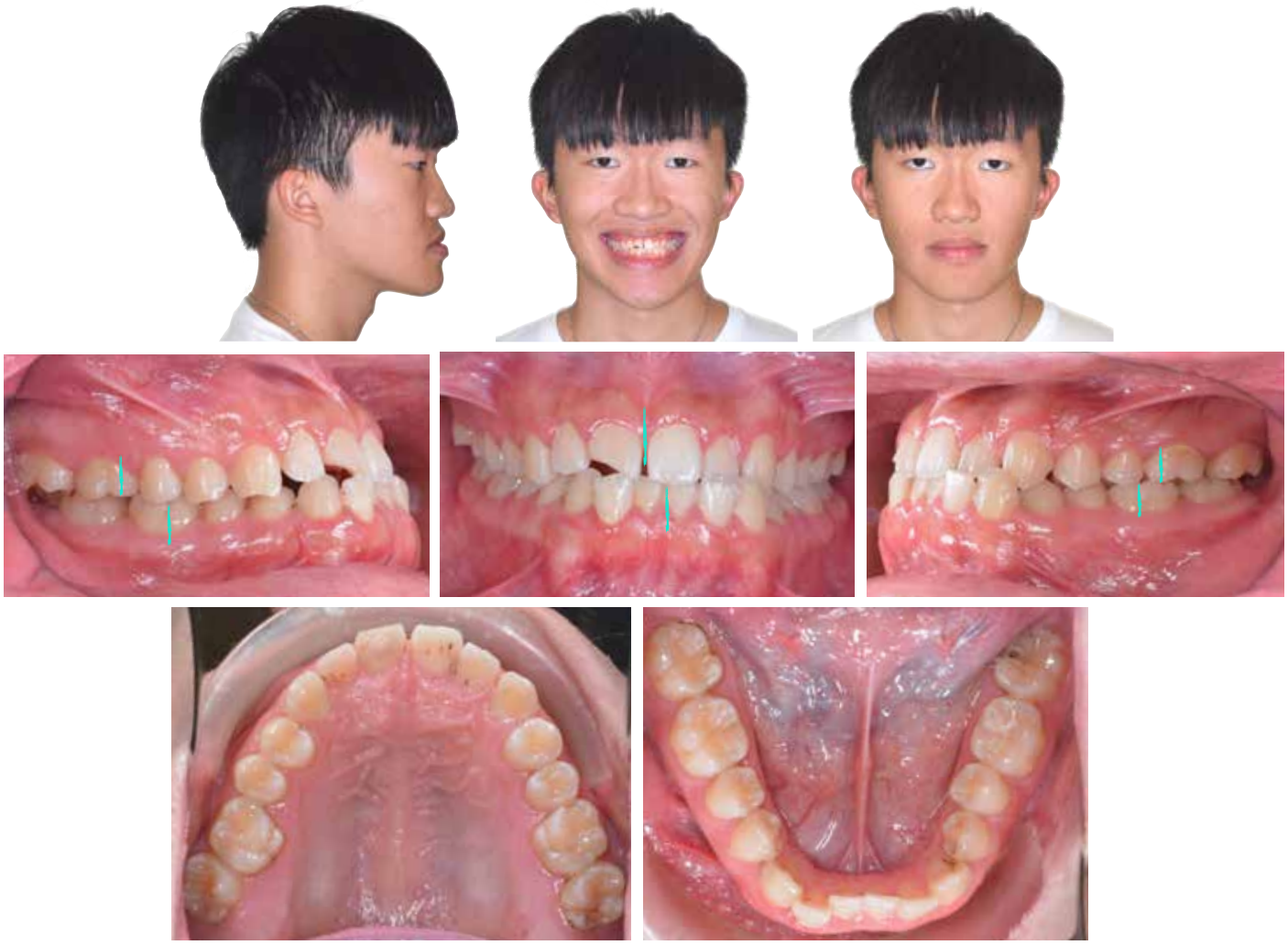


Fig. 1: *Pre-treatment facial and intraoral photographs in centric occlusion (C_O)*

Diagnosis and Etiology

A 19-year-old male presented for orthodontic evaluation for misaligned teeth and a protrusive chin (*Fig. 1*). A radiographic examination was performed with a panoramic radiograph, lateral cephalometric film, and a temporomandibular joint (*TMJ*) series (*Figs. 3-5*). Cephalometric analysis revealed a long face and protrusive maxilla and mandible (*Table 1*). The analysis also indicated a skeletal Class III accompanied with normal maxilla and protrusive mandible (*Table 1*). No contributing medical history was reported but there was a large chip off the distal-incisal edge of the UR1 due to dental trauma during childhood. The anterior crossbite may be related to the overgrowth of the mandible.

As for facial evaluation, a concave profile, retrusive upper lip to the E-line, and a relatively protrusive lower lip were noted. A gummy smile tendency was also noticed. The panoramic radiograph

Fig. 2: *A close-up shot of the anterior crossbite*

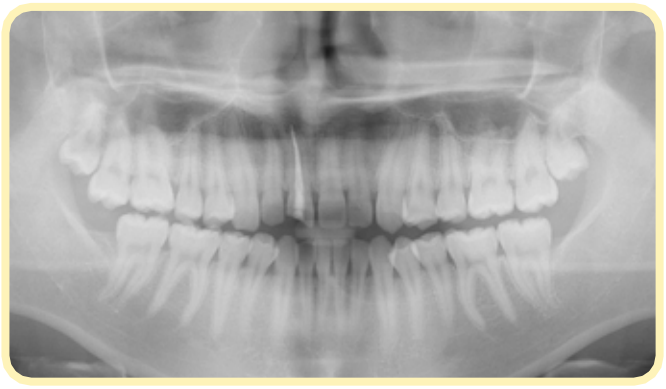


Fig. 3: *Pre-treatment panoramic radiograph*

Fig. 4: *Pre-treatment cephalometric radiograph*

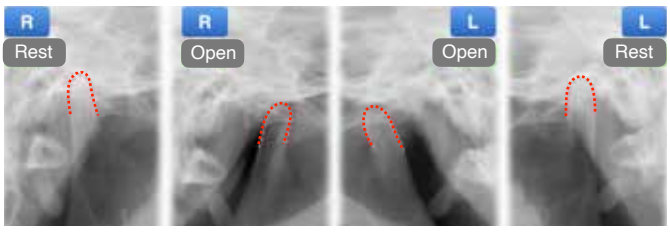


Fig. 5 :
Pre-treatment TMJ transcranial radiographs show the right (R) and left (L) sides in the rest and open positions. The mandibular condyles are outlined in red. Note the asymmetric mandibular condyle heads are longer on the right compared to the left side.

revealed missing L8s bilaterally and a past root canal treatment on UR1. The intraoral examination showed a diastema between the upper anterior teeth and anterior crossbite of the UR1, UL2, and UL3. The maxillary dental midline was coincident with the facial midline, and mandibular dental midline shifted 3mm to the left. The pre-treatment cephalometric analysis confirmed a skeletal Class III tendency (*ANB=-2˚*) as previously mentioned (*Fig. 4; Table 1*). The TMJ radiographs (*Fig. 6*) showed asymmetric condylar morphology, but there were no signs or symptoms of temporomandibular dysfunction (*TMD*). The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 27 points,[5] as shown in Worksheet 1 at the end of this report.[10]

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA˚ (82˚)	85˚	85˚	0˚
SNB˚ (80˚)	87˚	85˚	2˚
ANB˚ (2˚)	-2˚	0˚	2˚
SN-MP˚ (32˚)	28.5˚	28˚	0.5˚
FMA˚ (25˚)	21.5˚	21˚	0.5˚
DENTAL ANALYSIS			
U1 TO NA mm (4mm)	7	4.5	2.5
U1 TO SN˚ (104˚)	122.5˚	113.5˚	9˚
L1 TO NB mm (4mm)	5	-1.5	6.5
L1 TO MP˚ (90˚)	87˚	67.5˚	19.5˚
FACIAL ANALYSIS			
E-LINE UL (-1mm)	-3	-5	2
E-LINE LL (0mm)	-2	-2	0
%FH: Na-ANS-Gn (53%)	56%	55%	1%
Convexity:G-Sn-Pg' (13˚)	-10˚	-9˚	1˚

Table 1: *Cephalometric summary*

Treatment Objectives

1. Correct the anterior crossbite to an ideal overbite and overjet.
2. Achieve Class I canine and molar relationships.
3. Correct the midline discrepancy.

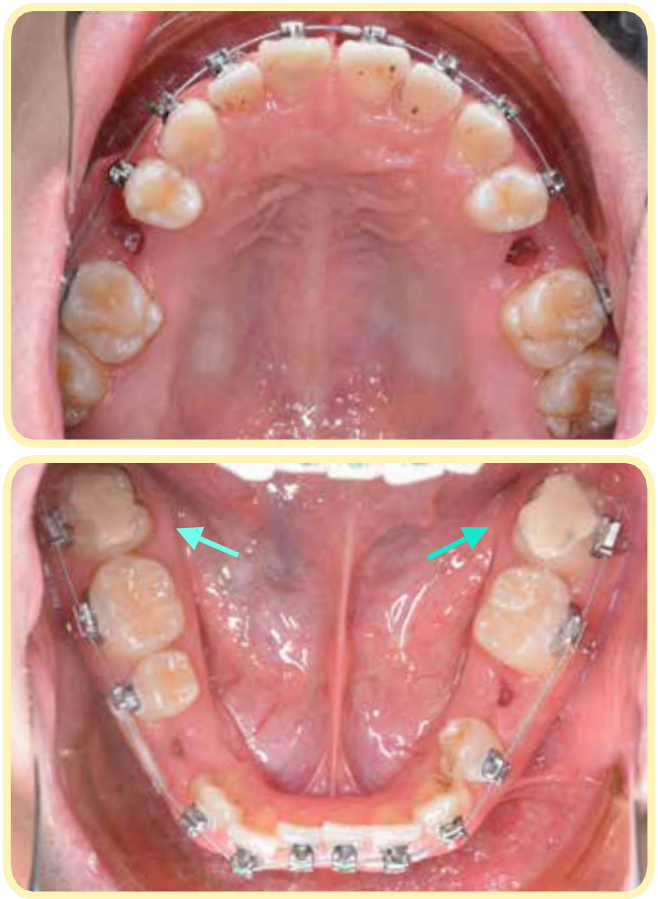


Fig. 6: *Premolars were extracted in the initial treatment. Posterior bite turbos were bonded on the lower arch for bite opening (blue arrows).*

Treatment Plan

The plan for this camouflage treatment was to resolve the Class III relationship by retracting the lower arch and correcting the anterior crossbite. Extraction of the UR5, UL5, LR4, and LL5 was scheduled to relieve the crowding and retract the lower lip (*Fig. 6*). Non-symmetrical extraction was indicated to correct the 3mm midline deviation. Posterior bite turbos and elastics were also used to assist with the correction (*Fig. 6*). Molar relationship would be rectified by Class III elastics. Low-torque brackets were selected for the upper anterior teeth and high-torque for the lower anterior teeth, aiming to compensate for the Class III elastic mechanics.

Treatment Alternatives

Lefort I orthognathic surgery with bilateral sagittal split osteotomy (*BSSO*) was the surgical treatment option for the patient. However, the patient refused the surgical approach taking into account the higher risk of complications and cost compared to the non-surgical options.

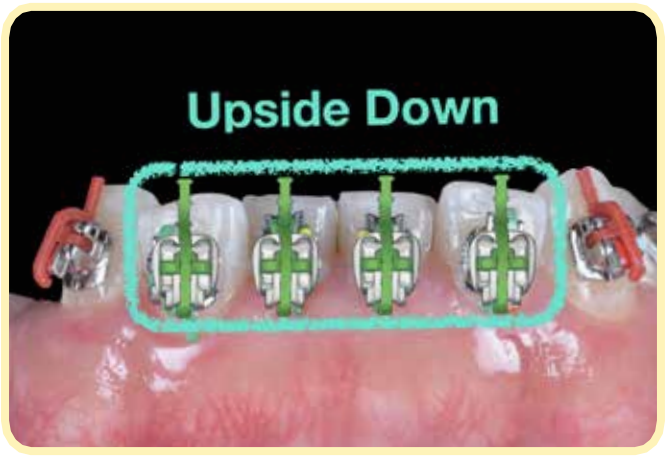


Fig. 7:
Low-torque brackets were positioned upside down to express high-torque in the lower anterior teeth.

Treatment Progress

A 0.022-in slot Damon Q® fixed appliance (*Ormco, Glendora, California*) with passive self-ligating (*PSL*) brackets was selected along with all specified archwires and orthodontic auxiliaries.

Before active orthodontic treatment, the patient was referred to extract the UR5, UL5, LR4, and LL5 (*Fig. 6*). 2 weeks later, Damon Q® 0.022-in PSL brackets (*Ormco, Glendora, CA*) were bonded on the lower teeth with 0.014-in CuNiTi archwire engaged. Upside-down low-torque brackets were bonded on the lower anterior teeth to serve as high-torque brackets (*Fig. 7*) to help avoid torque loss during the retraction of the lower arch.

Two occlusal bite turbos were constructed with Fuji II® type II glass ionomer cement (*GC America, Alsip IL*) on the mandibular 2nd molars to open the intermaxillary space for correction of the anterior crossbite (*Fig. 6*).

After one month of aligning and leveling the lower arch, the upper dentition was also bonded with PSL brackets. Standard torque brackets were used on all upper teeth except for low-torque brackets on the maxillary lateral incisors to resist Class III mechanics, as well as high-torque brackets on the U3s.

Early light short Class III elastics (*Parrot 5/6-in 2 oz, Ormco*) were used for 1 month to correct the anterior crossbite. In the 3rd month of treatment, a positive overjet was achieved, and thus the bite turbos were removed.

Fig. 8:
Five-ring power-chain on both upper sides to close extraction spaces and Class III elastics on the right side to adjust molar relationship and midline.

A five-ring power chain was placed bilaterally from the maxillary canines to the maxillary 1st molars to close the extraction spaces in the 5th month of treatment. Class III elastics (*Fox, 1/4-in, 3.5-oz; Ormco*) were also applied on the right side to correct the lower arch and midline deficiency (*Fig. 8*).

In the 8th month, leveling and alignment was completed. Both archwires were changed to 0.016x0.025-in SS. Class II elastics (*Fox, 1/4-in, 3.5-oz; Ormco*) were used for two months on the left side to correct the midline (*Fig. 17*).

In the 10th month, buttons were placed on the lingual side of the upper 2nd premolars and upper 2nd molars bilaterally. Power chains were hooked between the buttons in order to avoid molar rotation during the closure of extraction spaces (*Fig. 9*).

In the 18th month, the extraction spaces were closed but midline deviation still remained. Elastics (*Fox, 1/4-in, 3.5-oz; Ormco*) were placed from the UR4 and UR3 to the LL3 to reinforce the adjustment of the midline deviation (*Fig. 10*).

Fig. 9:
Elastomeric chains were hooked on the palatal side to accelerate the speed of space closure and prevent distal rotation of the posterior teeth.

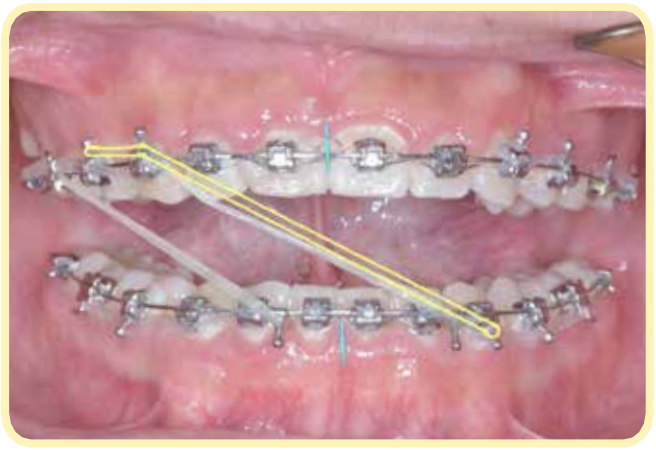


Fig. 10:
Low-torque brackets positioned upside down to express high-torque in the lower anterior and midline elastics are applied.

All fixed appliances were removed after 20 months of active treatment. All four extraction spaces were closed, and A-P Class I relationship was achieved. Gingivectomy and frenectomy were then performed with diode laser on the upper arch to enhance Pink and White esthetics (*Fig. 11*). After soft tissue adjustment, retention was accomplished with upper and lower clear overlay retainers. Also, a mandibular 3-3 lingual retainer was immediately bonded in place.

Results Achieved

Facial esthetics, gummy smile, and intermaxillary occlusion were significantly improved after 20 months of active treatment (*Fig. 12*). The canine relationships were corrected to Class I, and the molar relationship was significantly improved. The post-treatment panoramic radiograph documented acceptable root parallelism, except for UL6 and UL7 (*Fig. 14*). The superimposed cephalometric tracings illustrated that the upper 1st molar was protracted 5mm due to the closing of the extraction spaces with elastic force (*Fig. 13*). The axial inclination of the upper incisor (*U1-SN*) decreased 6˚ after treatment (*117˚ to 111˚*), and the axial inclination of the lower incisors (*L1-MP*) was inevitably tipped lingually (*87.5˚ to 68˚*). The upper and lower lips were both retruded following the retraction of the anterior segments. The mandibular plane angle (*SN-MP*) was well-maintained (*Table 1*). The Cast-Radiograph Evaluation (*CRE*) score was 10 points, as shown in the supplementary Worksheet 2.[11] The Pink and White dental esthetic score was 3 points (*Worksheet 3*).[12] The patient was pleased with the final result.

Retention

To prevent the relapse of crowding, a fixed retainer was placed from canine to canine on the lower arch. Two ESSIX® (*Dentsply Sirona, Harrisburg, PA*) overlay retainers were provided to retain the leveling and alignment of the dentition. The patient was instructed to use the overlay retainers full time for the first month and only while sleeping thereafter.

Discussion

Class III camouflage treatment is often challenging for orthodontists, especially for cases with additional complexities. In general, treatment is usually delayed until the end of puberty for true skeletal Class III patients (*Table 2*).[13] Although the suggested minimum age for skeletal Class III orthodontic intervention is 18 for both genders, it is important to

Fig. 11: *Gingivectomy and frenectomy were performed to achieve improved tissue esthetics*

Fig. 12: *Post-treatment facial and intraoral photographs*
In the lower occlusal view (bottom right), the inter-proximal area between LL4 and LL6 (blue arrow) is less desirable than between LR5 and LR6 (green arrow) since L4 has a smaller lingual cusp compared to L5, which may lead to higher occurrence of food impaction. See text for details.

inform patients of possible changes due to potential future growth. Therefore, an accurate diagnosis as well as proper treatment timing and treatment plans are crucial to achieve favorable outcomes.

For this patient, the growth of mandible was complete before treatment (*Table 2*). Therefore, the orthognathic facial profile in centric relation (C_R) position implied a good prognosis with camouflage treatment, which was carried out with a satisfying result (*Figs. 12-15*) in only 22 months without orthognathic surgery. Treatment progress is documented in Figs. 16-18. The major problems in this case were (*1*) full-cusp Class III malocclusion, (*2*) anterior crossbite, and (*3*) dental midline deviation (*3mm*).

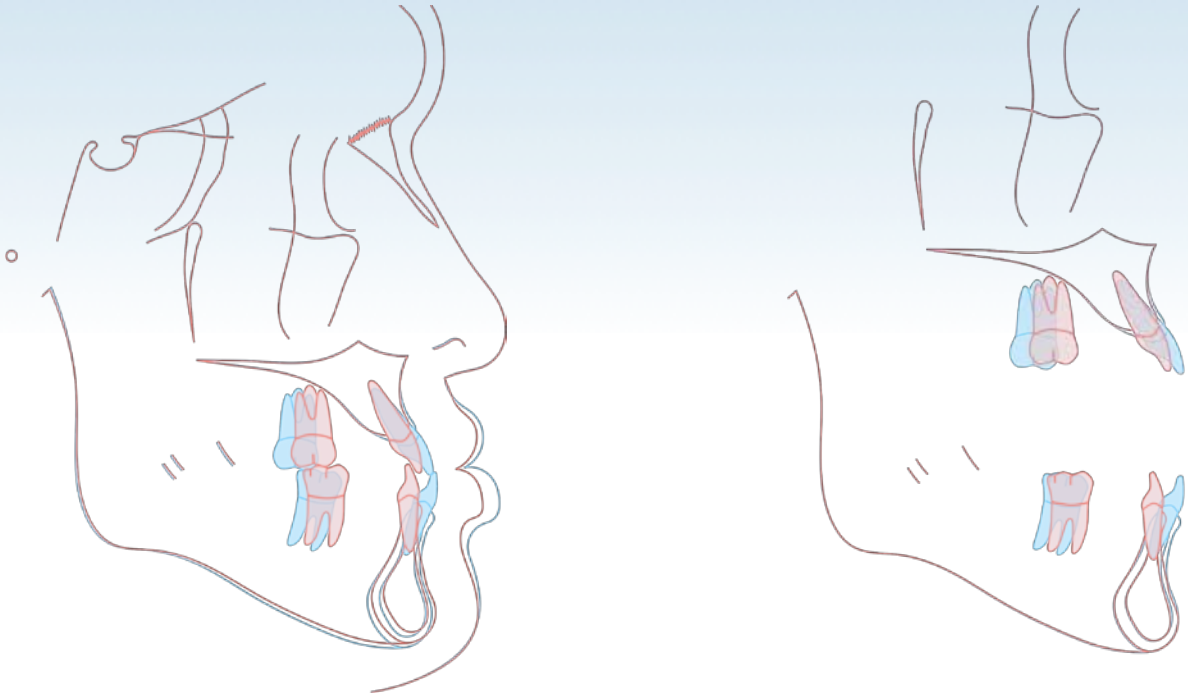


Fig. 13: *Superimposed cephalometric tracings (blue: pre-treatment; red: post-treatment) indicate that the pre-treatment Class III molar relationship was corrected to Class I due to 5mm of maxillary 1st molar protraction which was a benefit from the U5s extraction. However, inevitable lingual tipping of the lower incisors occurred due to the Class III camouflage treatment.*

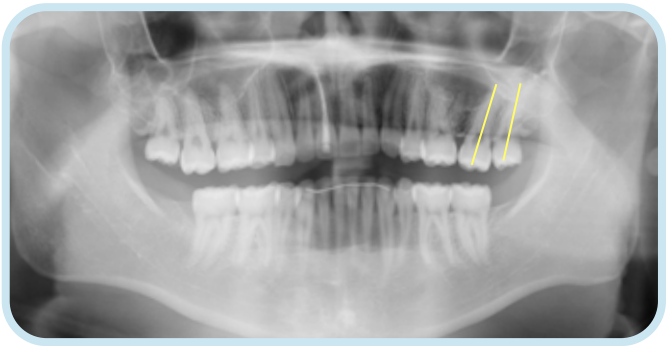


Fig. 14: *Post-treatment panoramic radiograph*

Full-Cusp Class III Malocclusion

In order to correct anterior crossbite and improve posterior intercuspation, the Extraction Decision Table of Chang (*Table 3*) was used to assess the necessity for extractions. In Class III camouflage treatments, U5 and L4 extractions are usually the

Fig. 15: *Post-treatment cephalometric radiograph*

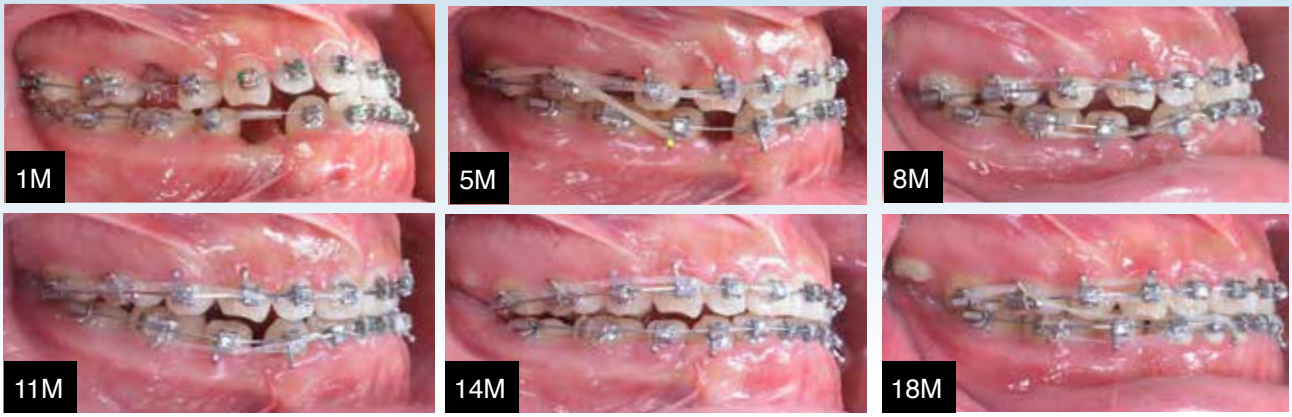


Fig. 16:
Treatment progression from the right buccal view. In the 5th month, Class III elastics (Fox, 1/4-in, 3.5-oz; Ormco) were used on the right side to correct the molar relationship and the midline deficiency.

Fig. 17:
Treatment progression from the frontal view. High torque brackets for the lower arch and low or standard torque brackets for the upper incisors were chosen to compensate for the reaction to the Class III elastics mechanism.

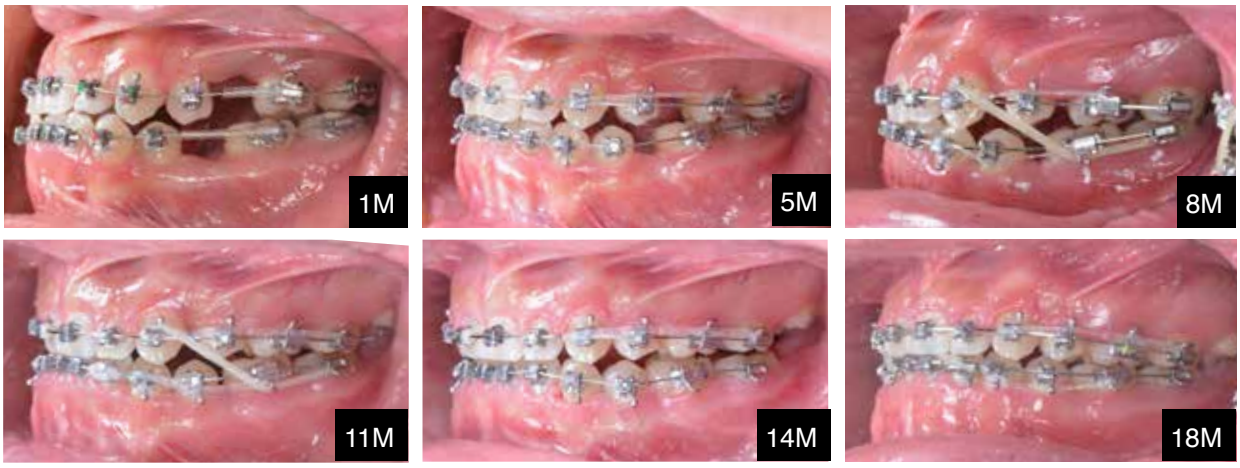


Fig. 18:
Treatment progression from the left buccal view. In the 8th month, Class II elastics (Fox, 1/4-in, 3.5-oz; Ormco) were used for two months on the left side to correct the midline and to close the intermaxillary space.

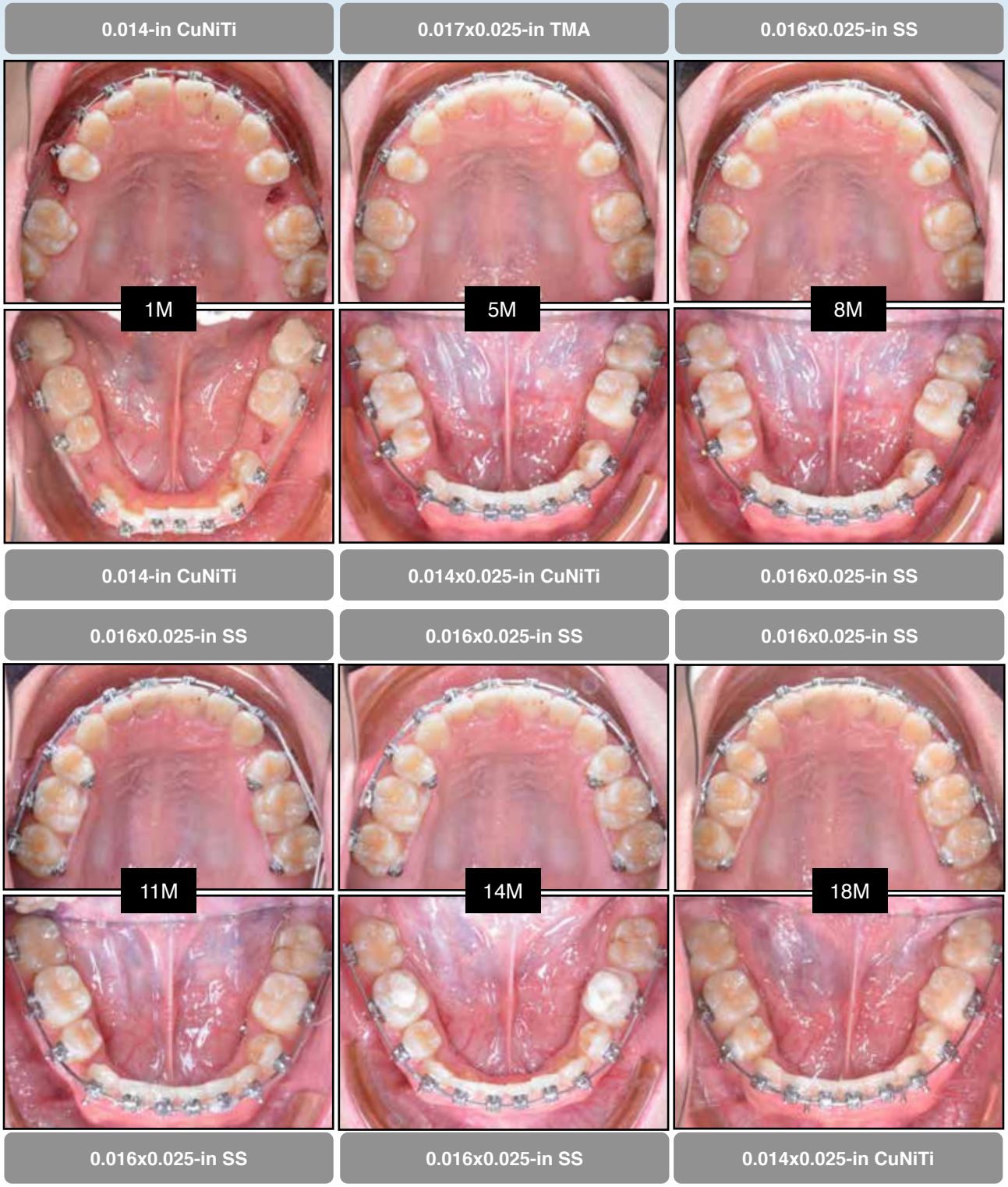


Fig. 19:
Treatment progression from the occlusal view. Compared to the lower arch, the upper arch followed a standard Damon Q® wire sequence. It was easier compared to the lower arch.

most common solution. For this case, the two factors in the decision table favoring extractions were the protrusive profile and anterior incisal inclination. Furthermore, the patient's perception for extractions was positive. As a result, asymmetrical premolar extraction in each quadrant was executed to provide spaces for differential space closure to correct the midline deviation.

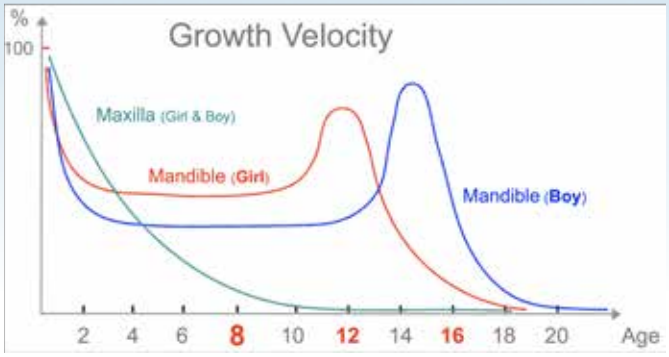


Table 2: Growth velocity of the mandible in different gender

Anterior Crossbite Correction

For the anterior crossbite correction, bite turbos were placed on the occlusal surface of the lower molars in order to open the bite (*Fig. 6*).[14,15] Once the intermaxillary space was created, Ni-Ti wire was placed into the bracket to align and level the dentition without the risk of occlusal interference. Bite turbos were bonded on the posteriors rather than anteriors due to a misaligned lower anterior dentition; also, alignment of the anterior teeth would be inhibited by an anterior inclined bite plate.

In general, Class III camouflage treatment flares the upper arch and retroclines the lower anteriors (*Figs. 9 and 20*). Therefore, high-torque brackets were bonded on the lower anterior teeth to prevent retroclination. On the contrary, low-torque or standard-torque brackets were selected for the upper anterior segment.

Midline Deviation

To correct midline deviation, asymmetrical extraction in combination with intermaxillary elastics may be a reasonable solution to meet the requirement (*Fig. 10*). In general, extraction of the U5 and L4 bilaterally is the preferred choice in most Class III camouflage treatments. Since the lower midline deviated 3mm to the left in this case, LL5 was extracted to enhance correction of the midline deviation (*Fig. 6*). However, the interproximal area between LL4 and LL6 may encounter food impaction more easily since the LL4 did not have a lingual cusp, so the interproximal contact area may be less desirable than LL5 and LL6 (*Fig. 12*). At the end of treatment, the 3mm midline deviation improved to 1mm left for the lower arch (*Fig. 21*).

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

Table 3: Chang's Extraction Decision Table

Fig. 20:
Class III elastic mechanics: a counterclockwise rotation appears in the lower arch when using Class III elastics. The bracket selection should be high-torque (HQ) for the lower anterior and low-torque (LQ) for the upper anterior segments to counteract the force.

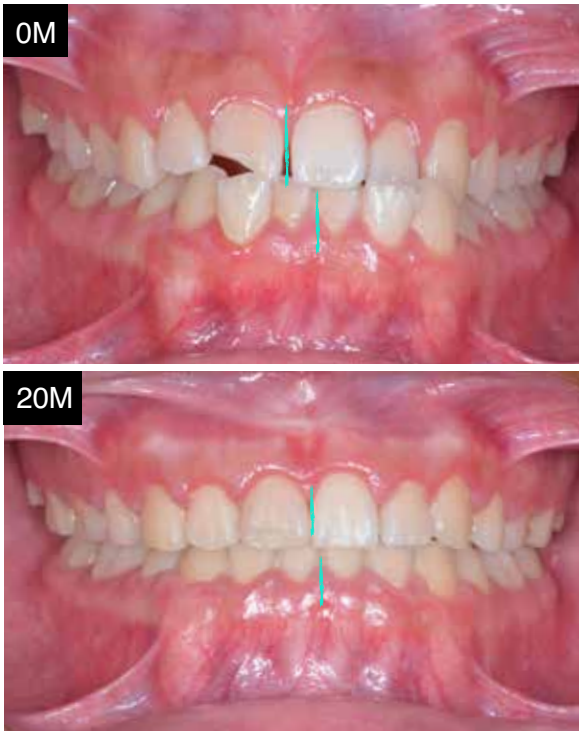


Fig. 21:
Midline was significantly improved after 20 months of treatment.

Conclusions

This difficult skeletal malocclusion was treated to an acceptable result without orthognathic surgery in only 20 months. With Chang's Extraction Decision Table (*Table 3*), a feasible treatment plan was completed with a pleasant outcome. In retrospect, the treatment time may have been decreased by using buccal shelf miniscrews. In addition, this case finished with a 67.5° L1-to-MP angle. Therefore, long-term follow-up was indicated to assure the continuous stability and maintenance of the occlusion.

References

1. Stellzig-Eisenhauer A, Lux CJ, Schuster G. Treatment decision in adult patients with Class III malocclusion: Orthodontic therapy or orthognathic surgery? Am J Orthod Dentofac Orthop 2002;122(1):27–37.

2. Proffit WR, Fields HW Jr, Sarver DM. Contemporary orthodontics. In: Contemporary orthodontics 4th ed. St. Louis: Mosby/Elsevier 2007:300–9.

3. Burns NR, Musich DR, Martin C, Razmus T, Gunel E, Ngan P. Class III camouflage treatment: What are the limits? Am J Orthod Dentofac Orthop 2010;137(1):9.e1-9.e13.

4. Costa Pinho TM, Ustrell Torrent JM, Correia Pinto JGR. Orthodontic camouflage in the case of a skeletal class III malocclusion. World J Orthod 2004;5(3):213–23.

5. Lin J, Gu Y. Preliminary investigation of nonsurgical treatment of severe skeletal class III malocclusion in the permanent dentition. Angle Orthod 2003;73(4):401–10.

6. Chang HF, Chen KC, Nanda R. Two-stage treatment of a severe skeletal Class III, deep bite malocclusion. Am J Orthod Dentofac Orthop 1997;111(5):481–6.

7. Rabie A-BM, Wong RWK, Min GU. Treatment in borderline Class III malocclusion: Orthodontic camouflage (extraction) versus orthognathic surgery. Open Dent J 2008;2:38–48.

8. Troy BA, Shanker S, Fields HW, Vig K, Johnston W. Comparison of incisor inclination in patients with Class III malocclusion treated with orthognathic surgery or orthodontic camouflage. Am J Orthod Dentofac Orthop 2009;135(2):146.e1-9; discussion 146-7.

9. Chang MJ, Kuo PJ, Lin JJ, Roberts WE. Mutilated Class III malocclusion with anterior crossbite and autotransplantation of two molars. J Digital Orthod 2019;54:4-23.

10. Cangialosi TJ, Riolo ML, Owens SE Jr et al. The ABO discrepancy index: A measure of case complexity. Am J Orthod Dentofac Orthop 2004;125:270–8.

11. Casko JS, Vaden JL, Kokich VG, Damone J, James RD. American board of orthodontics: Objecting grading system for dental casts and panoramic radiographs. Am J Orthod Dentofac Orthop 1998;114(5):589–99.

12. Su B. IBOI Pink and White esthetic score. Int J Orthod Implantol 2013;28:80-85.

13. Lin JJ. Creative orthodontics blending the Damon system and TADs to manage difficult malocclusions 2nd ed. Taipei: Yong-Chieh Ltd. 2010:298.

14. Tzatzakis V, Gidarakou IK. A new clinical approach for the treatment of anterior crossbites. World J Orthod 2008;9(4):355-65.

15. Tseng LY, Chang CH, Robert WE. Diagnosis and conservative treatment of skeletal Class III malocclusion with anterior cross bite and asymmetric maxillary crowding. Am J Orthod Dentofac Orthop 2016;149:555-66

Discrepancy Index Worksheet

TOTAL D.I. SCORE 27

OVREJET

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 = 5

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 = 7

OCCLUSION

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

Total = 6

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

Identify:

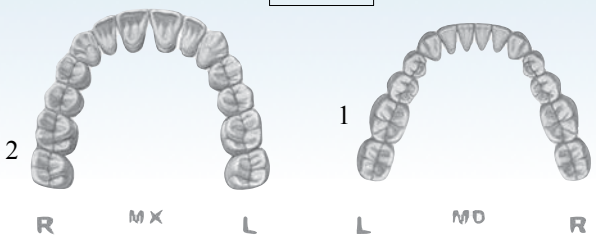
Total = 5

Cast-Radiograph Evaluation

Total Score: 10

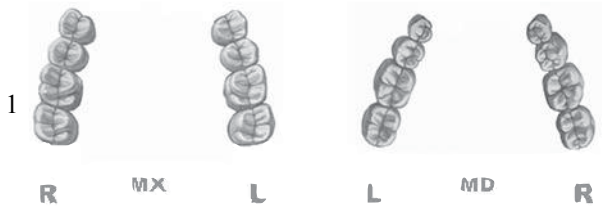
Alignment/Rotations

3



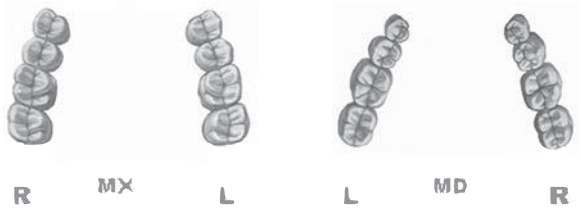
Marginal Ridges

1



Buccolingual Inclination

0

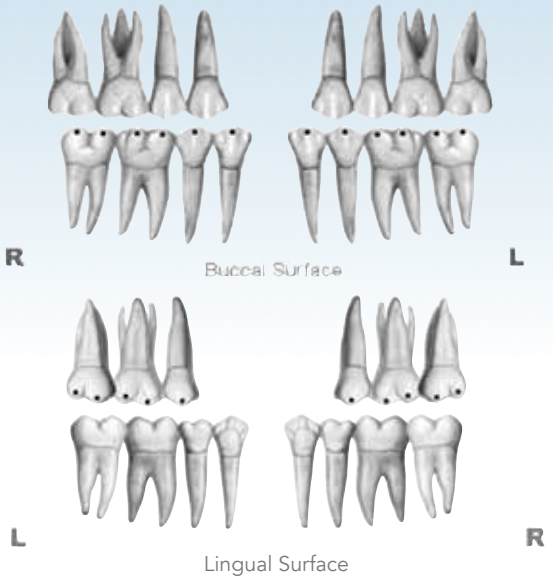


Overjet

0

Occlusal Contacts

0

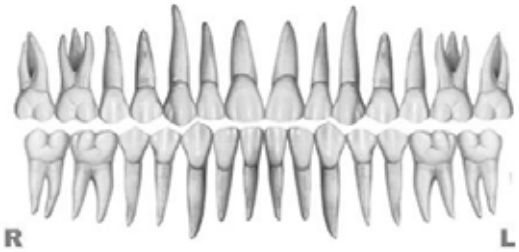


Occlusal Relationships

4

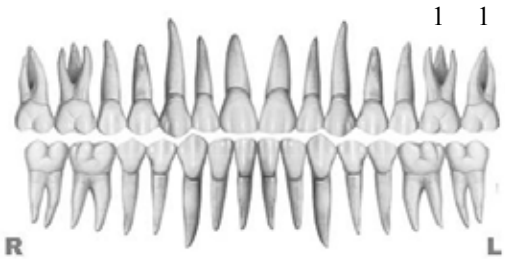
Interproximal Contacts

0



Root Angulation

2



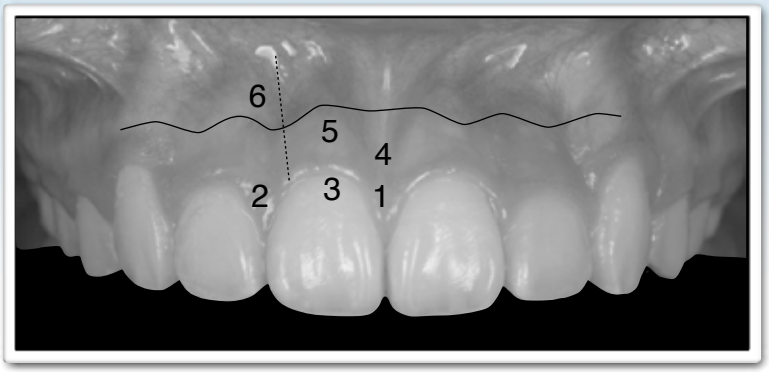
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink and White Esthetic Score

Total Score = 3

1. Pink Esthetic Score

Total = 1

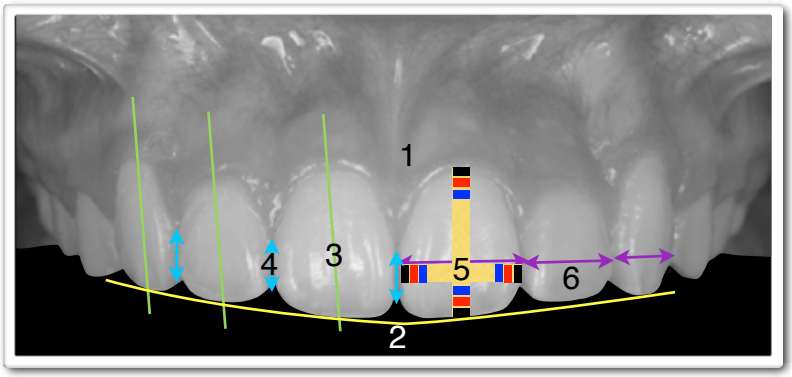


1. M and D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

2. White Esthetic Score (for Micro-esthetic)

Total = 2



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

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

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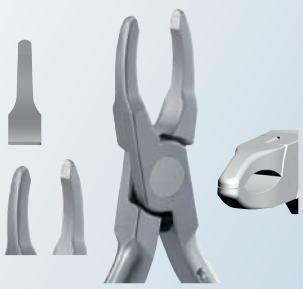

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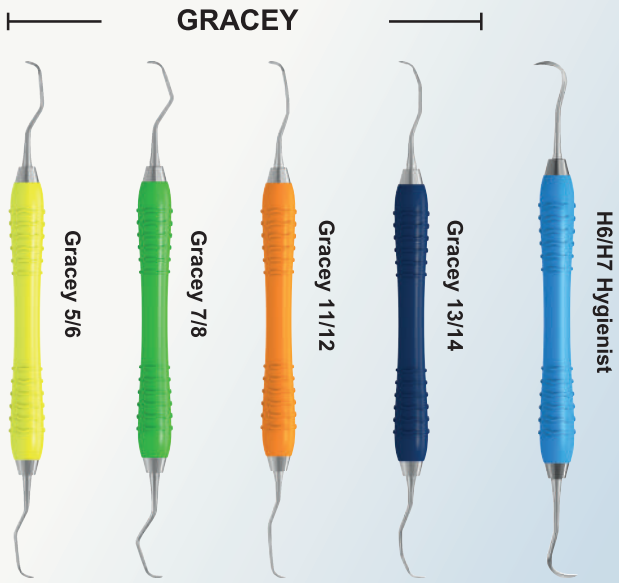

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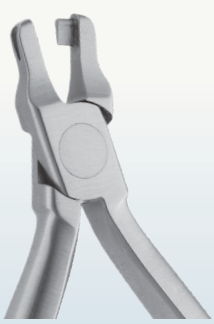

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Treatment of Blocked-In Upper Lateral Incisors and Congenitally Missing Premolars with 10mm Overjet

Abstract

History: *A 15-year-old female presented with flared upper central incisors and blocked-in upper lateral incisors with no lip contact.*

Diagnosis: *A skeletal Class I malocclusion (SNA 81˚, SNB 77˚, ANB 4˚) and an end-on molar Class III relationship with canine Class II relationship were noted. Dental analysis revealed flared upper central incisors (U1-to-NA 7mm; U1-to-SN 110˚), retroclined lower incisors (L1-to-MP 84˚) with an excessive overjet of 10mm. LR5 and LL5 were found to be congenitally missing. The facial profile was slightly convex. The Discrepancy Index (DI) was 19.*

Treatment: *Upper two-bicuspid extraction (UR4 and UL4) was conducted to provide space for retracting U1s and bringing the blocked-in U2s back into the arch. A passive self-ligating fixed appliance was introduced with upper anterior bite turbos and Class II elastics. Combining Class II elastics with anterior bite turbos can guide the mandible to occlude in a more protrusive position and open the bite to extrude the molars.*

Results: *After 25 months of treatment, a satisfactory profile and alignment was achieved. The Cast-Radiograph Evaluation (CRE) was 9, and the Pink and White esthetic score was 3. One discrepancy from an ideal occlusion was noted in the increased inclination of the lower incisors (L1-to-MP 103˚).*

Conclusions: *This case report demonstrated the treatment of blocked-in U2s in conjunction with flared U1s and bilateral congenitally missing L5s. Extracting U4s to result in one missing premolar in each quadrant is an important element of treatment planning. With proper mechanisms, anterior bite turbos and Class II elastics, a 10mm overjet can be treated to a pleasing result. (J Digital Orthod 2021;64:46-61)*

Key words:

Blocked-in teeth, congenitally missing teeth, excessive overjet, passive self-ligating brackets, anterior bite turbos, Class II elastics

Introduction

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

Congenitally missing teeth, or hypodontia, is a prevalent craniofacial malformation in humans, especially among the Asian population,[1] and is surprisingly common in our daily dental practices. Depending on the population studied, the most commonly missing teeth differ; nonetheless, missing mandibular second premolars rank highly among all ethnicities.[2-4] Individuals with hypodontia often present in clinical disguise on dental visits. Taking this case report as an example, the patient was a dental Class III case due to her missing L5s. Thus, it was still necessary to treat with Class II mechanics to fix the excessive overjet. There are different treatment options for hypodontia cases, for instance, resin-bonded fixed partial dentures (*RBFPDs*), or dental implants[5] when the congenitally missing space is

Lily Y. Chen,
Clerk, Beethoven Orthodontic center (Left)
Bear C. Chen,
Associate Director, Beethoven Orthodontic Center (Center left)
Chris H. Chang,
Founder, Beethoven Orthodontic Center
Publisher, Journal of Digital Orthodontics (Center right)
W. Eugene Roberts,
Editor-in-Chief, Journal of Digital Orthodontics (Right)

maintained. However, that was not the case for the current patient. There was no space left for any restorations. Creating space for such procedures would be too expensive and make little sense from the patient's perspective. Since there were flared upper central incisors and blocked-in upper lateral incisors, the maxillary arch length deficiency could be solved by two-bicuspid extraction. The excessive

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

overjet could be solved with upper anterior bite turbos[6,7] in addition to Class II elastics.[8,9]

History and Etiology

A15-year-old female sought orthodontic consultation for an unesthetic smile. Intraoral examination revealed flared U1s, blocked-in U2s, and bilateral congenitally missing L5s. Both arches showed anterior crowding with an excessive overjet of 10mm (*Figs. 1-3*). There were no contributing dental trauma, oral habits, nor significant signs and symptoms of temporomandibular dysfunction.

Diagnosis

Skeletal:

- Skeletal Discrepancy (*SNA 81°, SNB 77°, ANB 4°*)

Facial:

- Facial profile: *Convex*
- Lip Protrusion: *Near normal lip profile (-1mm upper and -1mm lower to the E-Line)*
- Symmetry: *No midline deviation*
- Smile Line: *Despite the blocked-in U2s, the rest of the upper anterior dentition corresponded to the lower lip curvature.*

Dental:

- Occlusion: *Bilateral end-on Class III molar relationship*
- Overjet/overbite: *10mm/5mm*
- Congenitally missing teeth: *LR5, LL5*

The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 19 as documented in the supplementary Worksheet 1.[10]

Fig. 2:
Pre-treatment panoramic radiograph shows congenitally missing LR5 and LL5 (red ovals).

Fig. 3:
Pre-treatment cephalometric radiograph showing flared U1s and blocked-in U2s

Specific Objectives of Treatment

The treatment objectives were to: 1. correct flared U1s, 2. align U2s, 3. relieve crowded dentition, and 4. obtain bilateral Class I molar and canine relationships.

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

- Allow normal expression of growth in all three planes

Dentition:

- Achieve Class I molar relationship
- Level both upper and lower dentition
- Expand maxillary and mandibular width

Facial Esthetics:

- Decrease the convex profile

Treatment Plan

According to the extraction decision chart proposed by Chang,[11] extraction is viable for treating a case with flared upper central incisors, protruded lip, and increased mandibular plane angle. Since the patient was open to extraction, bilateral extraction of U4s was purposed in order to relieve the maxillary anterior crowding and flaring. With both lower second premolars congenitally missing, the extraction resulted in one missing premolar in each quadrant. Upper anterior bite turbos and Class II elastics were indicated to resolve the anterior-posterior relation between the jaws. Bilateral infrazygomatic crest (*IZC*) bone screws (*BSs*)[12] were also a feasible option if elastics alone were not able to correct the overjet. Both fixed and clear retainers were planned to retain the arches after active treatment. Extraction of all four third molars was also suggested (*Fig. 4*).

Treatment Progress

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA° (82°)	81°	81°	0°
SNB° (80°)	77°	77°	0°
ANB° (2°)	4°	4°	0°
SN-MP° (32°)	37°	37°	0°
FMA° (25°)	30°	30°	0°
DENTAL ANALYSIS			
U1 TO NA mm (4mm)	7	3	4
U1 TO SN° (104°)	110°	102°	8°
L1 TO NB mm (4mm)	3	6	3
L1 TO MP° (90°)	84°	103°	19°
FACIAL ANALYSIS			
E-LINE UL (-1mm)	-1	-2	1
E-LINE LL (0mm)	-1	0	1
%FH: Na-ANS-Gn (53%)	54%	55%	1%
Convexity:G-Sn-Pg' (13°)	16°	15°	1°

Table 1: *Cephalometric summary*

After the two maxillary first premolars were extracted, 0.022" slot Damon Q® passive self-ligating (*PSL*) brackets (*Ormco, Brea, CA*) were bonded on all upper teeth, and a 0.014" CuNiTi archwire was inserted. The torque selection for the upper central incisors and canines was high torque, while standard torque brackets were selected for the lateral incisors (*Fig. 5*).

To avoid the blocked-in U2s occluding on the mandibular brackets, bonding on the lower arch was postponed until the U2s were aligned into the dentition. Therefore, the upper arch was bonded two months before the lower arch. Meanwhile, two occlusal bite-turbos constructed with Fuji II® type II glass ionomer cement (*GIC*) (*GC America, Alsip IL*)

Fig. 4:
The treatment plan required extraction, anterior bite turbos, and Class II elastics. See text for details.

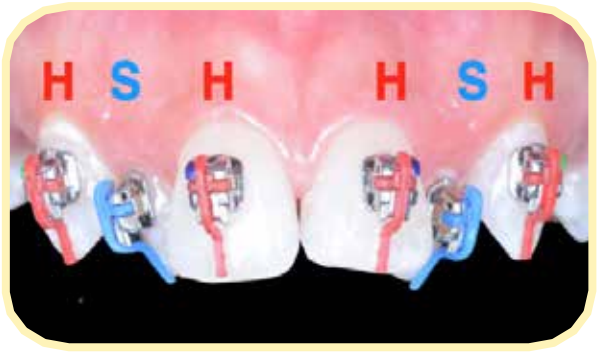


Fig. 5:
Torque selection for maxillary anterior teeth (H: high toque; S: standard torque)

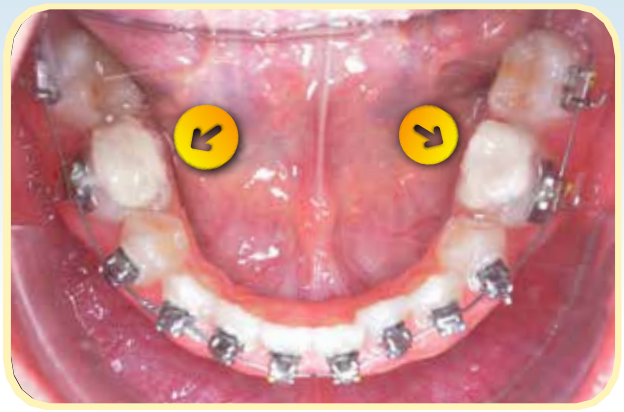


Fig. 6:
Glass ionomer cement was placed on L6s to increase the level of occlusion to prevent bracket interference

Fig. 7:
Anterior bite turbos were installed on U1s to reduce overjet.

were added on the L6s to increase intermaxillary space and keep the mandibular brackets from interfering with the maxillary occlusion (*Fig. 6*).

In the 4th month of treatment, anterior bite turbos were attached on the U1s to allow the mandible to occlude in a more anterior position to reduce the overjet (*Fig. 7*). In the same appointment, Class II elastics (*Parrot, 5/16", 2oz*) were attached to accelerate the process of reducing the excessive overjet. They were bilaterally attached from U3 drop-in hooks, passing inferior to the L6 brackets, and extending to

Fig. 8:
Class II elastics to facilitate anterior positioning of the mandible.

Fig. 9:
Figure-eight ties from canine to canine to bind anterior teeth as a group while closing extraction spaces.

Fig. 10:
13 months into treatment, all major problems were corrected. Power chain was kept in place from canine to first molar to keep the extraction sites closed.

L7 hooks. The elastics were extended to L7s rather than L6s to increase the horizontal force pulling the maxillary dentition backwards (*Fig. 8*).

In the 6th month of treatment, the bilateral occlusal bite turbos for gaining intermaxillary space were removed, and both upper and lower archwires were changed to 0.014x0.025" CuNiTi. A power chain was applied from UR3 to UL3 to consolidate and close spaces between them. In the 10th month, both archwires were changed to 0.017x0.025" TMA. Figure-eight ties were applied on both arches from canine to canine in order to fix anterior teeth as segments (*Fig. 9*).

In the 13th month, the primary problems - namely flared central incisors, blocked-in lateral incisors, and molar relationship - were significantly improved. Thus, at the same appointment, 0.016x0.025" SS archwires were fitted on both arches (*Fig. 10*). Three months later, in the 16th month of treatment, the lower wire was reversed for flattening the curve of Spee and achieving a better occlusion.

Another ten months were required to detail the occlusion. Intermaxillary elastics (*Chipmunk, 1/8", 3.5oz*) were utilized to correct the slight posterior scissor bite. The maxillary archwire was sectioned distally to the second premolars to increase posterior occlusal contacts. Inter-proximal reduction (*IPR*) was conducted on the maxillary central incisors to remove the black triangles and tighten the contact in-between teeth.

After twenty-five months of active treatment, all appliances were removed, and retention was

achieved with fixed and clear overlay retainers on both arches. Full treatment progress is documented in Figs. 19-22.

Treatment Results

After 25 months of active treatment, the blocked-in upper lateral incisors, flared upper central incisors, and crowding (*DI=19*) were corrected to an optimal alignment (*CRE=9*) as shown in the supplementary Worksheet 2. Treatment results are detailed in Figs. 11-15. The maxillary arch inter-molar width was decreased. The inter-canine width was increased as the upper molars were protracted while the canines were retracted. Class I molar and canine relationships were achieved. Compared to the protrusive upper lip before orthodontic treatment, the facial profile was near ideal to the E-line (*Fig. 11*). The right posterior occlusion was compromised because the LR7 was tipped medially as the LR8 erupted. Third molar extractions were suggested but the parents declined the procedure. The three-year follow-up evaluation documented the stability of the final occlusion (*Fig. 16*).

Fig. 11:
Pre- and post-treatment photographs showing lip position changes and overjet correction

From the superimposed cephalometric tracings (*Fig. 12*), the mandible was rotated clockwise, the vertical dimension was increased, and molars were extruded. These were due to the effect of anterior bite turbos and Class II elastics. The upper incisors were retracted 4mm by closing upper premolar spaces (*Table 1*). Discrepancy from an ideal occlusion was noted in the increased inclination of the lower incisors due to the influence of Class II elastics. Even though the lower incisors were more proclined, the occlusion was stable at the three-year follow-up (*Fig. 16*). The superimposed cephalometric tracings show increased mandibular ramus length, which seemed to be mandibular growth. Nonetheless, the age of this patient has to be taken into consideration.[13-15] Usually, the mandibular growth spurt in female occurs between 11 and 12 years of age (*Fig. 17*). There is little mandibular growth for a fifteen-year-old girl. Hence, the mandible was repositioned forward by the anterior bite turbos and Class II elastics, but whether there was true mandibular growth is uncertain.

The Pink and White esthetic score of 3 was due to wider upper central incisors, as shown in the supplementary Worksheet 3.[16] Full treatment progress is documented in Figs. 19-22.

Discussion

The treatment of this patient may appear intuitive, but the excellent result required a series of precise decisions. Below are some notable keys for success in the correction of this type of malocclusion.

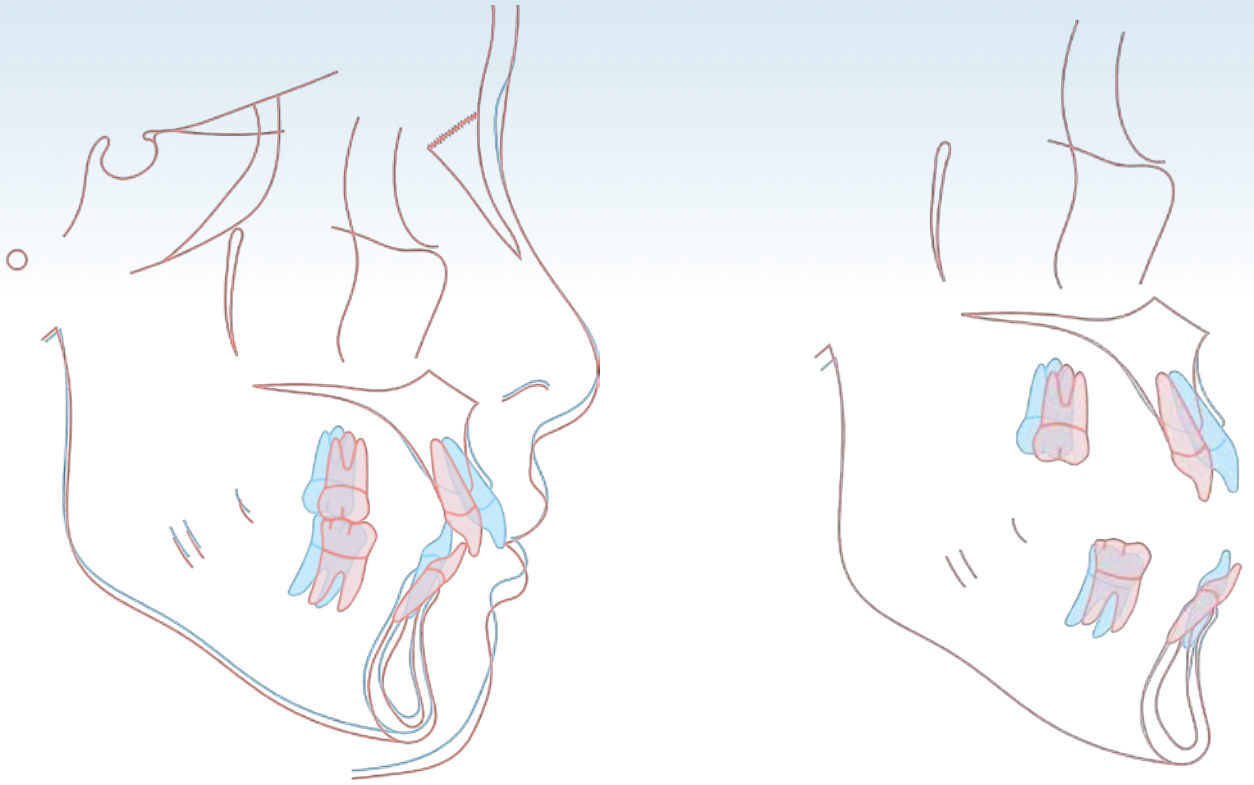


Fig. 12:
Superimpositions of the cephalometric tracings before (blue) and after (red) treatment document the clockwise rotation of the mandible, increased vertical dimension, molar extrusion, U1s retraction, and increased inclination of the L1s. See text for details.

Torque Selection

Torque is an applied moment that leads to tooth rotation.[17] When retracting anterior teeth to close extraction spaces, upper anterior teeth are prone to tip distally.[18] To compensate for this, high-torque brackets were chosen for the upper central incisors. Aligning blocked-in lateral incisors resulted in labial flaring. Thus, the torque selection for lateral incisors remained standard. Due to their location in the arch, canine roots usually lodge into the buccal cortical bone as they are retracted, so high-torque brackets were chosen for the canines (*Fig. 5*).

Anterior Bite Turbo and Class II Elastic

The mechanism of anterior bite turbos plus Class II elastics is similar to the mandibular advancement seen with Twin block, Frankel appliance, and clear aligners. Repositioning the mandible forward during puberty can stimulate growth of the condyles and ramus, which can decrease the discrepancy between the maxilla and the mandible.

Another critical step in this treatment was to attach Class II elastics in the same appointment as when anterior bite turbos were added. Anterior bite turbos were bonded to shift the mandible forward and to create vertical spaces in the posterior area for molars

Fig. 13: *Post-treatment facial and intraoral photographs*

Fig. 14: *Post-treatment cephalometric radiograph*

Fig. 15: *Post-treatment panoramic radiograph*

Fig. 16: *Three-year follow-up showing the stability of the final occlusion*

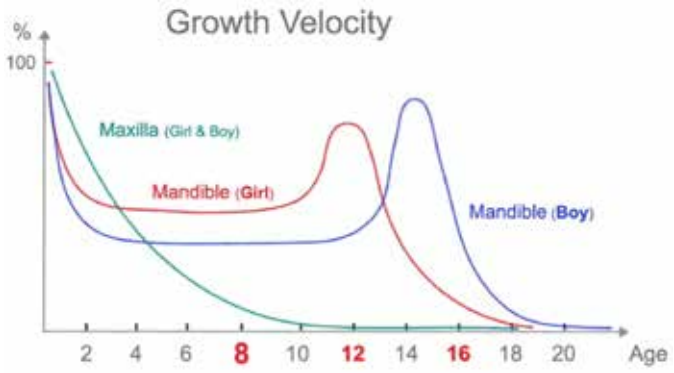


Fig. 17: *Growth curve of mandible and maxilla for both genders (Courtesy of Dr. Kazuto Kuroe)*

to extrude by virtue of the shape and thickness of the bite turbos.[18] Due to their sloped shape, the anterior bite turbos provided guidance for lower central incisors to slide forward and occlude in a protracted position so as to reduce the overjet. In this way, the overbite would not deepen as the upper anteriors were retracted to close the extraction spaces. Class II elastics were implemented to facilitate backward rotation of the maxilla and forward motion

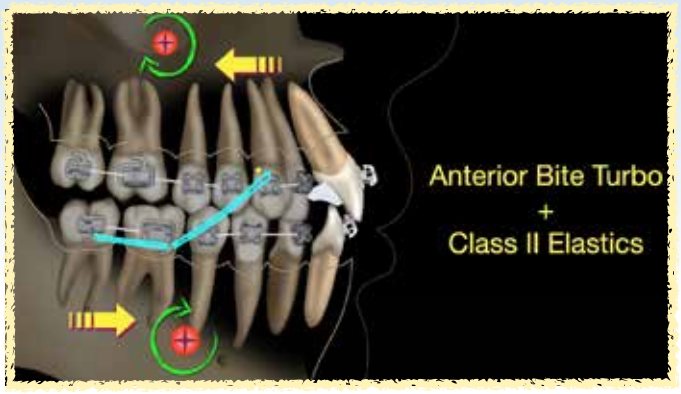


Fig. 18: *Mechanism of anterior bite turbo and Class II elastics*

of the mandible to bite on the anterior bite turbos, and thereby to foster lower molar extrusion (*Fig. 18*).

Space Closure without Deepening the Bite

Generally, it is inevitable that the bite becomes deeper after closing extraction space (*drawbridge effect*). This is a particularly crucial point for the present patient because she already had a deep bite. With upper bicuspid extraction, her anterior overbite and curve of Spee should be carefully controlled and monitored during treatment. The key was to close the space with 0.016x0.025" stainless steel wire. Anterior bite turbos were also necessary to maintain the interincisal relationship. Since there was play within the system, bending a reverse curve of Spee in the main archwire compensated for some torque loss. With adequate precautions, extraction and subsequent space closure is a routine strategy to improve alignment.

Conclusions

Assessing the etiology of a malocclusion is the first step for establishing an optimal treatment plan. As

bilateral U2s were blocked-in, and flared U1s with excessive overjet were also present, bicuspid extraction was a viable choice to provide sufficient space for upper anterior teeth retraction. Anterior bite turbos and Class II elastics were synergistic for repositioning the mandible forward and reducing the overjet.

***Fig. 19**:*
Treatment progression from the frontal view. Deeper overbite is inevitable for upper bicuspids extraction cases. However, thanks to anterior bite turbos, the overbite was maintained.

***Fig. 20**: Treatment progression from the right buccal view. U4s were extracted to relieve upper anterior crowding.*

***Fig. 21**:*
Treatment progression from the left buccal view. The bite turbos on LL6 and LR5 were made of GIC type II in order to open the bite and spare mandibular brackets from being interfered by maxillary teeth. Class II elastics were applied to decrease overjet.

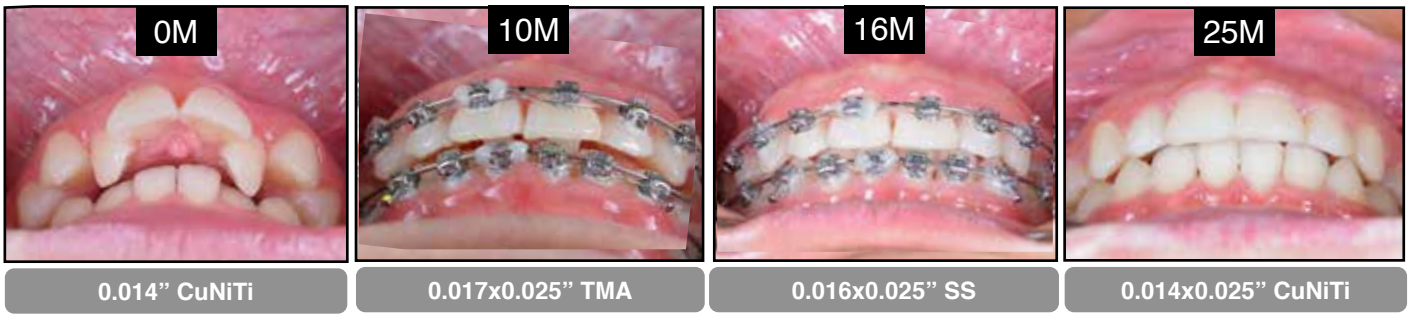


***Fig. 22**:Treatment progression of the overjet. Overjet was decreased and blocked-in U2s were corrected within 10 months.*

References

1. Rakhshan V. Congenitally missing teeth (hypodontia): A review of the literature concerning the etiology, prevalence, risk factors, patterns and treatment. Dent Res J 2015;12(1):1.
2. Goya H, Tanaka S, Maeda T, Akimoto Y. An orthopantomographic study of hypodontia in permanent teeth of Japanese pediatric patients. J Oral Sci 2008;50(2):143-50.
3. Al-Ani A, Antoun J, Thomson W, Merriman T, Farella M. Hypodontia: An update on its etiology, classification, and clinical management. BioMed Res Int 2017;2017:1-9.
4. Polder B, Van't Hof M, Van der Linden F, Kuijpers-Jagtman A. A meta-analysis of the prevalence of dental agenesis of permanent teeth. Community Dent and Oral Epidemiol 2004;32(3):217-26.
5. Bahrami M, Saleh Saber F, Hendi A. Comprehensive treatments for congenitally missing teeth and generalized diastema. Case Reports in Dentistry 2017;2017:1-5.

6. Deregibus A, Debernardi CL, Persin L, Tugarin V, Markova M. Effectiveness of a fixed anterior bite plane in Class II deep-bite patients. Int J Orthod Milwaukee 2014;25(1):15-20.

7. Kravitz N, Jorgensen G, Frey S, Cope J. Resin bite turbos. J Clin Orthod 2018;52:456-61.

8. Liu CW, Chang CH, Roberts WE. Class II deep bite malocclusion with posteriorly-inclined incisors. Int J Orthod Implantol 2012;25:32-42.

9. Pitts T. Begin with the end in mind: bracket placement and early elastics protocols for smile arc protection. Clin Impressions 2009;17:4-13.

10. Cangialosi T, Riolo M, Owens S, Dykhouse V, Moffitt A, Grubb J et al. The ABO discrepancy index: a measure of case complexity. Am J Orthod Dentofac Orthoped 2004;125(3):270-8.

11. Chang CH, Roberts WE. Orthodontics Vol. 1 [E-reader version]. Hsinchu: Newton's A; 2012.

12. Chang CH, Lin LY, Roberts W. Orthodontic bone screws: A quick update and its promising future. Orthod Craniofac Res 2020;24(S1):75-82.

13. Gomes A S, Lima E M. Mandibular Growth during Adolescence. Angle Orthod 2006;76:786–90.

14. Björk A. Timing of interceptive orthodontic measures based on stages of maturation. Trans Eur Orthod Soc 1972:64-74.

15. Thilander B, et al. Roentgen-cephalometric standards for a Swedish population. A longitudinal study between the ages of 5 and 31 years. Eur J Orthod 2005;27(4):370-89.

16. Su B. IBOI Pink & White esthetic score. Int J Orthod Implantol 2013;28:80-5

17. Archambault A, Lacoursiere R, Badawi H, Major P, Carey J, Flores-Mir C. Torque expression in stainless steel orthodontic brackets. Angle Orthod 2010;80(1):201-210.

18. Tseng L, Chang CH, Roberts WE. Correction of a full cusp Class II malocclusion and palatal impingement with intermaxillary elastics. Int J Orthod Implantol 2015;38:54-72.

Discrepancy Index Worksheet

TOTAL D.I. SCORE: 19

OVREJET

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. 9.5mm	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. Per tooth = 0

Total = 5

OVERBITE

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

Total = 2

ANTERIOR OPEN BITE

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

Total =

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. 6mm (upper)	=	4 pts.
> 7 mm.	=	7 pts.

Total = 4

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side _____ pts.
Full Class II or III	=	4 pts. per side _____ 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° 37° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° 84° = 1 pt.

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

Total = 0

OTHER (See Instructions)

Supernumerary teeth	_____ x 1 pt.	=
Ankylosis of perm. Teeth	_____ x 2 pts.	=
Anomalous morphology	_____ x 2 pts.	=
Impaction (except 3rd molars)	_____ x 2 pts.	=
Midline discrepancy (≥ 3mm)	@ 2 pts.	=
Missing teeth (except 3rd molars)	_____ x 1 pt.	=
Missing teeth, congenital	2 x 2 pts.	= 4
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: Congenitally missing LR5, LL5

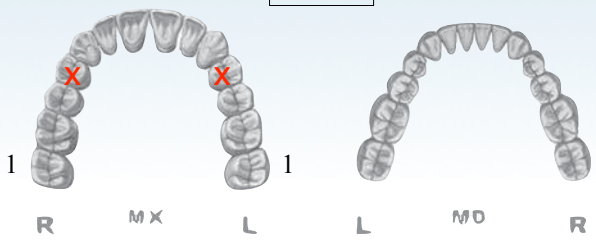
Total = 4

Cast-Radiograph Evaluation

Total Score: 9

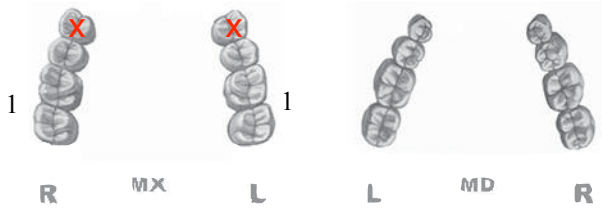
Alignment/Rotations

2



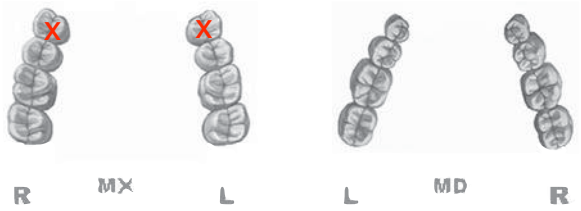
Marginal Ridges

0



Buccolingual Inclination

0

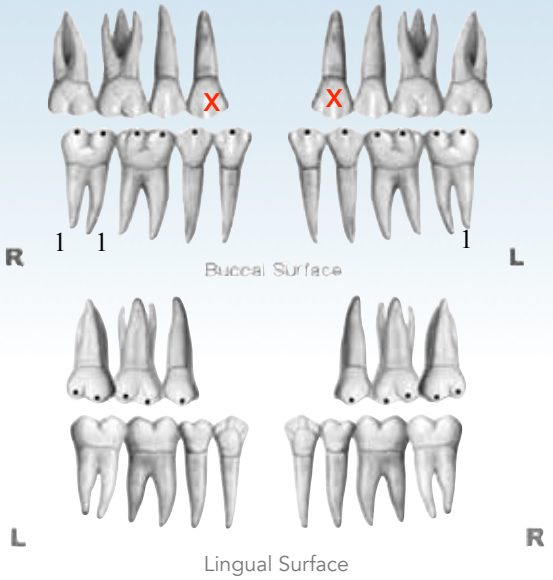


Overjet

0

Occlusal Contacts

3

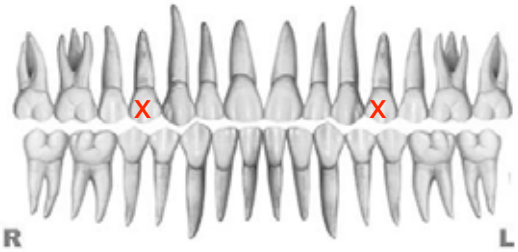


Occlusal Relationships

2

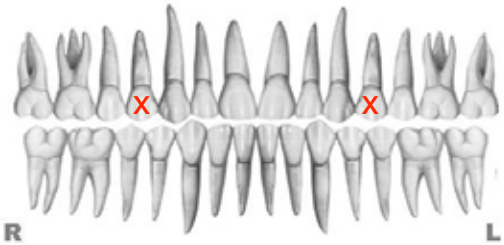
Interproximal Contacts

0



Root Angulation

0



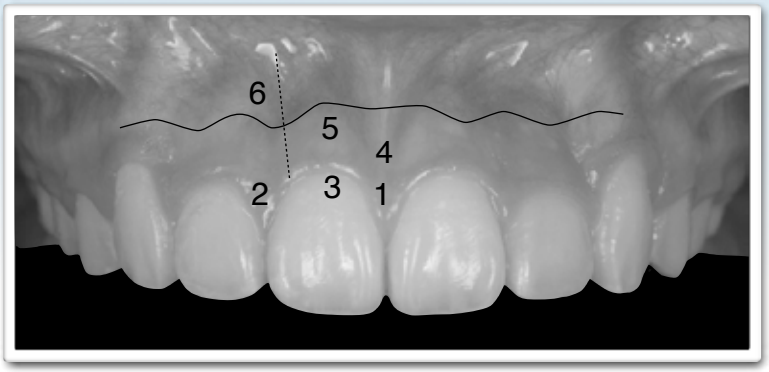
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 2

1. Pink Esthetic Score

Total = 0

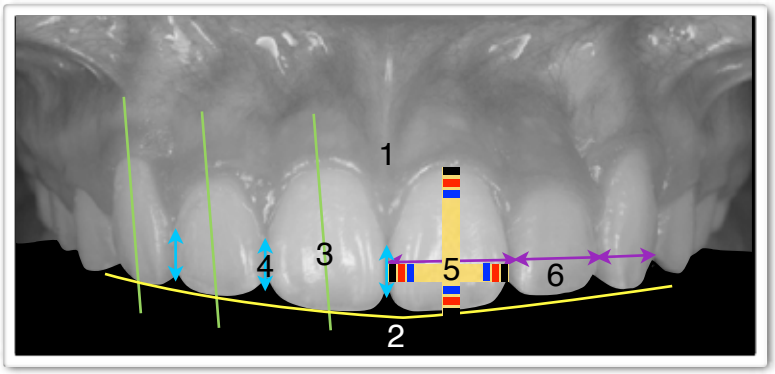


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

2. White Esthetic Score (for Micro-esthetic)

Total = 2



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

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

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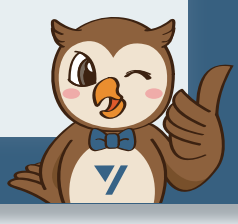

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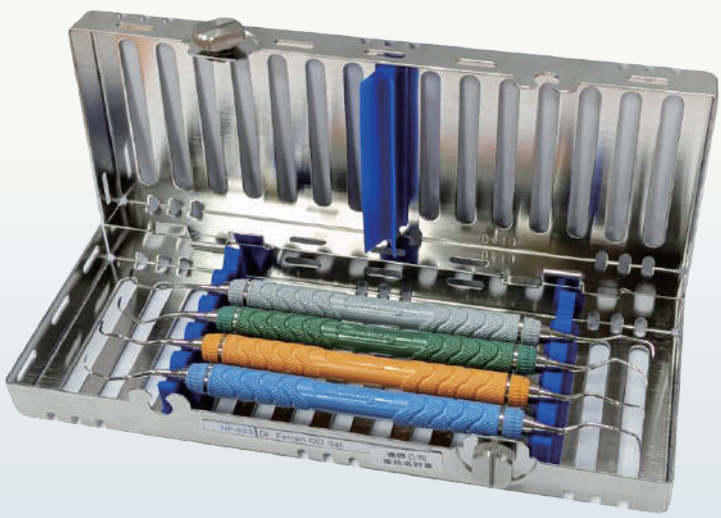

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5. Finishing bending & fixed retainer

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1. Four stages of efficient orthodontic treatment
2. Simple and effective anchorage system
3. Extraction vs. Non-extraction analysis

Practice: Patient photo management

Module 3 - 5/12

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

Practice: Ceph tracing

Module 4 - 6/2

1. Excellent finishing
2. Retention & relapse

Practice: Ceph superimposition & measurement

Module 5 - 6/16

1. Simplify your system
2. Extraction vs. non-extraction

Practice: Case report demo

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2. Class II correction

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

Topic: Modfied VISTA (蘇筌瑋醫師)

Module 8 - 9/15

1. ABO DI, CRE workshop
2. Open bite

Topic: Modified 2X4 appliance in ortho treatment (徐玉玲醫師)

Module 9 - 9/29

1. Asymmetry
2. Implant-ortho combined treatment
3. Interdisciplinary treatment-adult complex cases

Topic: Interdisciplinary approach (邱上珍醫師)

Module 10 - 10/13

1. Minor surgeries in orthodontics
2. Digital orthodontics

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

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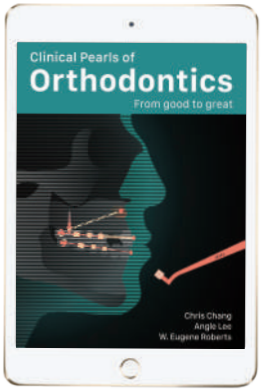

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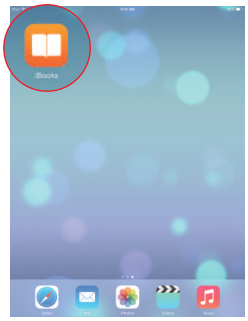

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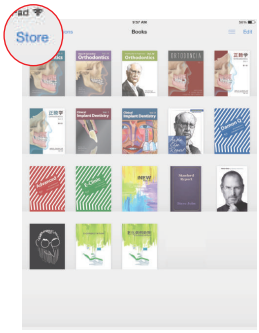

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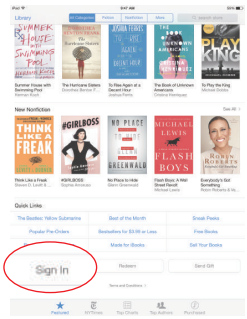

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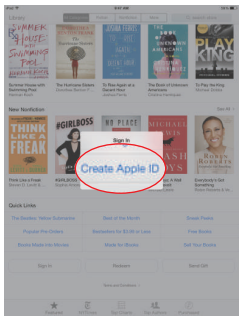

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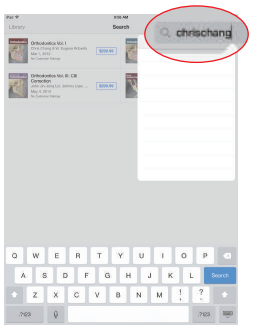

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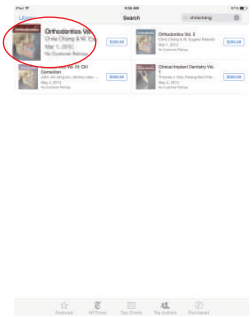

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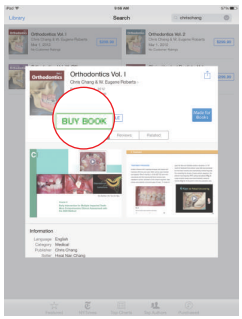

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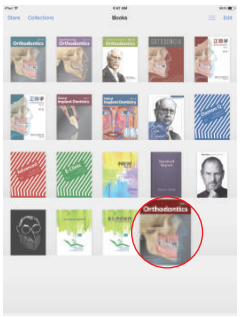

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A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 2

Part II

Edward Hartley Angle (1855–1930) had essential gifts of mechanical genius and dexterity, but these traits alone could not have brought him the status of singular greatness in the history of modern orthodontics. There were many other similarly talented individuals interested in "orthodontia" during the specialty's early years. It was Angle's bold, creative drive and his confident powers of persuasion in introducing new and simplifying devices, new methods, and new nomenclature that distinguished him from his peers, then and now.

The Writer

As a writer and speaker, Edward Angle was a precise wordsmith, a lecturer of great fluency, and a master at descriptive and colloquial speech (Fig. 1). His letters contained within the Angle document archives (1899–1910) were spiced with sentences of rich humor and painterly narrative.[1:37-38;2:35;3:196-197] He enjoyed using dialect[1:751–753] and dry sarcastic wit[1:25;2:123] to great effect in his letters, after the fashion of his revered contemporary, Mark Twain. By 1909, after his triumphant return to the East Coast as a moneyed celebrity in New York, Angle exuded proudly the prosperity he earned as the fruit of his labors - his orthodontic book-writing skills and appliance development ingenuity.[3:305-306] He gleefully boasted to friends and colleagues about the unmitigated success of his brainchild: "Orthodontia is on the boom."[3:305]

Angle's style of writing was largely verbal: his letters (and probably his speeches) were dictated

Fig. 1:
Edward H. Angle at his writing desk in his Pasadena, California home, mid-1920s.

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Corresponding author: Dr Sheldon Peck, Clinical Professor of Developmental Biology, The Harvard School of Dental Medicine. Boston, MA 02115
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Accepted: February 2009. Submitted: February 2009.

Sheldon Peck

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Clinical Professor of Developmental Biology, The Harvard School of Dental Medicine, Boston, Mass.

Private practice, Newton, Mass.

to and transcribed by his talented secretary (and later, second wife), Anna Hopkins. He was gifted with the turn of phrase, using colorful language in original ways, and often waxing effusively in a highly readable way.

Some observers have suggested that Anna deserved much of the credit for the high quality of Angle's written record through her significant literary input during typing. There is absolutely no evidence to support this assertion, given the admirable consistency of Angle's literary output, handwritten as well as typewritten, even during periods when Anna's absence was known, such as when she was attending the College of Dentistry at the University of Iowa from 1900 to 1902. Angle's letters to Anna are just as colorful and articulate as the rest of his correspondence.[2:152-154] However, Anna did provide valuable technical skills and judgment. She knew how to craft solid, well-spelled, grammatically correct text. She likely served as a trusted sounding board for her exuberant boss, and she surely must have woven some subtle corrections and softened phrases into his sometimes acerbic commentaries. Dr. Angle often appended his own handwritten corrections, notes, or comments to the final typewritten letters. And to almost all addressees, including some close relatives, he hand-signed his letters boldly as "Edward H. Angle." Only with old friends would he let go and sign a creative or diminutive nickname. At rare times during the 1899 to 1910 period, Anna would sign his letters in his absence. Her version of his signature is rather authentic-looking, but still recognizably not his own.

For a period in 1901-1902, when Anna Hopkins was away at the University of Iowa studying for her dental degree, Angle's correspondence was managed by his younger sister, Lillian, an accountant by occupation. The technical quality of the letters that "Lillie" attempted to transcribe during that time was noticeably weaker, and Angle knew it. He had to apologize often to his correspondents for lateness and errors, and he resorted to handwritten corrections and appended notes more frequently.[2:254]

Angle recognized that some of the commonplace vocabulary employed in orthodontia could be false or misleading. For example, the world of orthodontia that Angle entered in the 1880s was one engaged primarily in "tooth regulation," procedures, and mechanisms geared to make crooked teeth less irregular. Hardly any attention was given by the patient or doctor to the role of occlusion or bite discrepancy in the etiology of tooth irregularities. Early on, Angle became convinced that anomalies of molar occlusion were prime factors in the origins of most orthodontic

problems, including dental crowding. Thus, he took the bold step of popularizing the word "mal-occlusion" in the late 1890s, around the time he was creating his landmark work "Classification of Malocclusion." Published in 1899, that article brought order out of chaos, simplicity from existing diagnostic complexity, transformations that Angle's creative mind seemed particularly adept at seeing and doing. Quickly, he changed the title of his textbook from a prosaic "The Angle system of regulation and retention of the teeth …" (1890–1899) to the then ground-breaking concept, "Treatment of malocclusion of the teeth …" (1900, 6th edition).

Angle was a perfectionist whose painstaking exactness in his scientific thinking and writings became a hallmark of his lifetime of work in orthodontics. His detailed letters to managers and book editors of the SS White Dental Manufacturing Company show him as a polymath with a remarkable understanding of the tasks of typesetter, illustrator, and publisher.[3:82-90] Angle edited his book six times over, modifying and adding to it every time, as his own expertise developed and progressed, turning what began as a 20-page article in 1887 into a 628-page text in 1907. He always seemed to be at work on an address, an illustrated presentation, or publication. He prepared by hand many of his intricate drawings and by 1900 had a library of over a thousand glass lantern-slides for projection. Besides his well-known textbook editions, Angle wrote around 80 articles for publication in various professional journals in the United States, Europe, and Australia between 1887 and his death in 1930.[3:766-772] In addition, during his lifetime, close to 100 abstracts and commentaries about his work were published.[3:772-775] Another 150 articles are recorded in the indexed scientific literature about Edward Angle and his legacy, and this number continues to grow.[3:775-784]

In addition to his own writing, Angle's letters show that he served enthusiastically as a mentor in scientific writing and editing, long before the era of peer review. He generously volunteered ideas and topics for former students and colleagues, including one of his first four students, Milton T. Watson,[1:203-205] longtime friend William J. Brady,[1:211] and brother-in-law/editor Cy Camp,[2:240-241] who was essential in the final editing and proofing of the sixth edition (1900) of Angle's textbook. Angle conscripted all of them and three other colleagues to write popular articles to increase public awareness of the young specialty of orthodontia in the first decade of the 20th century.[2:214-216]

Minneapolis merchants, Robert Foster and Otto Keidle, remained close friends with the Angles from their formative years there. In the Angle letter archive from 1899 to 1910, "Bob and Otto" (also called "White Child and Baron") received some of the most entertaining yarns and homespun dialects from an Edward Angle at his charmingly best.[1:1-3] Angle, who no longer used his childhood name "Hart" with newly acquired friends, still often signed off humorously as "Rube" or "Reuben" or the like.[2:294] In his well-written personal ramblings to friends, Angle's broad and deep nonprofessional interests in people, poetry, literature, history, and the world came through clearly.[1:103,151-152;2:232]

The Inventor

Edward H. Angle's correspondence and patents reveal features of the most dynamic side perhaps of this multidimensional man: the rapt and consummate inventor, a human wellspring of new ideas (Fig. 2). During his lifetime, Angle applied for and received 45 patents (his wife Anna obtained his 46th patent in 1934, four years after his death). Most were appliances and instruments related to clinical orthodontics, but they included laboratory equipment and a novel automobile wheel. His contemporary role models were likely among the new breed of inventive, risk-taking industrialists, such as Thomas Edison, George Eastman, and Charles Kettering. America led the world by the beginning of the 20th century in technological innovation and entrepreneurship. In the first years of the 1900s, American medicine was ablaze with new light and directions for the medical and dental community. At Johns Hopkins University, William Osler initiated creative reforms in clinical education and single-handedly systematized the field of internal medicine. At Northwestern University, Greene Vardiman Black introduced the nomenclature of tooth anatomy and the modern principles and tools of operative dentistry.

Edward Angle's rationale for patenting his inventions was to take legal claim of his ideas and to protect his business interests.[1:126-128;3:372] However, many of Angle's colleagues criticized him for the zeal with which he protected his breakthrough appliances and systems for doing "tooth regulation" and "orthodontia" more easily. Patent protection certainly makes sense in today's high-stakes environment of corporate espionage and intellectual property rights, but in Angle's time, patenting - particularly in medicine - was viewed in many circles as selfish and mercenary.

Angle's enthusiasm for advancing the materia technica of orthodontics was so strong that he freely mentored, encouraged, and worked with colleagues in their efforts to develop new appliances. This is seen in Angle's letters to Henry A. Baker of Boston in which he praises the "Baker method of anchorage"[1:229] and later seeks to protect Baker's professional reputation as the first to use intermaxillary anchorage[2:667-669,784] against equal claims made by Calvin S. Case of Chicago. It is also apparent in his letters to E. L. Townsend where he encourages Townsend to write and publish articles concerning Townsend's idea for a prosthetic bridge appliance.[2:622] Angle worked

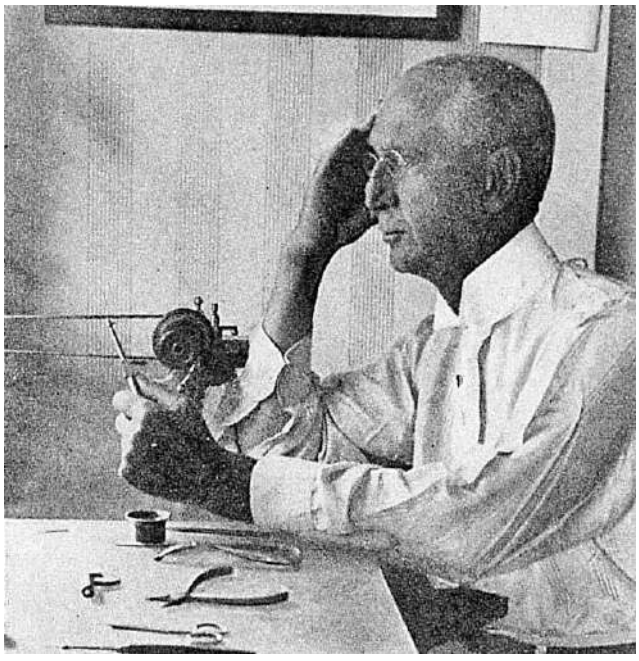

Fig. 2: *Dr. Angle, the inventor, at his workbench in Pasadena, mid-1920s. There is evidence that he was ambidextrous in his prodigious mechanical skills.*

cooperatively with several of his former students to develop orthodontic appliances and instruments: Jacob Lowe Young, Spencer R. Atkinson, and Albert H. Ketcham each jointly held patent rights to one or more inventions with Angle.* Furthermore, trusting the biomechanical acumen of his former student Milton T. Watson, Angle asked him to try out competitors' orthodontic appliances and to conduct a comparative study and report back to Angle with his conclusions.[2:279-280]

Angle, the enterprising innovator, worked and reworked designs to develop the best appliances. As President of the E. H. Angle Regulating Appliance Company, incorporated in St. Louis in May 1907, he kept track of the work of other inventors active in the budding field of orthodontia and maintained a folder with relevant patents filed by others. Within the 11-year record of correspondence covered by the Angle letter archives, he relentlessly hounded those he perceived as idea stealers, patent infringers, and plagiarists - Drs. Clarence D. Lukens, James N. MacDowell, and Miland Knapp, and manufacturers Julius Aderer, Claudius Ash, and Blue Island Specialty Company. In anger, he slapped some with lawsuits and inflammatory defamations.

The age-old rule that brilliant inventors make poor business people did not apply to Edward H. Angle. He was in fact the consummate, confident businessman, maximizing income and minimizing expenses. Angle was a demanding taskmaster in his detailed letters to the machinists to whom he outsourced appliance manufacture at various times: William Hahn, the Hardinge brothers, and John E. Canning. They were required to fabricate his devices with tight tolerances and on tight budgets.† He held the SS White Dental Manufacturing Company, which by 1895 became the exclusive distributor of the Angle System, to a rigorous Angle-controlled business relationship. His detailed handwritten invoices from the "E. H. Angle Regulating Appliance Co." show his (and Anna's) arithmetic accuracy in billing to the penny, making a lie of his schoolboy reputation of being weak with numbers.

The Professional

Dr. Angle was an inspiring teacher and professional role model for his students. His patients saw him as a devoted, caring, and hard-working doctor. His acquaintances and friends viewed him as an upstanding citizen with personal magnetism and delightful wit (Fig. 3a & b). He focused a large measure of his life to fostering and molding orthodontics as a self-standing specialty, a profession unto itself. The whole purpose of his Angle School of Orthodontia was to create a community of professionals locally, nationally, and internationally. As he expressed it, "Besides making this an ideal school for teaching this interesting science, I want it to be more than that. I want each class to be a federation of friends and enthusiastic workers for the new science."[2:288]

With unsurpassed content and style, and a growing network of influential former students touting his greatness, Edward H. Angle was in great demand as

* References 3:590-593, 608-615, 699-703.

† References 1:35, 71-73, 144-145; 3:407-408.

a lecturer. He was a passionate and informed speaker, and had descriptive visuals to project about orthodontia that most presenters did not have. His treatment approaches were ingenious for his time. Many of his ideas, such as the buccal tube and the "edgewise" mechanism, have survived the test of time and are still fresh and useful in everyday modern orthodontics. During his St. Louis and New London years documented in his letter archive, he kept a full schedule of speaking engagements and actually turned down many invitations to speak. Those lectures he wrote about are cited in the Angle Archives book under the subject index entry for "Speaking Engagements."[3:815]

Angle was a mentor in the fullest sense of the word. He continued to provide direction and advice to his students long after they completed his course. He spent time writing friendly instructive letters particularly to some of his favorite early graduates, including Lloyd S. Lourie,[2:321] Milton T. Watson,[1:265–266] and Guilhermena Mendell.[3:396] Several of his students (e.g., Norman Reoch and Herbert Pullen) stayed on for a while after graduation to be Angle's office assistants, permitting more interaction and learning.[1:320;2:689]

Encouraging letters with personal advice were exchanged with colleagues who did not graduate his course, but for whom he had a liking. For example, he had a rich correspondence mentoring two dentists whom he taught in the late 1890s at Marion-Sims College of Medicine in St. Louis, and who spent some time in his office before the creation of the Angle School: Herman T. Spann[2:38-39] in Germany and Arthur C. Edmonds[1:208-210] in South Africa. Angle wrote

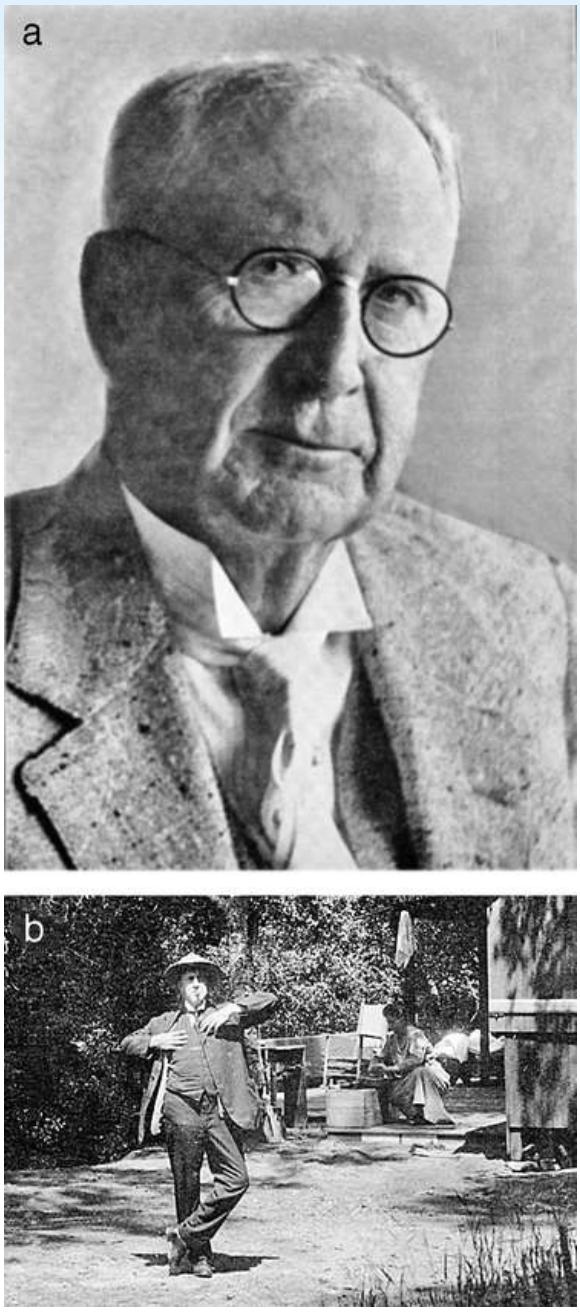

Fig. 3:
(a) Despite his somewhat austere look, always dressed in starched wing collar and tie (portrait photo, mid-1920s), Edward Angle's letters reveal him as a person of great sociability, charm, and wit.
(b) Here, he clowns for the photographer at his cabin in the San Gabriel Mountains near Pasadena, while Anna prepares food in the background (1919).

supportive words even to former students who dropped out of his course for personal reasons, such as E. H. Stanley[1:607] of Seattle, Washington. Perhaps his most tender counseling was the support and encouragement he gave his secretary Anna Hopkins to attend dental school, graduating from the University of Iowa in 1902.[2:152-154] Afterward, she returned under Angle's wing as an informal student and teacher at all future sessions of the Angle School, although she never actually practiced dentistry or orthodontics. Their famous compatibility and years of teamwork blossomed into a lasting marriage in 1908.

Edward Angle, who raised his opinionated voice about so many things and people in his professional sphere, was surprisingly apolitical. Comments in his letters about current events, personalities, and world affairs were remarkably rare. Of the little we may deduce, he was a pacifist who avoided politics and detested imperialism.[1:625-626]

His idealism about orthodontic education was anchored deeply in his bones. Angle was generous in giving free advice to inquiring doctors,[2:396-398] and he proudly proclaimed that he "never received a farthing" directly off his school.[3:432] That was indeed true. His altruism was partly driven by his perception that orthodontia needed a legion of trained practitioners in order to be recognized as a specialty. He also knew that the more orthodontists he trained to use his appliances, the better would be his chances for a lifetime annuity from appliance-sale royalties. Therefore, he taught many financially strapped students without charging them tuition.[2:362,479;3:420] In 1902, he wrote of his dream to run a free-of-charge school, for both student and patient.[2:451] Twenty years later, in Pasadena, the Angle College of Orthodontia became his dream-come-true with complete financial support provided by his grateful alumni, many of whom remembered Angle's generosity to them when they most needed it.

Paradoxically, as much as Angle was a practicing idealist about access to education based on merit, he was intractably stuck in the 19th century on some professional issues of the day, such as fee-splitting and student decorum. Through 1908, his last days in St. Louis before his retirement from the active practice of orthodontia, Angle routinely gave 20% of his specialist's fee to the referring general dentist as a commission. Thus, he wrote many short perfunctory letters to accompany his checks to the referring doctors. This kind of kickback scheme was standard practice in American medicine at the time, but the times were changing rapidly at the beginning of the 20th century. New graduates rejected fee-splitting practice as unethical, and soon it was completely outlawed. Early in the life of the new American Society of Orthodontists (ASO), this problem was confronted, to the dismay of Dr. Angle and many of his older contemporaries who viewed the issue as trivial. Regarding the behavior of students, Angle demanded military-style obedience and agreement on the part of his Angle School students. Four of his students in 1906 questioned Angle's lectures to such a vocal extent that he expelled them all from his course. This matter became a cause célèbre at the ASO Board of Censors, who ultimately sided with one of the dismissed students (Hubert C. Visick) and prompted ASO founder Edward H. Angle to resign with characteristic 19th-century gravitas.[3:342,505-507]

On the other hand, Angle showed a sympathetic, almost paternal concern for his patients.[1:73-74,109-111,112–114] Some he tried to coax into better cooperation with well-chosen words in his letters. Others he gently or not-so-gently prodded because of missed appointments or nonpayment of account. He personally seemed to know much about each member of his family of patients. He enjoyed establishing some lasting doctor-patient relationships in which patients continued to correspond with Angle long after treatment and even after his retirement from practice.[3:260-261]

Summation

As a coda, can anything be presented about multi-faceted Edward H. Angle - short of recommending perusal of his extensive papers published in the Angle Archives multi-volume sourcebook - to highlight further the persona and world of this legendary figure in the history of medicine? Today, almost 80 years after his death on August 11, 1930, those who knew Dr. Angle personally are deceased, too. Through the inexorable progression of years, Edward Angle, like others of olden fame, has faded from being a familiar personality to being merely a recognizable name. Two illuminating tributes from close contemporaries offer personal reflections on the man.

One was written by Martin Dewey, DDS, MD, who stood among the most accomplished of Angle School graduates. It was published as his editorial for the first issue of *The International Journal of Orthodontia* in 1915, when Angle was approaching 60 years of age:

It is well known that Dr. Edward H. Angle is the Nestor of orthodontia. To him, more than to any other individual, is this science indebted. His life has been spent nursing and developing it.

To practically every dentist today throughout the world, orthodontia is synonymous with Dr. Angle's name. Few men have the privilege of living to see the child of their creation in science develop to that degree of efficiency which orthodontia now so rightly enjoys. Most pioneers in the field of science only find the trail; Dr. Angle not only blazed the trail, but he today enjoys the rare pleasure of seeing this pathway trodden by the multitudes who seek information at this shrine.

All those who have had the privilege of intimate acquaintance with Dr. Angle know how jealously he has guarded orthodontia. To keep it out of the hands of the incompetent and thus prevent it being besmirched by faulty results has been his one ambition. To this end he has constantly striven, constantly lifted his voice, and constantly cautioned his students throughout the length and breadth of the land.

The International Journal of Orthodontia *in this, its initial number, pays a tribute of respect to the work of this great man. His ideals of service, of thoroughness, of care and attention to detail, perfect results, and devotion to one's work, will ever be its motto.*

In the final analysis, Anna Hopkins Angle, DDS, may have given us the best simple characterization of Dr. Angle. She knew this complex man better than anyone did. In 1932, two years after Angle's death, she submitted a solicited biographical sketch of her famous husband for *The National Cyclopædia of American Biography*. In addition to the requisite dates, places and happenings, she inserted three defining sentences that probably reflected how the Angles wished Edward Hartley Angle would be remembered. Her earnest words, understandably hagiographic, still express one of the most fitting tributes we may bestow on this extraordinary prime mover in the evolution of orthodontics:

> *Dr. Angle was a thinker of vision and imagination and a lover of the beautiful in character, art, and nature. He was fond of children, literature, and outdoor life. He lived and worked intensely and gave always the best his mind and hand could evolve to advance the profession of which he was the founder and leader.*

REFERENCE

Numbers in superscript in this article refer to related Angle letters (volume:page) as published in the comprehensive archival publication cited: Peck, S. ed. The World of Edward Hartley Angle, MD, DDS: His Letters, Accounts and Patents. 4 Volumes. Boston, Mass: E.H. Angle Education and Research Foundation; 2007. ISBN 978-0-9779524-0-3; available on a nonprofit basis at angle@allenpress.com.

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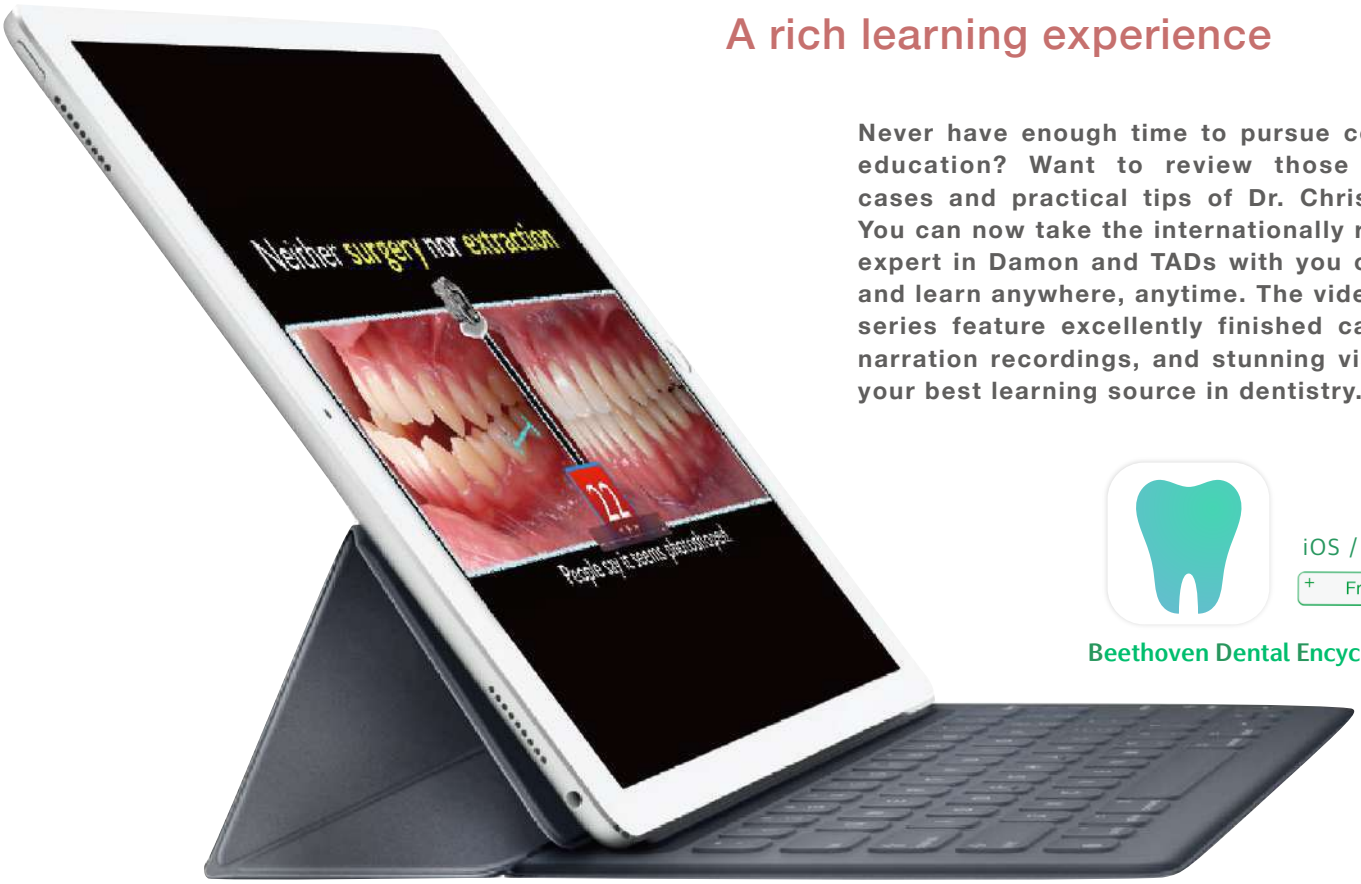

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Chapter 3. Rooftop Aviary

I don't feed the birds because they need me; I feed the birds because I need them.
— Kathi Hutton

Fig. 1: Dr. Chang's rooftop aviary makes use of a relatively redundant space of only 13m². With waist-high glass walls and wire mesh ceilings, air circulation is ensured while providing a shield against the winter winds.

Birdwatching has long been enjoyed as a recreational, as well as social activity. In the course of locating then observing different species of birds while appreciating each of their distinct sounds, birdwatchers find relaxation, refreshment, as well as excitement while immersing themselves in nature. What if such mental and spiritual satisfaction could be kept close at hand, right on your rooftop? Imagine waking up to the chirping of canaries and budgerigars that blend in with the local birdsong, golden pheasants and quail pecking on the grains by your feet, while Gouldian finches and cockatiels welcome you with their rainbow colors and bubbly hospitality.

An aviary is a creative and exciting way to make use of any spare outdoor space, especially if these feathered friends spark joy within your heart. The aviary on the Changs' rooftop uses a relatively redundant corner, measuring only around 13m². Originally set up to be a separate plantation area from the rooftop garden, it was designed with a complete drainage system, practically identical to the one in the garden, including drainage trays, non-woven cloth, and suitable planting materials (see Chapter 2 for details). The construction of the aviary has been designed with waist-high glass walls at the bottom and wire mesh walls and ceiling (Fig. 1) to ensure ventilation while providing a shield against the colder winter winds (after all, it is HsinChu - the Windy City - we are talking about!)

There are three keys to building a rooftop aviary: (1) a close-to-nature design, (2) easy maintenance, and (3) approachability. To start off, as previously mentioned in our last edition - *Wildlife Habitat for Quail* - an environment that is designed to replicate their natural habitat is important for undomesticated animals that are to be accommodated around the household. As the base of the aviary is an open soil ground, plants can grow freely without the limitations of planting containers, giving them higher chances to thrive. Dr. Chang ingeniously chose sweet potato

Fig. 2: Four Gouldian finches snacking on some homegrown sorghum. Take just one look at them, and it is self-explanatory as to why they are also called rainbow finches.

leaves as the main plant to cultivate, and the reasons are three-fold. First, sweet potato leaves are a type of climber, and once the leaves reach the top the of the aviary, they create natural shade so that the birds will have somewhere cool to hide from the direct summer sunlight. Secondly, they are edible and extremely fast-growing. Not only do the birds get to nibble on them, the Changs also enjoy their own sustainable supply of organic sweet potato leaves. Lastly, like any other plants, they benefit from animal droppings, specifically the nitrogenous matters in the droppings. This brings us to the second key point - easy maintenance of the aviary.

Once the natural waste-to-nutrient circulation has been formed, there is no need to manually dispose of the bird droppings. Periodically, Dr. Chang adds fresh sand to the aviary ground, not just to cover up the remaining droppings but also to accelerate the decomposition process. For the water supply, we can see yet another pinch of Dr. Chang's ingenuity. Positioned under a dripping tap, what seems to be a bird bath fountain is actually a 3-tier dessert tray (Fig. 6). As the tap water gently descends from the top to the bottom, each tier is constantly refreshed with clean water for the birds to drink, play, and bathe in. To ensure easy maintenance, it is important that the dessert tray is raised from the ground, by stacking rocks or bricks underneath, to prevent quail and pheasants - the naughty sand-diggers - from getting the bottom tier muddy.

Fig. 3: Research found that black-headed Gouldian finches are amiable and even passive while their red-headed counterparts are more aggressive and competitive. Such a difference correlates with the fact that black-headers are often seen in a natural environment where resources are plentiful, whereas red-headed Gouldian finches are more likely found where survival is difficult.

(Illustrations by Jenny Chang)
(Sourced: Gouldian finch head feathers coloring. Retrievable at: http://www.gouldianfinches.eu/en/genetics/genetics-and-mutations-in-gouldian-finches/mutations-and-inheritance-of-head-coloring/)

Fig. 4: A male golden pheasant with stunning plumage. Dr. Chang jokingly named this pheasant Trump for its golden head feathers.

Fig. 5: A female golden pheasant has a much duller plumage, but her air is still incomparable. By her feet are some wiggling mealworms, which are added to the birds' diet for more nutrient.

Fig. 6: A 3-tier dessert tray is placed under a trickling tap to provide fresh water for the birds to drink, play, and bathe in.

Fig. 7: Bird houses, tree branches, wire, and sticks are hung on the ceiling of the aviary, providing nibbling toys and perching spots for the birds to enjoy.

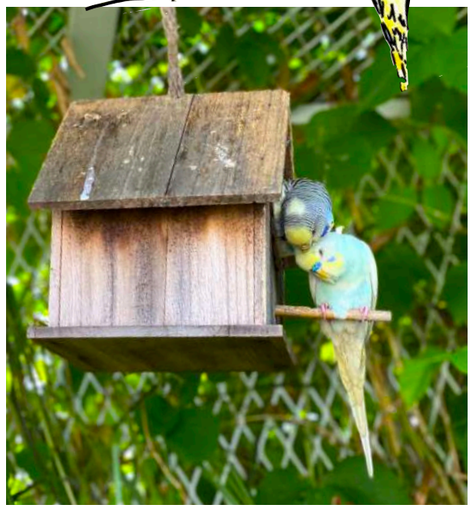


Fig. 8: Budgerigars, also affectionately known as budgies, pair up to mate and raise off-springs. The pair stays together unless parted by natural or human causes.

Fig. 9: Nature is full of amazement. In front of such a joy-filled aviary, there is hardly anyone who can resist the temptation to press their noses against the glass and take in everything the nature has on display.

The third key to a rooftop aviary is its approachability, and not just in the sense of distance. The aviary has to be friendly for both its feathered residents and the human admirers so that the pleasure can shared and enhanced reciprocally. Bird houses, tree branches, and wires bent into different shapes can be easily fastened to the aviary ceiling thanks to the wire mesh, serving as nibbling toys or resting spots for the birds to perch and rest on in the course of their exploration in the aviary. Whatever fun they are having will be shared with their fascinated audience, whose noses are pressed against the glass walls (Fig. 9).

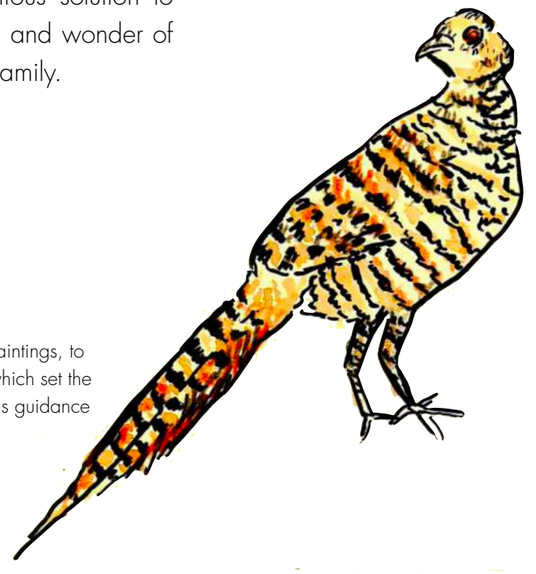
An aviary designed to imitate its residents' natural habitat is an ingenious solution to maintenance. With the housekeeping aspects of caring simplified, the fun and wonder of keeping an aviary have definitely been maximized for Dr. Chang and his family.

Desk editor of JDO & a wildlife enthusiast*

Annie Chen

* Title bestowed by Dr. Chris Chang

Special thanks to Jenny Chang for the exquisite paintings, to Kristine Chang for providing written information which set the foundation for this article, and to Chester Yu for his guidance on typesetting.



「慧根，會跟」— 國際大師

• 本文發表於國防醫學院牙醫學系八十週年系慶專刊 — 「校友專訪」單元，經同意轉載。*(J Digital Orthod 2021;64:)*

■圖一：受訪當日與陳福裕總會長夫婦合影

張慧男醫師，生於 1961 年的雲林鄉村。小學念了七年，在畢業前，不會說國語，也沒穿過布鞋。在 30 歲赴美國攻讀博士前，也不曾開口說過英文。國外深造後回台時，身無分文，靠著與銀行貸款開業。

二十多年後的今日，以其幽默感、優美的幻燈片以及精湛的牙科技術和高效率的教學方法，跳脫傳統牙科教學的框架，於國內及二十多個國家進行演講，並開設線上國際性牙醫課程。自 1996 年陸續創立貝多芬牙醫集團旗下的矯正、植牙、一般牙科和兒童牙科等診所。出版八本矯正、植牙相關之電子書和《賈語錄》、《川語錄》、《慧根，會跟》，分享人生哲學和成長歷程。並於 2009 年獲選《商業周刊》百大良醫。

I am a NIKEST!

訪談中提到張慧男醫師在美國留學期間的趣事時，伴隨著他招牌自信的眼神，張醫師脫口而出「I am a NIKEST!」，進行訪談的學生們一頭霧水。NIKEST 是什麼呢？

張醫師離鄉背井於美國深造時，多數矯正醫師同學們為富家子弟，因此校內經常會舉辦高爾夫球賽。張醫師原本並沒有接觸過高爾夫球，在得知只需兩支球桿便能報名比賽後，勇敢地參加了比賽。起初同學們看著張醫師不熟練的技術，嘲諷著他「愚蠢的亞洲人」，但張醫師並不氣餒，每日利用時間固定練習。在博士畢業前，順利在高爾夫球比賽中獲得冠軍，讓原先瞧不起張醫師的

■圖二：
張醫師於 2021 貝多芬青少年高爾夫球賽與主辦同仁合影

文｜ 沈秉毅 林子祺 D76
帶訪老師｜ 黃仁勇 陳福裕

同學們另眼相待。至今張慧男醫師依舊保持著每日練習高爾夫球的習慣，並創立了擁有國際積分認證的貝多芬青少年高爾夫球比賽。

「Just do it」一定是大家耳熟能詳的標語，這個標語便是 Nike 運動品牌銷售全球各地的口號。張醫師在美國的友人幫他取了個綽號叫「Nikest」，象徵著張醫師「Just do it」、「說做就做」，積極進取的態度。「多做多錯，點滴改進，盡心盡力，要求效率，努力探索」，正是張醫師得以不斷在傳統牙科中突破的必勝心法。

興趣與生活的結合

提到事業、家庭和生活的平衡，張醫師答道，「沒有人是可以真正平衡」的，例如愛因斯坦，在科學上有如此的成就，卻不是一個好父親，一生沒有見過自己兒子幾次。張醫師笑稱，「還好自己並不夠成功，家庭顧的還不錯，生活中也不忘進行自己的興趣。」

至於張醫師的興趣眾多，包括彈吉他、拉小提琴、打高爾夫、攀岩，而在繁忙的一天中如何分配工作和興趣的時間呢？張醫師擅於將興趣結合於自己生活的事物中，「早上起床第一件事就去拉小提琴，看電視時一定彈吉他，洗澡前一定練習高爾夫球，睡前最後一件事也是拉小提琴。」張醫師打趣的說，「日常生活中不可能不洗澡、

■圖三：張醫師於自宅與家中的有機庭園合影

不睡覺吧？」他將自己的興趣融入自己日常生活的一環，因此他的興趣並不會花多餘的時間，就不須「抽出」時間來了。

與真正的高手過招！

張慧男醫師說，頂尖的高手都會擁有更多的興趣與專長，若要進步，要向高手學習。但高手不多，必須眼睛放亮，找出真正的高手並向其學習。

張慧男醫師人生中遇到最重要的貴人，便是他高爾夫球的球友，陸晉德先生。陸晉德先生擁有過於常人的智慧，張醫師首次於高爾夫球場遇見陸晉德先生，便非常佩服其上知天文、下知地理的聰明才智，特別是他的投資理財能力，讓張醫師

■**圖四**：張醫師線上國際演講實況

尤其佩服。當時的陸先生已在享受退休生活，張醫師從與他的聊天中獲益良多，也對張醫師日後退休生活的規劃產生偌大的影響。因此張醫師認為陸晉德先生是真正的高手，也稱他為自己的人生導師。

對後輩的勉勵

「樂觀的人在每個危機裡看到機會，悲觀的人在每個機會裡看見危機。」— 前英國首相溫斯頓・邱吉爾。

機會很多，不要抱怨，並且善用智慧去做抉擇！

■**圖五**：2018 年巴西演講時，張醫師與聽眾合照

2021-2022 第十三年度

貝多芬 矯正精修班

時間：週二上午 09:00-12:00

地點：金牛頓教育中心（新竹市建中一路 25 號 2 樓）

上課日期：

2021 6/8、7/13、8/24、9/14、10/19、11/9、12/14

2022 1/11、2/15、3/15、4/12

- **09:00 ~ 10:00 精選文獻分析**
- **10:00 ~ 10:30 精緻完工案例**
- **10:50 ~ 12:00 臨床技巧及常犯錯誤分享**

全新的第十三年度 2021-22 貝多芬精修班，是由國際知名講師張慧男醫師主持，並偕同貝多芬牙醫團隊住院醫師群共同主講。

每月一次的課程之中，包含了：

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

2021-22 貝多芬精修班內容豐富精彩，讓您經由每個月一次的課程，在面對各式的臨床案例時，更能游刃有餘、得心應手。

學習目的：

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

報名專線：03-5735676 #218

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

Dr. John JJ Lin, Taipei, Taiwan

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

Dr. Tom Pitts, Reno, Nevadav, USA

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

Dr. Javier Prieto, Segovia, Spain

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

Dr. Don Drake, South Dakota, USA

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Dr. Ron Bellohusen, New York, USA

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

Dr. Errol Yim, Hawaii, USA

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

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New Release!

Dr. Chang live-streaming with Ormco, Russia on 11, Sep., 2021, sharing his orthodontic jouney with aspiring talents from the younger generation.