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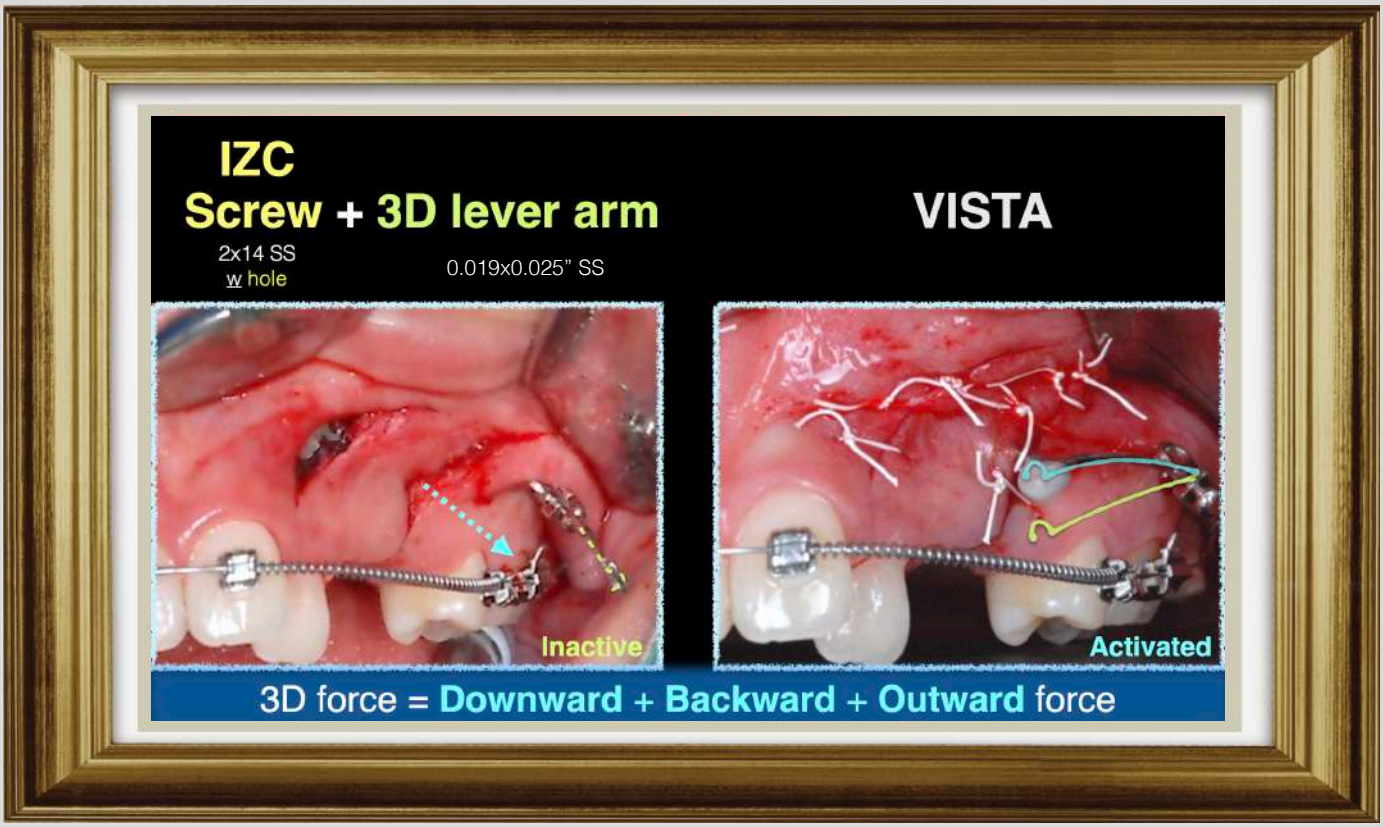

A 3D lever arm is anchored by an OrthoBoneScrew® and is designed to produce a downward, backward, and outward force to recover the impacted canine. On the left view, the device is inactive (green dotted line), with the force vector needed indicated with a blue arrow. On the right, the device is activated by attaching the lever arm to the impaction through a button and a power chain.

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2023-24 熱愛學矯正

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

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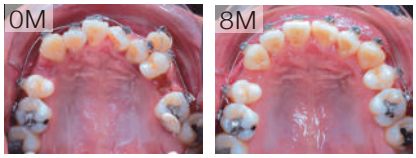
Damon Master

(Thu) 9:00-17:00 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 and result evaluation. Combining in-class teaching assistants, after-class video review and chair-side observation, participants will learn to master the essential tips of the Damon System.

2024

Module 1 - 3/28
Module 2 - 4/11
Module 3 - 4/25
Module 4 - 5/16
Module 5 - 5/30
Module 6 - 6/20
Module 7 - 6/27
Module 8 - 7/11
Module 9 - 7/25
Module 10 - 8/29
Module 11 - 9/19



Damon + .014 Cu NiTi

Excellent Finishing

(Tue) 9:00-12:00 中文授課

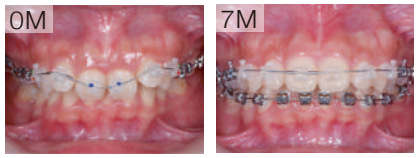
Critically reviewing classical literature and contemporary papers and applying lessons learned to clinical work; utilising ABO's DI and CRE standards to turn excellent finishing into attainable goals.

Finishing XV

Module 8 - 11/7/23'
Module 9 - 12/19
Module 10 - 1/9/24'
Module 11 - 3/12

Finishing XVI

Module 1 - 4/16
Module 2 - 5/21
Module 3 - 6/18
Module 4 - 7/9
Module 5 - 8/13
Module 6 - 9/10
Module 7 - 10/22
Module 8 - 11/5
Module 9 - 12/10
Module 10 - 1/14/25'
Module 11 - 2/18



Damon Clear

Screws & Aligners

International Workshop English Class

The workshop demonstrates how to incorporate TADs and minor surgeries in complex orthodontic treatment, combining world-class lectures, model and surgical hands-on practices, and clinical observation.

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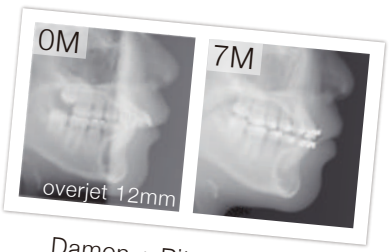
2024

Class - 11/26-28



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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The New Way of Learning

Recently, I was invited to give a two-day lecture in Turkey, after which the organizer arranged a visit to Cappadocia, an ancient city in Turkey renowned for its unique hills and recognized as a UNESCO World Heritage Site. We spent three days there enjoying the incredibly beautiful scenery. Apart from visiting the city's main attractions, we also flew in a hot air balloon ride soaring above the landscape, making it a very enriching journey. When the journey had ended, I reflected on the entire trip to Turkey and asked myself: Was it worth it to experience such a fantastic place? The answer is obviously a resounding yes. However, another question also arose: Is it worth the effort to travel all the way to distant Turkish destinations? The answer is a clear **NO**. If you happen to be there, visiting Cappadocia is a must, but it is not worth going out of your way to visit such a remote place. To appreciate the beauty of Cappadocia, there are many videos on YouTube that offer even more spectacular and beautiful views than your firsthand experience. It genuinely does not require so much time and effort to go there.

This conclusion made me think about the two-day lecture in Turkey. Was it worth traveling so far to deliver this two-day lecture? The answer is a definite **NO**. If I were asked to do it again, I think delivering the course via online video from home would suffice. In hindsight, there was no need to travel so far. Similarly, for those dentists attending the course, I believe there was no need to go to that specific location for in-person lectures. If there is a genuine desire to learn, then that is usually accompanied by self-motivation and a focus to study the required knowledge accordingly, rendering the need for face-to-face lectures redundant.

My journey to Cappadocia has made me realize that many things in my professional journey should be accomplished in the most straightforward way. Regarding orthodontic education, online video conferences are an excellent method of learning, as is uploading instructional videos on YouTube for motivated individuals to study. As technology advances, the necessity to travel to distant locations to engage in hands-on learning diminishes.

What does not change, however, is the need for us as professionals to keep advancing our orthodontic skills and techniques as we continue our journey along the path to glory.

Chris Chang PhD, ABO Certified, Publisher of JDO

Full-Cusp Class II Malocclusion with 12 mm Overjet: Non-Extraction Treatment with Bone Screws and Passive Self-Ligating Appliance

Abstract

History: *A 12-year-old female presented with flared maxillary central incisors.*

Diagnosis: *The skeletal Class I relationship (SNA, 85˚; SNB, 80˚; ANB, 5˚) was associated with a full-cusp Class II molar relationship on the right side and an end-on Class II molar relationship on the left side. Dental analysis revealed flared maxillary central incisors (U1-to-NA, 10 mm; U1-to-SN, 128.5˚) with an excessive overjet of 12 mm. The facial profile was convex with protrusive lips (1.5 mm/4.5 mm to the E-line). The Discrepancy Index was 20.*

Treatment: *A fully fixed passive self-ligating (PSL) appliance was bonded on all present permanent teeth (UR6-UL6 and LL6-LR6). Skeletal anchorage was provided by bilateral infrazygomatic crest (IZC) miniscrews. Class II elastics were implemented to reduce the overjet and overbite.*

Results: *After 22 months of active treatment, satisfactory facial profile and dental alignment were achieved. The Cast-Radiograph Evaluation score was 18, and the Pink and White esthetic score was 0.*

Conclusions: *A full-cusp Class II malocclusion with 12 mm overjet, flared U1s, 100% overbite, and periodontal impingement was treated without extraction. Bilateral IZC anchorage facilitated the retraction of the entire maxillary dentition. The 12 mm overjet was corrected to a pleasing result with stability noted at the 5-year follow-up. (J Digital Orthod 2023;72:4-18)*

Key words:
Excessive overjet, full-cusp Class II malocclusion, periodontal impingement, Class II elastics, infrazygomatic crest miniscrews, passive self-ligating appliance, interproximal reduction

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, permanent teeth are numbered 1-8.

Traditionally, an overjet greater than 10 mm required orthognathic surgery for optimal correction.[1,2] To correct full-cusp Class II malocclusions with lip and incisor protrusion, bicuspid extraction is the usual option in non-surgical treatment planning.[3] In this case report, however, a full-cusp Class II malocclusion with a 12 mm overjet was treated to a pleasing result with neither surgical intervention nor extraction. The primary objective for this case report is to present a conservative option for treating this challenging malocclusion.

History and Etiology

A 12-year-old female sought orthodontic consultation for bimaxillary protrusion. Extraoral examination showed protrusive lips with a trapped lower lip. Intraoral examination revealed an

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Publisher, Journal of Digital Orthodontics (Center right)
W. Eugene Roberts,
Editor-in-Chief, Journal of Digital Orthodontics (Right)

excessive overjet of 12 mm associated with flared U1s and 100% overbite complicated by periodontal impingement (Figs. 1-5). No contributing dental trauma, oral habits, nor significant signs or symptoms of temporomandibular dysfunction were noted.

Diagnosis

Skeletal:

- Intermaxillary relationship: *Skeletal Class I relationship (SNA, 85°; SNB, 80°; ANB, 5°)*

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

Fig. 2:
Pre-treatment panoramic radiograph. Unerupted upper second molars were noted.

Fig. 3: Pre-treatment cephalometric radiograph

- Mandibular plane angle: *Within normal limits (WNL) (SN-MP, 36.5°; FMA, 29.5°)*
- Vertical Dimension of Occlusion (VDO)*: WNL (Na-ANS-Gn, 54.5%)*

Facial:

- Convexity: *Convex profile (G-Sn-Pg', 14.5°)*
- Symmetry*: WNL*

Fig. 4:
Inferior (a) and left lateral (b) intraoral views show a 12 mm overjet, periodontal impingement, and flared maxillary anterior teeth.

- Lip Protrusion: *Protruded upper and lower lips were 1.5 mm/4.5 mm to the E-line.*

Dental:

- Classification (molar relationships)
  Right side: *Full-cusp Class II;*
  Left side: *End-on Class II*
- Overjet: *12 mm*
- Overbite: *5 mm 100% overbite with periodontal impingement*

The American Board of Orthodontics (ABO) Discrepancy Index (DI) was 20, as documented in the supplementary Worksheet 1.[4]

Treatment Objectives

The treatment objectives were to correct:

(1) 12 mm overjet,

(2) impinging overbite,

(3) protrusive maxillary dentition,

(4) flared maxillary anteriors,

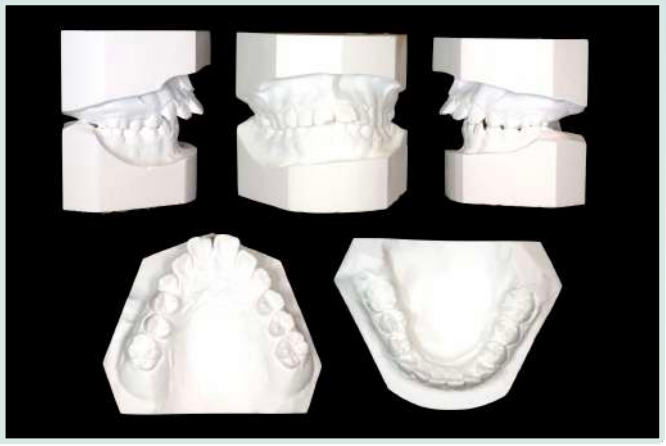

Fig. 5: Pre-treatment dental models (casts).

(5) protruded upper and lower lips, plus

(6) Class II molar and canine relationships.

Treatment Plan

To correct the full-cusp Class II molar relationship with an excessive overjet, adequate space was necessary to retract the entire maxillary dentition.

Three treatment options were proposed:

(1) Try non-extraction treatment for 12 months with bilateral infrazygomatic crest (IZC) bone screws inserted to retract the maxillary dentition.[5]

(2) Extract U4s with bilateral IZC bone screws inserted to retract the maxillary dentition.

(3) Extract U4s and L4s, and close spaces.

After a thorough explanation of the advantages and disadvantages of the different treatment plans, the patient chose treatment plan (1), fully aware that bicuspid extraction was indicated if progress was not adequate after the initial 12 months of treatment.

CEPHALOMETRIC SUMMARY			
	PRE-TX	POST-TX	DIFF.
SKELETAL ANALYSIS			
SNA° (82°)	85°	84°	1°
SNB° (80°)	80°	81.5°	1.5°
ANB° (2°)	5°	2.5°	2.5°
SN-MP° (32°)	36.5°	38°	1.5°
FMA° (25°)	29.5°	31°	1.5°
DENTAL ANALYSIS			
U1 TO NA mm (4 mm)	10	3	7
U1 TO SN° (104°)	128.5°	107°	21.5°
L1 TO NB mm (4 mm)	2	2.5	0.5
L1 TO MP° (90°)	79°	82.5°	3.5
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	1.5	-2.5	4
E-LINE LL (0 mm)	4.5	0.5	4
%FH: Na-ANS-Gn (56%)	54.5%	55%	0.5%
Convexity: G-Sn-Pg' (13°)	14.5°	10.5°	4°

Table 1: Cephalometric summary

Treatment Progress

0.022" slot Damon Q® passive self-ligating (PSL) brackets (Ormco, Brea, CA) were bonded on all teeth except for the unerupted U7s and L7s. 0.014" CuNiTi archwires were inserted in both arches; low torque was selected for both the maxillary and mandibular anteriors (Fig. 6). Class II elastics (Quail, 3/16", 2 oz) were then applied to reduce the excessive overjet in the early stage of treatment:[6] they were bilaterally attached from U4 drop-in hooks to L6 buccal hooks (Fig. 7) and were discontinued 1 month after application. The maxillary archwire was changed

from 0.014" CuNiTi to 0.014x0.025" CuNiTi in the 3rd month (3M) of treatment.

After 4 months (4M) of initial alignment, 2x12-mm OrthoBoneScrews® (iNewton Dental, Inc., Hsinchu City, Taiwan) were placed bilaterally in the infrazygomatic crests (IZCs) (Fig. 8). These bone screws anchored a continuous retracting force to retract the maxillary dentition. The maxillary and mandibular archwire sequences were: 0.014x0.025" CuNiTi, 0.017x0.025"TMA, and 0.016x0.025" SS.

Interproximal reduction (IPR) was performed in the 6th month (6M) on both maxillary and mandibular incisors (Fig. 9) in order to (1) gain space to relieve crowding, (2) reshape the tooth forms, and (3) eliminate black triangles after alignment.[7-12]

After 12 months (12M) of treatment, both canine and molar relationships were significantly improved (Fig. 10). The overjet was reduced from 12 to 0 mm. The brackets on the L4s and L5s were re-bonded to more gingival positions, and the mandibular archwire was thus changed back to 0.014x0.025" CuNiTi.

Bilateral IZC bone screws were removed in the 14th month (14M) of treatment. L7s were erupted and bonded. A composite resin restoration was performed on UR1 to fix the incisal edge defect.

In the 20th month of treatment, the maxillary archwire was sectioned distal to the canines, and drop-in hooks were inserted from U3s to U5s (Fig. 11). Continuous intermaxillary elastics (Ostrich, 3/4", 2 oz, full-time) were prescribed to settle the occlusion. Archwire adjustments were performed on both maxillary and mandibular archwires for detailing and

Fig. 6:
Torque selection: Low torque for both (a) maxillary anteriors and (b) mandibular anteriors.

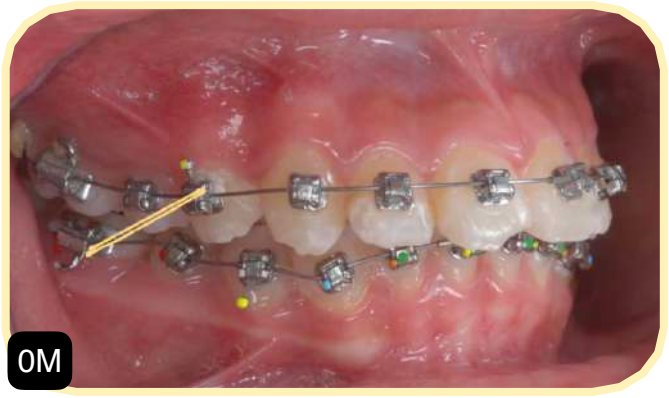

Fig. 7:
Class II elastics were attached bilaterally from U4 drop-in hooks to L6 buccal hooks to facilitate reduction of the excessive overjet (0M~1M).

Fig. 8:
IZC screws (arrow) were inserted bilaterally in the 4th month to retract the maxillary dentition (4M~14M).

Fig. 9:
Interproximal reduction (IPR) was performed: (a) before IPR; (b) after IPR.

Fig. 10:
Class I canine and molar relationships were almost achieved by the 12th month (12M). The overjet was reduced to 0 mm.

Fig. 11:
Finishing and detailing: maxillary archwire was sectioned distal to the canines with archwire adjustment. Continuous intermaxillary elastics (Ostrich, 3/4", 2 oz, full-time) were prescribed to settle the occlusion (20M).

finishing. After 22 months of active mechanics, all appliances were removed (Figs. 12-15).

Retention

Lingual fixed retainers were bonded on the lower incisors, and Essix overlay retainers (Densply Sirona, Charlotte, NC, USA) were delivered on both arches.

Treatment Results

A Class I occlusion with an ideal overbite and overjet was achieved. The ABO Cast-Radiograph Evaluation (CRE) was 18 points (Worksheet 2).[13] The Pink and White esthetic score was 0 (Worksheet 3).[14] Compared to the protrusive lips before orthodontic treatment, the facial profile was nearly ideal to the E-line (Fig. 15).

From the superimposed cephalometric tracings (Fig. 16), three points were noted. (1) The maxillary incisors were retracted 7 mm, which decreased the U1-SN angle by 21.5° (Table 1). (2) U6s were retracted. Such a huge amount of maxillary retraction could be attributed to the continuous retracting force provided by the IZC screws and the arch expansion effect of the Damon system application. (3) The mandibular incisors were slightly flared by an increase of 3.5° in the L1-MP angle with mandibular molar extrusion, attributable to the effects of Class II mechanics and non-extraction after relieving the crowding.

Follow-up

The whole treatment progress, along with follow-up records, documents the stability of the final occlusion (Figs. 17-20).

Fig. 12: Posttreatment facial and intraoral photographs

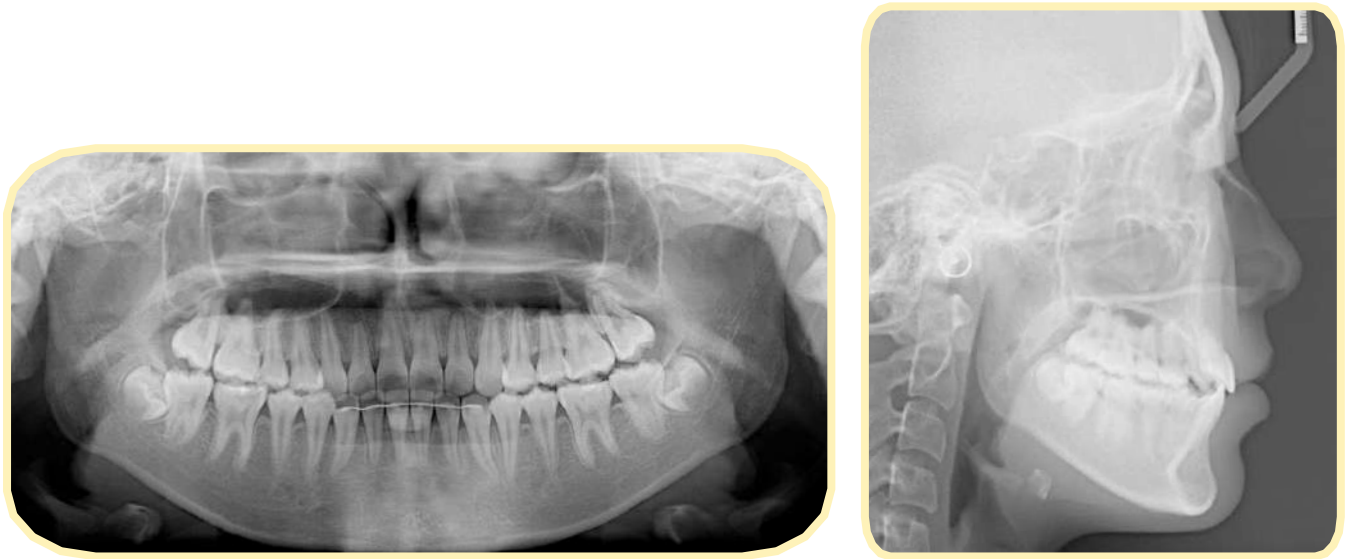

Fig. 13: Posttreatment panoramic (left) and cephalometric radiographs (right)

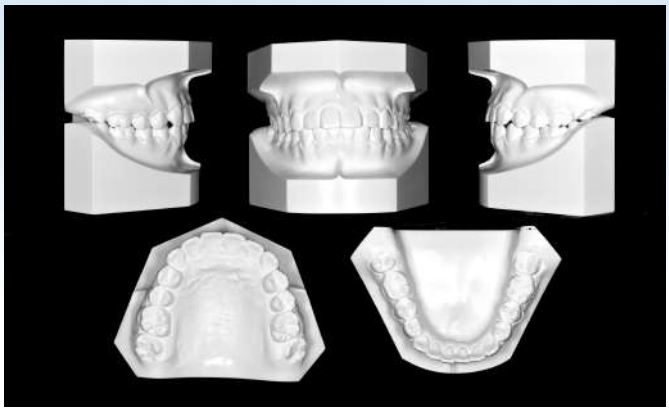

Fig. 14 Posttreatment dental models (casts)

Fig. 15:
Pre- and posttreatment photographs showing changes in the lip position and correction of the excessive overjet

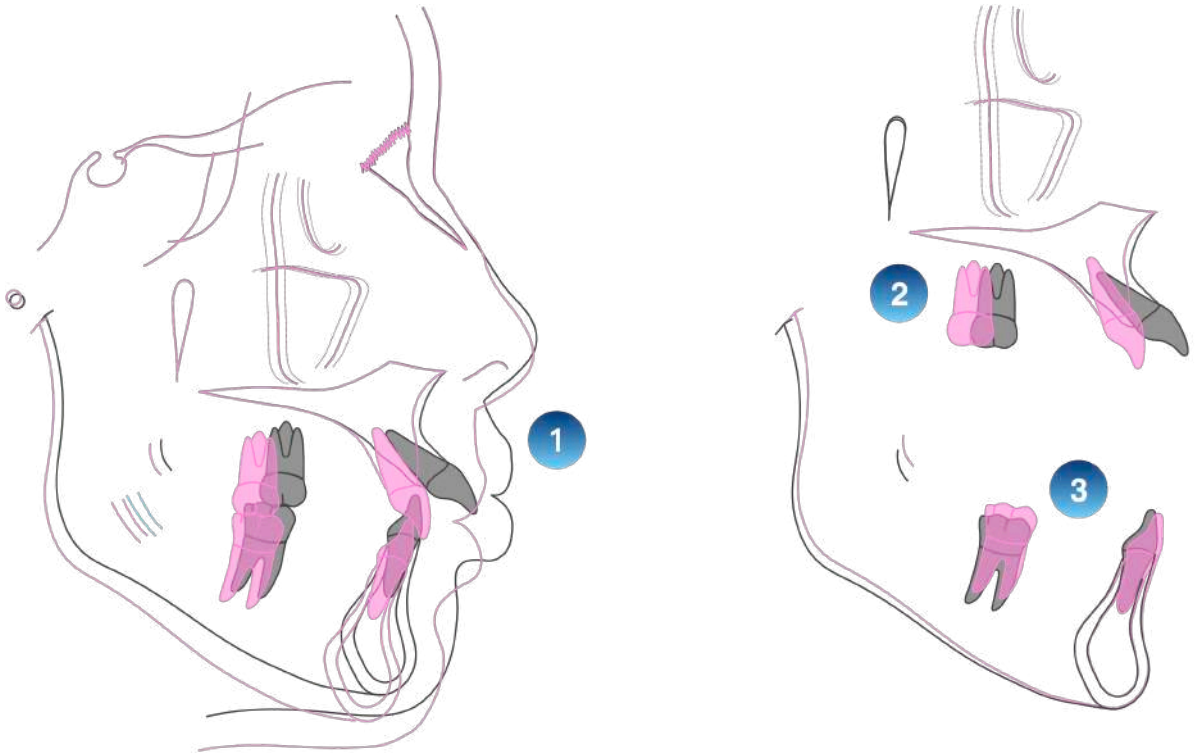

Fig. 16:
Superimpositions of the cephalometric tracings before (black) and after treatment (pink) document (1) retraction and decreased inclination of U1s, (2) retraction of the maxillary first molars, and (3) slight flaring of L1s and extrusion of mandibular first molars. See text for details.

***Fig. 17**: Treatment progress - overjet*
The overjet was corrected from an excessive 12 mm to 0 mm, and the result was still stable 5 years after treatment.

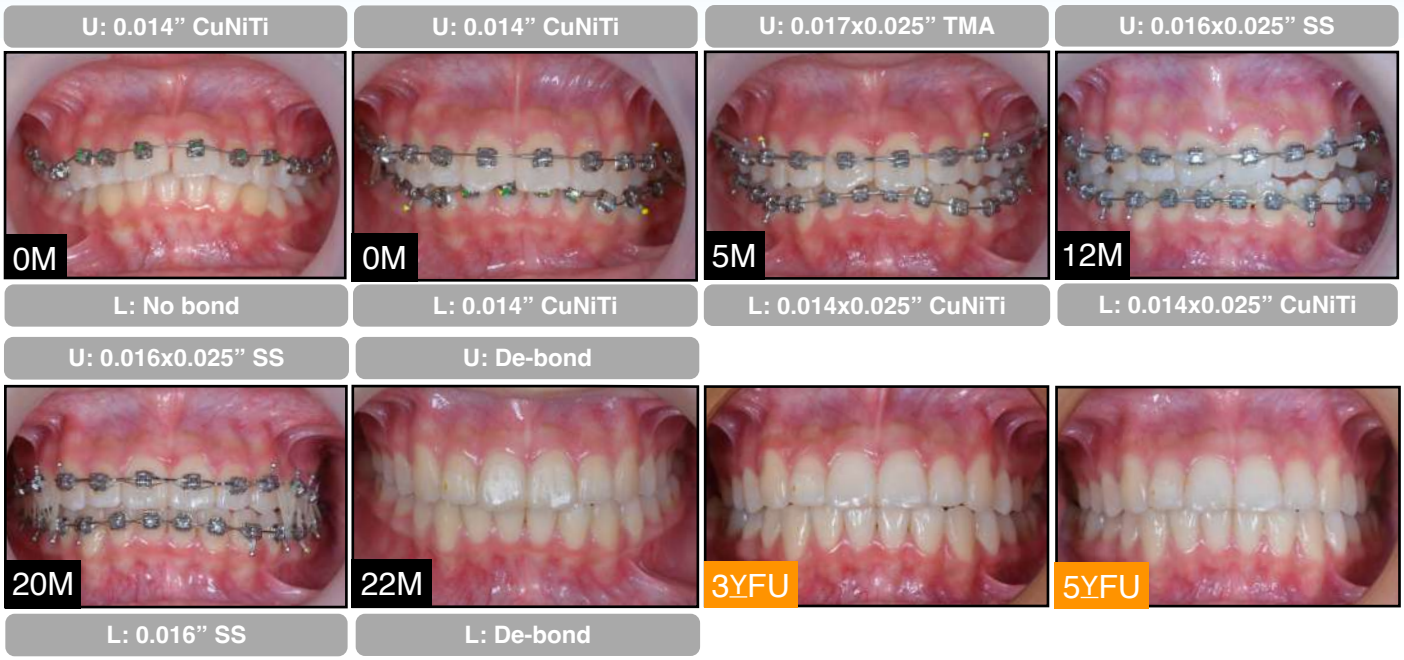

***Fig. 18**: Treatment progress - frontal view with archwire specifications*

Discussion

This young patient with an excessive 12 mm overjet, full-cusp Class II malocclusion, and lip protrusion was delighted that neither orthognathic surgery[1,2] nor extraction of four bicuspids[3] was performed during her treatment. Nevertheless, bilateral Class I canine and molar relationships, reduced overjet (0 mm), and an acceptable facial profile to the E-line were achieved (Figs. 12-16). The upper lip was retruded 4 mm, to -2.5 mm to the E-line (Table 1). The finish was 1.5 mm more retrusive than ideal (-1.0 mm to the E-line) but it was harmonious with the facial profile. Three notable aspects of the treatment are discussed below:

1. Treatment planning: Try non-extraction

In treatment planning, three options were given. After a thorough explanation and discussion with the patient, option (1) was chosen: try non-extraction treatment for 12 months with bilateral IZC bone screws inserted to retract the maxillary dentition.

Although extraction of U4s could solve the excessive overjet with full-cusp Class II malocclusion more predictably,[3] as in treatment

options (2) and (3), the patient was still given the chance to try non-extraction treatment with a deadline for evaluation. If after 12 months of treatment with IZC bone screws the overjet was still not solved, extraction would be considered.

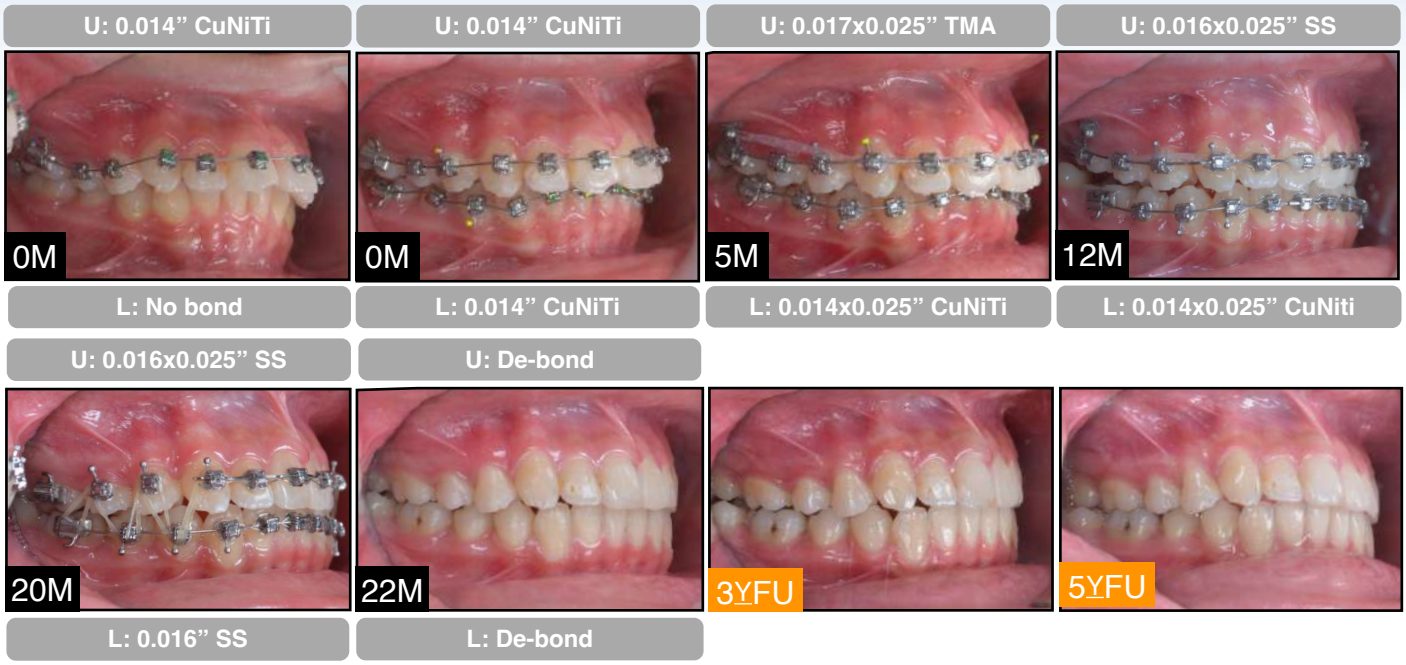

Fig. 19: *Treatment progress - right buccal view.*
U7s were unerupted, allowing space to retract the maxillary dentition. IZC screws were inserted from the 4th month to 14th month (4M~14M), providing anchorage to retract the entire maxillary dentition.

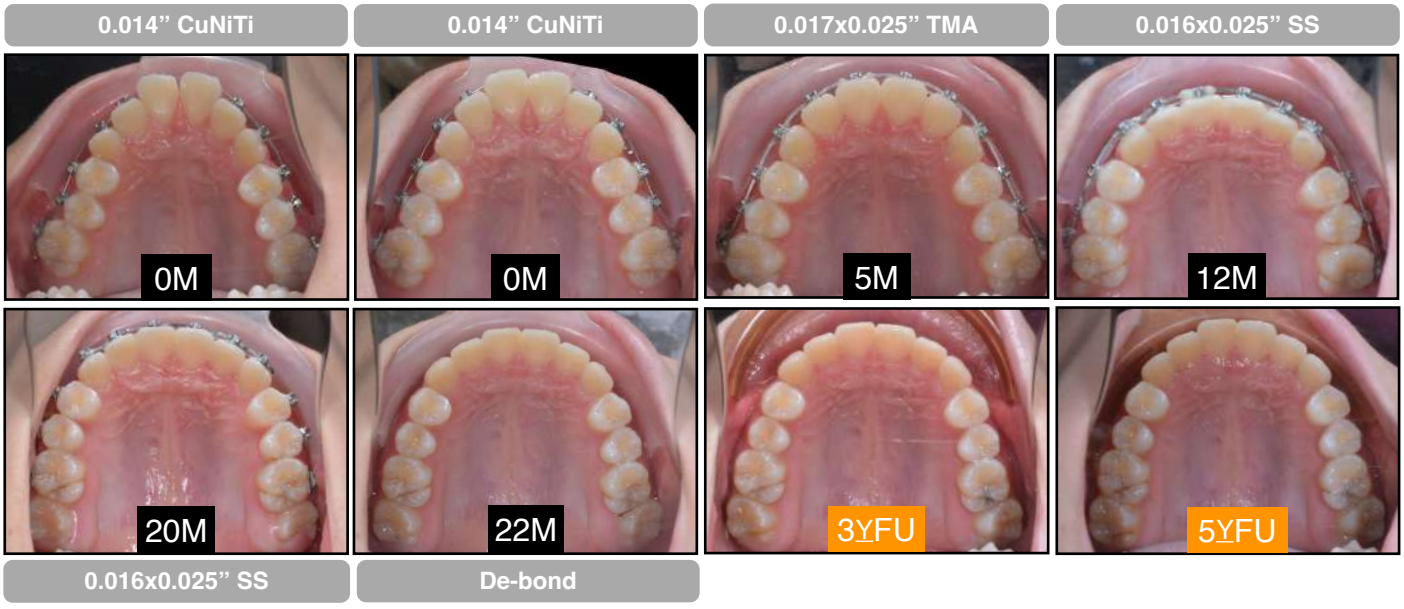

Fig. 20: *Treatment progress - maxillary occlusal view. Note arch form development was stable at the 5-year follow-up.*

In this case, the result after 12 months of treatment was more than satisfactory (Fig. 10). Therefore, extractions were ruled out. Nevertheless, it is important to give a thorough explanation of the possibility/probability of extraction before commencing the treatment.

2. Temporary Skeletal Anchorage Devices: IZC bone screws

Since both U7s were unerupted (Fig. 1), there was adequate space to retract the whole maxillary dentition. However, in patients with a protrusive profile, if retraction was attempted with only Class II elastics, it would lead to an excessively convex facial profile and posterior rotation in the mandible, which increases the lower facial height, and.[19] Temporary skeletal anchorage devices (TSADs), however, can provide skeletal anchorage and vertical control while retracting the maxillary dentition without the adverse effect of Class II elastics, making it possible to perform a non-extraction treatment. IZC bone screws were inserted in the 4th month and were removed in the 14th month, when a reduced overjet (0 mm) and bilateral Class I canine and molar relationships were achieved. In retrospect, a better correction could have been achieved without Class II elastics.

It should be noted that the insertion site of IZC bone screws was above the U6 buccal root (Fig. 8) instead of the area between U6 and U7 as commonly used in adults.[5] The bone width and quality for screw retention in this site was much better than between U6 and U7, since the U7s were unerupted.

3. Arch form Development: PSL brackets

To correct such a large overjet, adequate space was required to retract the maxillary anteriors. Since the U4s were not extracted, the space was gained from: (1) retracting the entire maxillary dentition into the space of the unerupted U7s, accomplished with power chains anchored by IZC screws, (2) IPR of maxillary anteriors, and (3) arch form expansion (development).

In this present case, the maxillary arch form was tapered (Fig. 1); therefore, arch form expansion yielded substantial space for anterior retraction. With the aid of Damon Q® PSL brackets, arch expansion was achieved with a light continuous force instead of a traditional heavy short force generated by a rapid palatal expander (RPE).[20,21] Expansion performed with PSL brackets results in less discomfort and complications, it is not age-limited,[21] and it results in more physiologically determined tooth positions than RPE.[20-23]

It is important to note that the expanded arch form was still stable at the 5-year follow-up with the retention of lingual fixed retainers on the lower arch and Essix overlay retainers on both arches (Fig. 20).

Conclusions

This case report demonstrates the treatment of a full-cusp Class II malocclusion complicated by an excessive 12 mm overjet, flared U1s, and 100% overbite with periodontal impingement. Non-extraction treatment was made possible by using TSADs as anchorage to retract the entire maxillary dentition and by expanding the arch with PSL brackets. The result was stable at the 5-year follow-up.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE **20**

OVERJET

0 mm. (edge-to-edge)	=	
1 - 3 mm.	=	0 pts.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	3 pts.
7.1 - 9 mm.	=	4 pts.
> 9 mm. 12 mm	=	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 = **5**

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 = **4**

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side 2 pts.
Full Class II or III	=	4 pts. per side 4 pts.
Beyond Class II or III	=	1 pt. per mm. additional ____ 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° 5° = 4 pts.

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

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

SN-MP

≥ 38° 36.5° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° 79° = 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	_____ x 2 pts.	=
Spacing (4 or more, per arch)	_____ x 2 pts.	=
Spacing (Mx cent. diastema ≥2mm)	@ 2 pts.	=
Tooth transposition	_____ x 2 pts.	=
Skeletal asymmetry (nonsurgical tx)	@ 3 pts.	=
Addl. treatment complexities	_____ x 2 pts.	=

Identify:

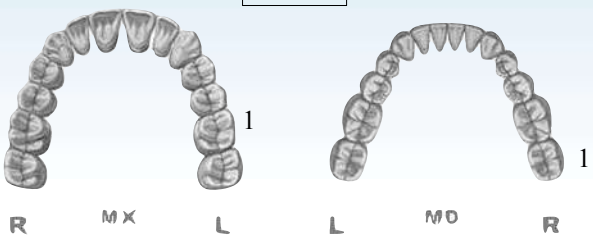
Total = **0**

Cast-Radiograph Evaluation

Total Score: 18

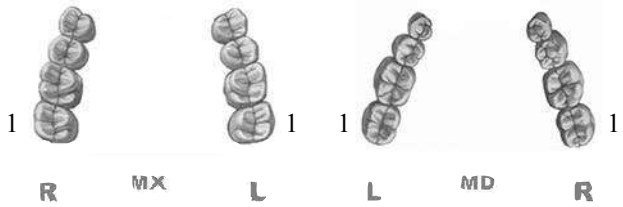
Alignment/Rotations

2



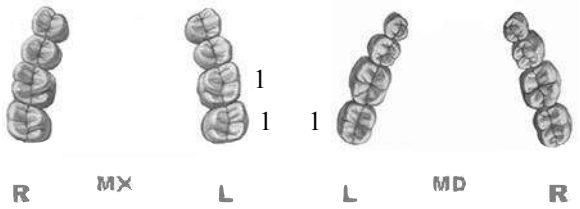
Marginal Ridges

4



Buccolingual Inclination

3

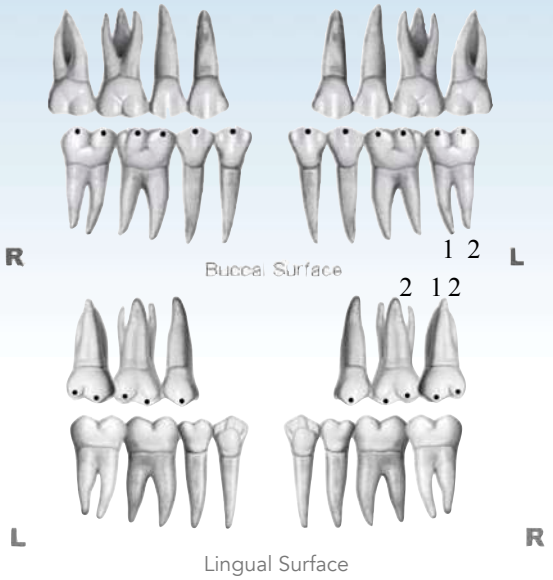


Overjet

0

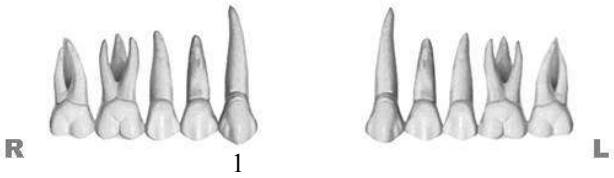
Occlusal Contacts

8



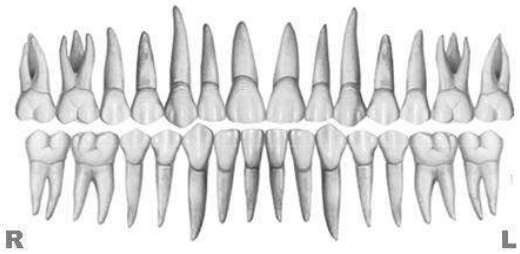
Occlusal Relationships

1



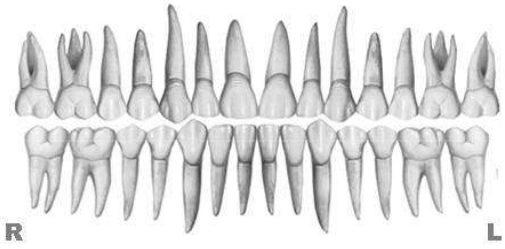
Interproximal Contacts

0



Root Angulation

0



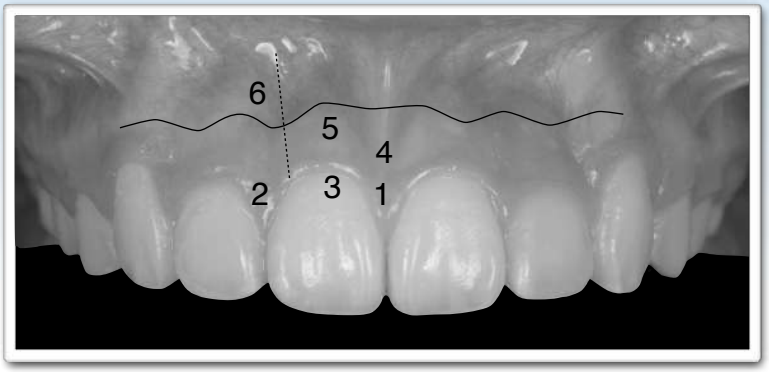
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 0

1. Pink Esthetic Score

Total = 0

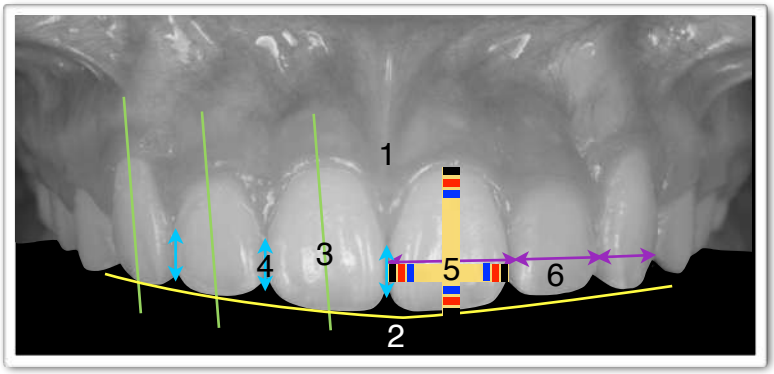


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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 = 0



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

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

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

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

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2024

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Keynote (optional) Nov 29

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* Fees cover local transportation, meals and three nights of shared accommodation (double occupancy). Airport pick up is available upon request with additional charges.

* Early bird rate ends two months prior to the course date.

Dr. Chris Chang

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

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

Prof. Dr. Paulo Fernandes Retto, Portugal

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

IMPACTION

Course Schedule

DAY 1 **Chair-side observation**

DAY 2 **Lecture, chair-side observation**

Lecture topic: Screws & Aligners

DAY 3 **VISTA & 4 other minor surgeries for orthodontic practice**

Hands-on workshop

DAY 4 **Keynote workshop**

(optional) conducted by Newton's A team

VISTA

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2024 第二十四屆
貝多芬高爾夫邀請賽
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宗 旨

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日 期

54 洞比桿賽
預　賽：2023 年 12 月 30 - 31 日
決　賽：2024 年 1 月 1 日

地 點

寶山高爾夫球場（新竹縣寶山鄉寶新路二段 465 號）

資 格

2000 年 12 月 30 日（含）至 2011 年 12 月 29 日（含）之間出生具業餘身份選手參加。

報 名

11 月 27 日前掃描 QR Code 填寫表單或傳真新竹市高爾夫球委員會報名。

電話：0972-957917 彭小姐
傳真：03-5388112

主辦單位：貝多芬齒顎矯正中心　承辦單位：新竹市體育會高爾夫委員會　FLY GOLF 曾秀鳳高爾夫教學中心

協辦單位：寶山高爾夫俱樂部　Newton's A 金牛頓藝術科技　安徒生兒童牙醫診所　NEWTON 金牛頓植牙中心　彼得潘兒童青少年牙醫診所

2024 一年一度 Damon Master Program


+


全新改版的 2024 年貝多芬高效 Damon 矯正大師系列課程，是由**國際知名講師張慧男醫師親自規劃及授課**，課程特色強調由臨床病例帶動診斷、分析、治療計畫擬定與執行技巧，本年度亦特別加入最新的**數位矯正與隱形牙套**的內容，並邀請了貝多芬牙科集團各院院長演講**特別矯正專題**。

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

名額有限，一年僅有一次機會在台完整體驗 Damon 矯正大師課程，錯過只能等明年囉！

Module 1 - 3/28

1. Selecting your ideal first case
2. Bonding position
3. Bonding + BT + ceph tracing
4. TADs + space closing + hook + spring
5. Finishing bending & fixed retainer

Practice: Clinical photography（黃亭雅, 陳韻如醫師）

Module 2 - 4/11

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

Practice: Patient photo management（金牛頓工程師）

Module 3 - 4/25

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

Practice: Ceph tracing（金牛頓工程師）

Module 4 - 5/16

1. Excellent finishing
2. Retention & relapse

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

Module 5 - 5/30

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

Practice: Case report demo（陳俊宏醫師）

▲ **Computer training (Mac): 1:30-3:00 pm**

Module 6 - 6/20

1. Class III correction
2. Class II correction

Topic: Early orthodontic treatment（曾淑萍醫師）

Module 7 - 6/27

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

Topic: Modified VISTA（蘇筌瑋醫師）

Module 8 - 7/11

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

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

Module 9 - 7/25

1. Implant-ortho combined treatment
2. Asymmetry

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

Module 10 - 8/29

1. Minor surgeries in orthodontics
2. Digital orthodontics

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

Module 11 - 9/19

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

Topic: Pre-aligner treatment（林詩詠醫師）

▲ **Special lecture: 1:30-2:30 pm**

時間：週四全天（9 am - 5 pm）

地點：金牛頓藝術科技（新竹市建中一路 25 號 2 樓）

費用含課程視訊*、iPad、課程電子書與材料。

*贈送之課程視訊提供兩年時間串流觀看。

報名專線 湧傑 Yong Chieh

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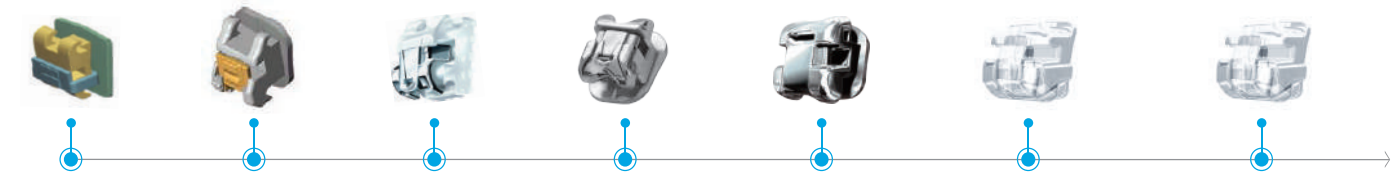

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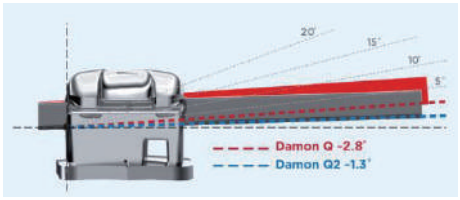

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Labially Impacted Maxillary Canine with Class III Malocclusion: Bone-Anchored 3D Lever Arm Mechanics

Abstract

Introduction: *A 17-year-old female was referred by another dentist to assess her impacted canine.*

Diagnosis: *The patient was skeletal Class I (SNA, 84.5˚; SNB, 81˚; ANB, 3.5˚) with bilateral end-on Class III molar relationships. Her profile suggested a Class III malocclusion since she had a high mandibular angle of 48˚. The upper left deciduous canine (ULc) was present, the UL3 was labially and horizontally impacted, and root resorption of the apex of the UL2 was noticed. The Discrepancy Index (DI) was 47.*

Treatment: *The impacted canine was treated using the vertical incision subperiosteal tunnel access (VISTA) technique and a custom 3D lever arm anchored by an OrthoBoneScrew® (OBS) inserted in the left infrazygomatic crest (IZC) to produce a submucosal space for retracting and extruding the impaction and aligning it into the normal canine position.*

Outcome: *After 30 months of active treatment, the impacted upper left canine was recovered and aligned in an ideal relationship. The Cast-Radiograph Evaluation (CRE) was 16, and the dental esthetic (Pink & White) score was 4.*

Conclusions: *The VISTA surgical exposure is a unique approach for submucosal movement of the impactions. Skeletal anchorage using OBS with a 3D lever arm provides an independent force system for retracting the impaction. (J Digital Orthod 2023;72:26-49)*

Key words:
Impacted maxillary canine, infrazygomatic crest miniscrews, bone screw anchorage, vertical incision subperiosteal tunnal access (VISTA), 3D lever arm, root resorption

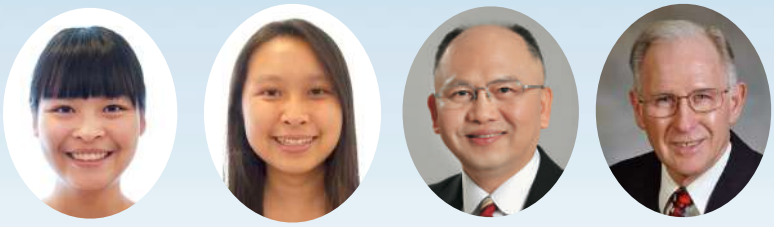
Introduction

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, and deciduous teeth are delineated a-e.

Tooth impaction has long been an intractable anomaly. Among the different kinds, maxillary canine impactions are the second most common impactions with a prevalence of 0.2-2.8%.[1] Therefore, the etiology and management of maxillary canine impactions are major concerns for clinicians. When treating impactions, spontaneous eruption is preferred over surgical intervention to achieve better keratinized gingiva and less root resorption. Spontaneous eruption can be achieved with selective removal of the deciduous canines, extraction of adjacent premolars, or by creating space using orthodontic mechanics.[2,3] However, if the impacted canine is located in an ectopic eruption site, surgical intervention with orthodontic mechanics may be indicated.[4]

In this present case, an impacted maxillary left canine was located labially overlying the apices of the central and lateral incisors. This case report demonstrates a surgical intervention using the

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



vertical incision subperiosteal tunnel access (VISTA) technique and bone screw anchorage combined with a 3D lever arm to retract the impaction into the arch. With thorough, stepwise surgical details and treatment progress, this challenging case was finished with a satisfying outcome with minimal gingival scarring and root resorption.[5]

History and Etiology

A 17-year-old female sought orthodontic consultation for her crowded dentition, posterior

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

crossbite tendency, and impacted maxillary canine (Fig. 1). A clinical examination revealed a nice facial profile with a slightly retrusive upper lip. The sagittal relationship was an end-on Class III malocclusion. Crowding was about 9 mm and 6 mm in the upper and lower arches respecitively (Fig. 2). Panoramic and lateral cephalometric radiographs revealed the position of the impacted upper left canine (UL3) (Figs. 3 and 4). A pre-treatment cone beam computed tomography (CBCT) image showed that the impacted UL3 was located labially between UL1 and UL2 (Fig. 5). The root of the ULc was not resorbed, but the root apex of the UL2 was slightly resorbed by the impacted UL3 (Fig. 6).

Diagnosis

Skeletal:

Skeletal Class I: *SNA, 84.5°; SNB, 81°; ANB, 3.5°*

Mandibular Plane Angle: *SN-MP, 48°; FMA, 41°*

Fig. 2: *Pre-treatment study models*

Dental:

Occlusion: *end-on Class III molar*

Overjet: *1 mm*

Upper incisors: *Within normal limits (WNL) (U1-NA, 3 mm; U1-SN, 104°)*

Fig. 3: *Pre-treatment panoramic radiograph*

Fig. 4: *Pre-treatment cephalometric radiograph*

Fig. 5:
Pre-treatment CBCT images of the maxillary dentition shows a labially impacted UL3 positioned between the roots of UL1 and UL2.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA° (82°)	84.5°	83°	1.5°
SNB° (80°)	81°	80°	1°
ANB° (2°)	3.5°	3°	0.5°
SN-MP° (32°)	48°	48°	0°
FMA° (25°)	41°	41°	0°
DENTAL ANALYSIS			
U1 TO NA mm (4mm)	3	1	2
U1 TO SN° (104°)	104°	97°	7°
L1 TO NB mm (4mm)	8	5	3
L1 TO MP° (90°)	75°	72°	3°
FACIAL ANALYSIS			
E-LINE UL (-1mm)	-2	-4	2
E-LINE LL (0mm)	1	-3	4
%FH: Na-ANS-Gn (53%)	47%	53%	6%
Convexity:G-Sn-Pg' (13°)	15°	13°	2°

Table 1: Cephalometric summary

Lower incisors: *protrusive and decreased axial inclination (L1-NB, 8 mm; L1-MP, 75°)*

Impaction: *Labially impacted UL3, with crown impinging on the UL2 root; slight root resorption of UL2*

Facial: *Slightly retrusive upper lip (upper and lower lips were -2 mm and 1 mm to the E-line respectively.)*

The cephalometric summary is in Table 1. The American Board of Orthodontics (ABO) Discrepancy Index (DI) was 47 points as shown in the subsequent Worksheet 1.

Treatment Objectives

1. Achieve Class I canine and molar relationships.
2. Resolve the labially impacted maxillary canine.
3. Attain ideal overjet and overbite.
4. Improve facial esthetics.

Treatment Alternative

Three treatment options were proposed using full-fixed appliances:

Option 1: Extract the impacted canine (UL3) and substitute with premolar (UL4).

On the contrary, extraction of LL4, LR4, UR4, ULc and surgically removing the impacted UL3 would decrease the duration and difficulty of the treatment. However, substituting the impacted UL3 with the adjacent first premolar would compromise the esthetics and function of the occlusion, which may result in a lack

Fig. 6:
Pre-treatment CBCT images showed slight root resorption of the UL2 by the impacted UL3.

of occlusal guidance, an unbalanced occlusion, dental arch asymmetry, compromised dental esthetics, and temporomandibular joint disorder.[6]

Option 2: Non-extraction treatment with modified VISTA and OBS 3D lever arm

Extract only the deciduous canine (ULc), and use the modified VISTA technique combined with a 3D lever arm anchored with an OrthoBoneScrew® (OBS) (iNewton Dental, Inc., Hsinchu City, Taiwan) to align the impacted UL3. However, due to the Class III malocclusion, high mandibular plane angle (SN-MP, 48˚; FMA, 41˚), as well as the crowded arch, this non-extraction approach might result in an anterior open bite and lip protrusion.

Option 3: Four-bicuspid extraction with modified VISTA and OBS 3D lever arm

Chang's extraction decision table was consulted to assess the necessity for extraction (Table 2).[7] The two main factors favoring extraction of all four first premolars were a high mandibular plane angle (FMA 41°) and >7 mm crowding in the maxillary arch. The extraction could resolve crowded dentition, maintain the lip profile, and correct the Class III malocclusion. The modified VISTA technique would be used to uncover the impacted canine, which would be repositioned using a 3D lever arm and power chains anchored to an IZC OBS. However, this option would probably take the longest time (Fig. 7).

After a thorough discussion of all three options, Option 3 was considered the most suitable treatment plan for both the clinicians and the patient.

	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 2: Chang's Extraction Decision Table

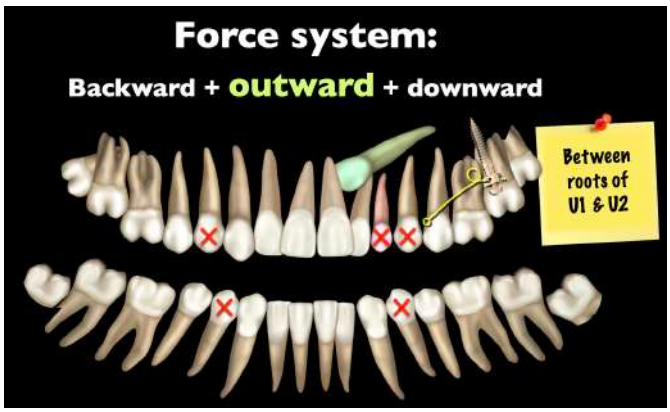


Fig. 7: Proposed treatment (Option 3) in illustration

Treatment Progress

Four first premolars and the upper left primary canine were extracted. A passive self-ligating (PSL) fixed appliance (Damon Q®, Ormco Corporation, Glendora, CA) was bonded on all maxillary teeth except for the UR2 and UL2, and a 0.014-in CuNiTi archwire was engaged in order to start the active treatment. Low-torque brackets were bonded on the UR2 in the 7th month, as well as on the UL2 in the 11th month since by then there were adequate spaces created by open coil springs. Additional labial root torque was applied to UR2 and UL2 using auxiliary torquing springs from the 18th to 21st months (Figs. 8-11).

Two months into treatment, the impacted canine was surgically uncovered since there was adequate space created by extracting the deciduous canine and first premolar. The IZC screws and 3D lever arm independent force system designed by Chang delivered the necessary retraction force for the impacted UL3, without producing undesired side effects on other teeth. Details for the surgical flap and force system design will be discussed later in this report.

The post-operative radiographs monitored the movement of the impacted canine (Fig. 12). After 5 months of activation, the 3D lever arm and IZC screw were removed since the UL3 was up-righted and internally positioned in the arch, coronal to the mucogingival junction. In the 9th month, the UL3 was bonded with a high-torque bracket, and the UL2 was bonded with a low-torque bracket (Fig. 13). Light force archwires (0.014-in CuNiTi) were utilized to align the upper and lower arches. The archwire sequence for both arches are shown in Table 3 and Fig. 11.

It was a priority to prevent further torque loss of the mandibular incisors (L1-MP, 75˚) during closure of the extraction spaces and to compensate for dumping the mandibular incisors by the Class III elastic mechanics, so from the 16th to the 18th months a 0.016x0.025-in pre-torqued (+15°) archwire on the

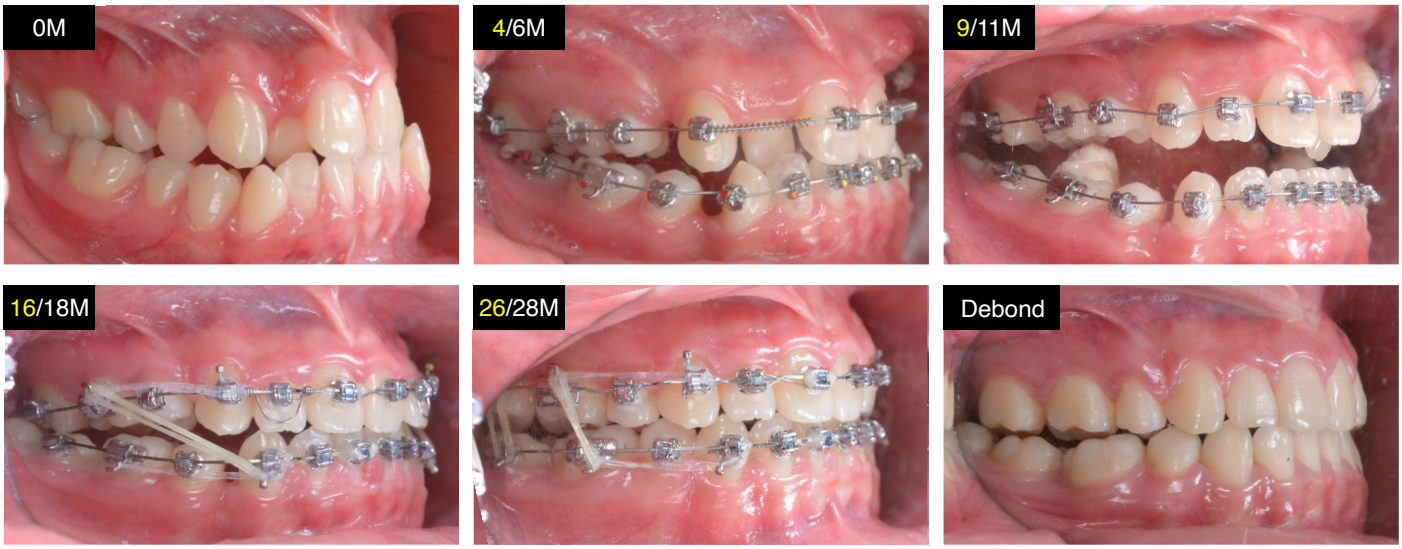


Fig. 8:
Treatment progress - right buccal view. Note the UR2 was not bonded with a bracket until the 5th month. The posterior bite turbos (glass ionomer cement (GIC)) were placed on the occlusal surfaces of L6s to create interocclusal space for blocked-in lateral incisors.

on the mandibular arch delivered a continuous light force of lingual root torque to the mandibular incisors. For this patient, the mandibular incisors were bonded with standard-torque brackets. Upside-down low-torque brackets could have been bonded on the lower anterior teeth to serve as high-torque brackets to prevent torque loss on the mandibular incisors (Fig. 14).

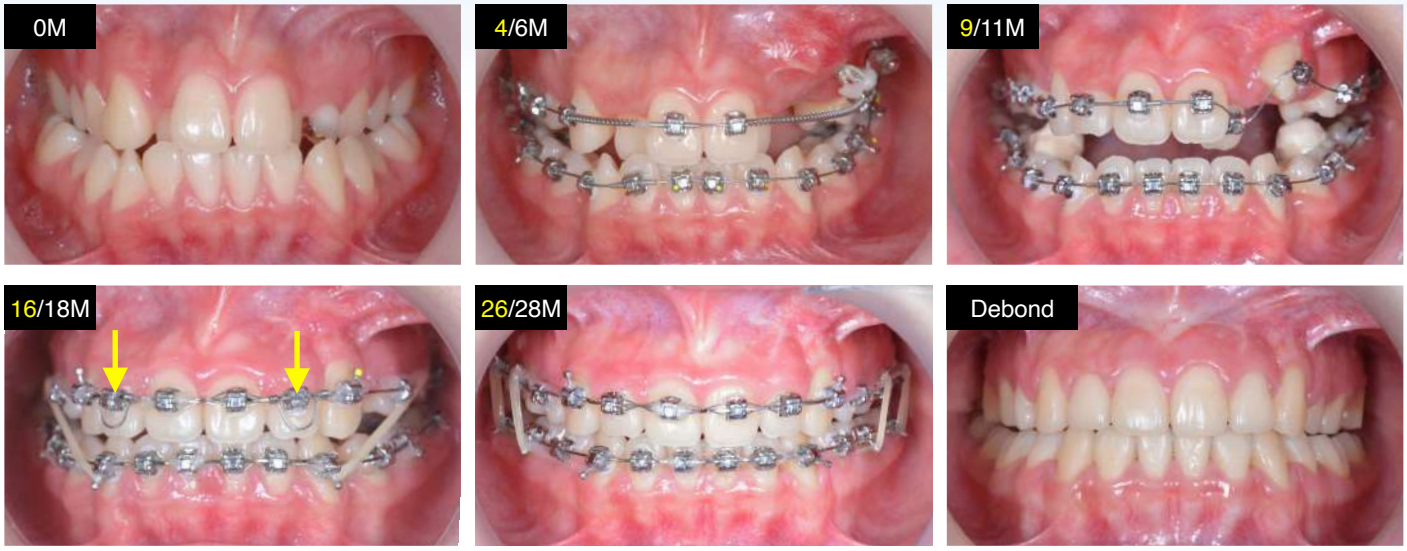


Fig. 9:
Treatment progress - frontal view. Additional labial root torque was applied to UR2 and UL2 using auxiliary torquing springs (yellow arrows) in the 18th month, and Class III elastics (Fox, 1/4-in, 3.5 oz; Ormco) were added. In the 20th month, inter-maxillary elastics (Chipmunk, 1/8-in, 3.5 oz) were used for settling the occlusion.

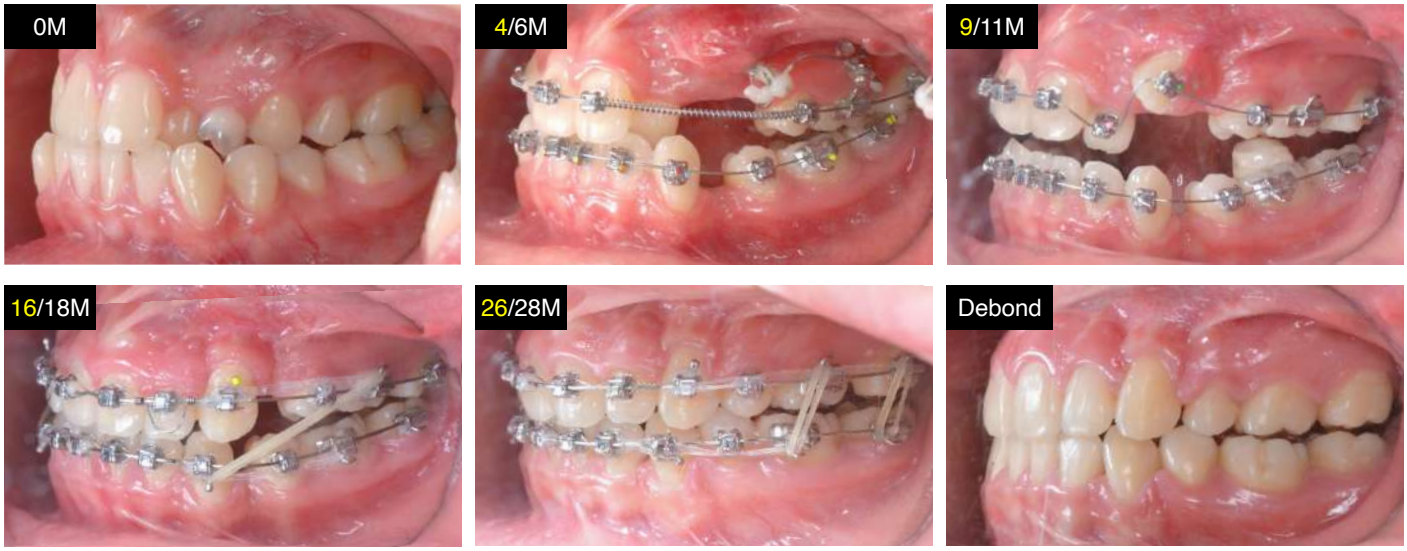


Fig. 10:
Treatment progress - left buccal view. The impacted UL3 was successfully aligned into the arch and was bonded with a high-torque bracket 9 months after surgery.

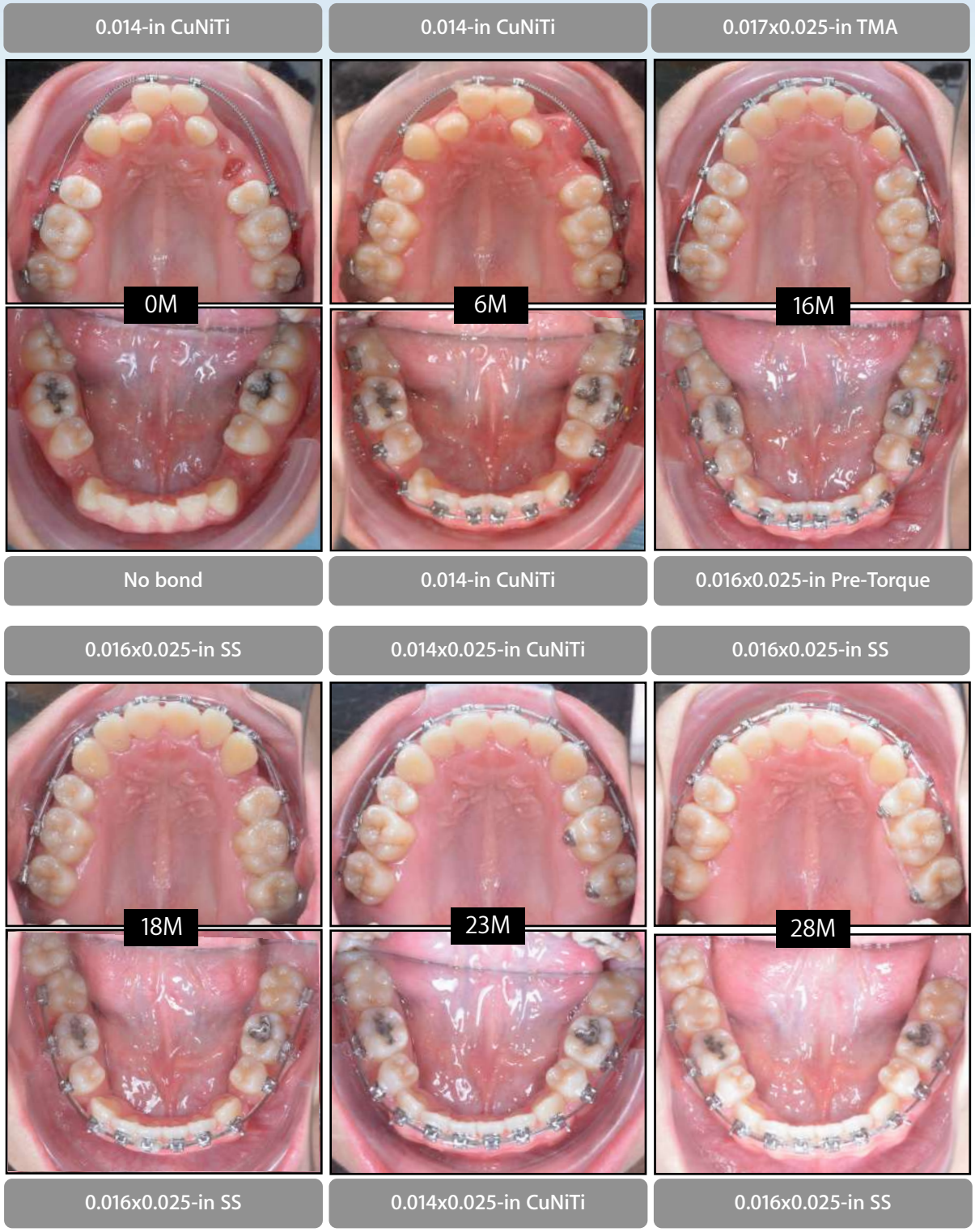


Fig. 11:
Treatment progress from both upper and lower occlusal viewers is specified in months (M), and the archwire sequence is provided from the beginning of the treatment (0M) to twenty-eight months (28M).

Months Surgery/Ortho	Archwire	Notes
0/0		Extraction of LL4, LR4, UR4, UL4, and ULc
	U: 0.014 CuNiTi	Bond Damon® appliance on the maxillary teeth from 7-7 (*except: UR2, UL2, UL3 not bonded)
0/2		**VISTA surgical exposure of UL3 + IZC OBS + 3D lever arm**
1/3		Remove suture
2/4		Tighten up the power chain of UL3
4/6	U/L: 0.014 CuNiTi	Tighten up the power chain of UL3 Bond Damon® appliance on the mandibular teeth from 7-7
5/7		Bond Damon® appliance on UR2 Remove 3D lever arm and IZC OBS
9/11		Bond Damon® appliance on UL2 and UL3 GIC (bite turbos) on LL6 and LR6
12/14		Remove GIC from LL6 and LR6
14/16	U: 0.017x0.025 TMA L: 0.016x0.025 pre-torqued	Ligature figure 8 ties from 3-3
15/17	U: 0.016x0.025 SS L: 0.016x0.025 Pre-torqued	Power chain (PC) from 3-6
16/18	U/L: 0.016x0.025 SS	Drop-in hooks and PC Fox (1/4-in, 3.5-oz) from U6 to L3 (bilateral): Class III elastics Torquing spring on UL2 and UR2 for labial root torque Add 15° on the lower archwire from 2-2
18/20		Chipmunk (1/8-in, 3.5-oz) from UL6 and UL7 (lingual) to LL6 and LL7 (buccal) for posterior crossbite correction Buttons on UL6 and UL7
20/22		Chipmunk (1/8-in, 3.5-oz) from UL6 and UL7 (lingual) to LL6 and LL7 (buccal) Remove Torquing spring from UL2 and UR2 Torquing spring on UL1 for lingual root torque Expand upper archwire PC
21/23	U/L: 0.014x0.025 CuNiTi	Chipmunk (1/8-in, 3.5-oz) from UL6 and UL7 (lingual) to LL6 and LL7 (buccal) Rebond UR7, UR4, UL4, LR4, and LL4
22/24	U/L: 0.017x0.025 TMA	Chipmunk (1/8-in, 3.5-oz) from UL6 and UL7 (lingual) to LL6 and LL7 (buccal) Expand upper and lower archwire PC

Table 3A: *Treatment sequence (continued on the next page)*

Months Surgery/Ortho	Archwire	Notes
23/25	U/L: 0.016x0.025 SS	Expand upper archwire, and constrict lower archwire. Torquing spring on UL2 for labial root torque
26/28		**Chipmunk (1/8-in, 3.5-oz) from UL6 and UL7 (buccal) to LL6 and LL7 (buccal) to settle occlusion**
28/30		Debond

Table 3B: *Treatment sequence (continued from the last page)*

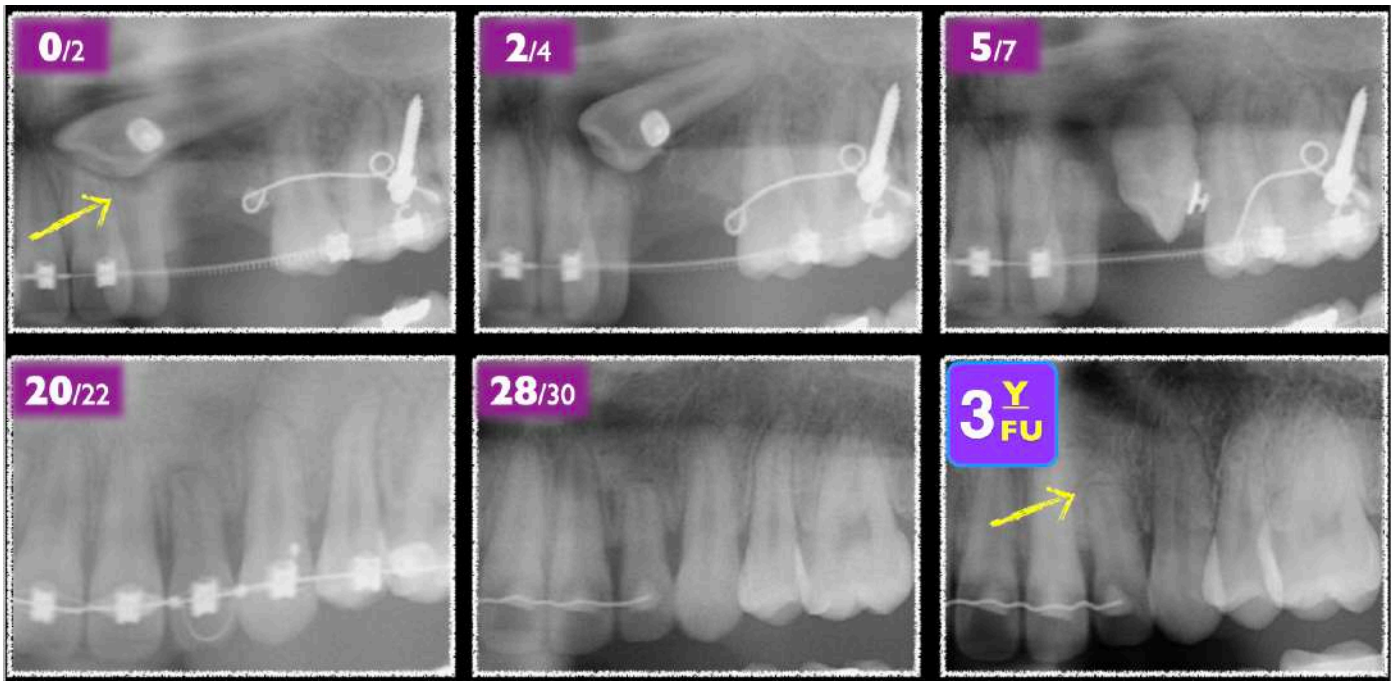


Fig. 12:
A panel of six radiographs shows recovery progress of the impacted UL3. Each radiograph is labelled with the time in months since surgery and initiation of the traction (first number), and the number of months into active treatment (second number). Thus, the upper left view (0/2) is the immediate postoperative radiograph for the surgery performed two months into treatment. Note the UL2 was not bonded with a bracket during traction of the impacted UL3 in the first 7 months of treatment. Only little root resorption of the UL2 was found in the 3-year follow-up.

For the posterior crossbite correction, maxillary arch expansion and mandibular arch constriction was carried out during the 20th to 23rd months by adjusting the archwires (Fig. 15). In addition, crossbite elastics (Chipmunk, 1/8-in, 3.5-oz) were applied from the lingual buttons on UL6 and UL7 to the buccal side of LL6 and LL7 in the 20th to 24th months (Fig. 16).

In the last month of treatment (30M), the archwires were sectioned distal to the second premolars, and inter-maxillary elastics (Chipmunk, 1/8-in, 3.5-oz)

Fig. 13:
After 5 months of traction and 7 months of active treatment, UL3 is visible underneath the overlaying gingiva (left picture). Note the line of traction for the 3D lever arm is buccal and occlusal which produces outward and downward forces on the impacted UL3. After 9 months of traction and 11 months of active treatment, brackets were bonded on the UL2 and UL3, and a CuNiTi archwire was used to align the arch (right picture).

Fig. 14:
By positioning the low-torque brackets upside down, high torque was expressed on the mandibular anterior teeth. (Q: torque)

were hooked from UL6 and UL7 to LL6 and LL7 on the buccal side to settle the occlusion (Fig. 17).

All treatment progress and sequencing details are shown in Table 3.

Results

After 30 months of active treatment, the maxillary anterior gingivectomy and frenectomy were performed using a diode laser to improve dental

Fig. 15:
Expansion of the maxillary arch can be observed from a comparison of pre- and posttreatment records. (Photo sizes corrected by measuring the second premolar - blue line; pre-treatment arch length - green line; arch expansion after 30 months of active treatment - purple line.)

keratinized gingival tissue around UL3, but there was no gingival recession. There was no change in the pre-existing root loss of the adjacent lateral incisor nor further root resorption on any other teeth during active treatment (Fig. 19). The dentition was well-aligned with bilateral Class I canine and molar relationships. Even though there was still occlusal fitting left to be improved in the posterior section, it was acceptable to finish at this occlusion and allow the patient's mastication movements to naturally settle the occlusion, which can be observed at the 5-year follow-up (Figs. 20 and 21).

The posttreatment panoramic, cast models, and lateral cephalometric radiographs document the outcome following 30 months of active surgical and orthodontic treatment (Figs. 22-24). Superimposed cephalometric tracings (Fig. 25) showed slight dumping of the maxillary and mandibular incisors. However, this was inevitable after closing the extraction spaces. The facial profile showed retrusive upper and lower lips from the esthetic line. Nevertheless, the patient was satisfied with the facial profile.

The ABO Cast-Radiograph Evaluation (CRE) score was 16 (Worksheet 2) calculated after the 5-year

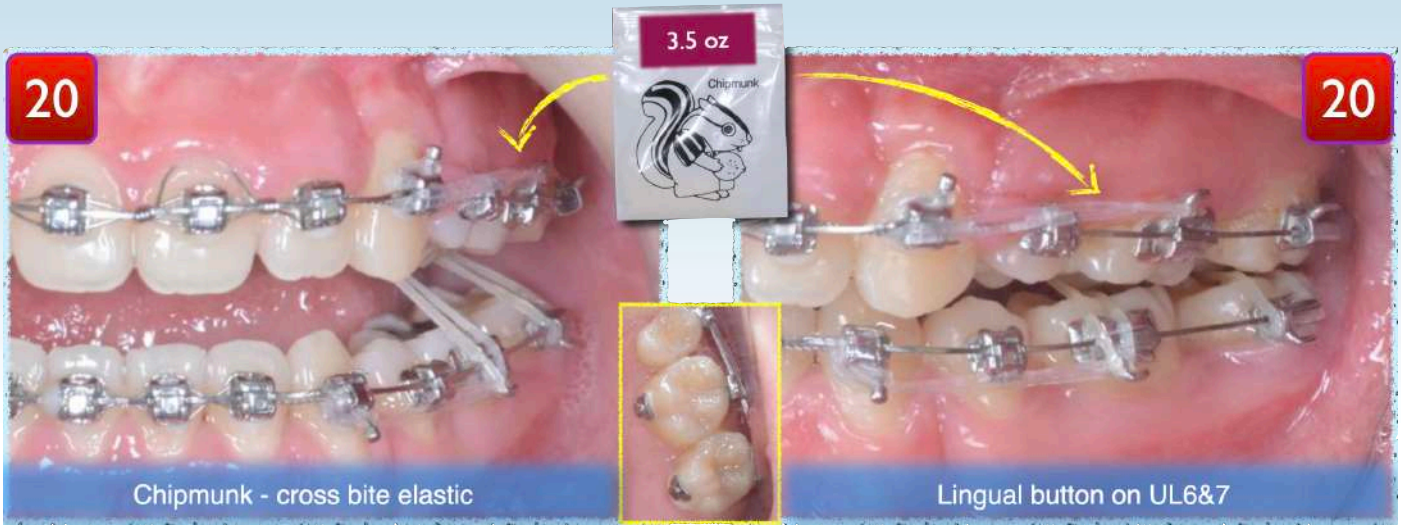


Fig. 16:
Intraoral photographs in the 20th month of treatment from the frontal view (left picture) and left buccal view (right picture). Chipmunk elastics (1/8-in, 3.5-oz) from UL6, UL7 (lingual button) to LL6, LL7 (buccal) were used to correct the posterior crossbite.

Fig. 17:
Intraoral photograph taken at the 28th month of treatment from the frontal view. Chipmunk elastics (1/8-in, 3.5 oz) from UL6, UL7 (buccal) to LL6, LL7 (buccal) were used to settle the occlusion.

follow-up; the major CRE discrepancies were posterior crossbite due to the tooth relapsing to its original state.

Retention

To prevent relapse, an anterior fixed retainer was bonded on the lingual surfaces of the maxillary and mandibular arches from canine to canine. Removable clear overlay retainers were delivered for both arches, and the patient was instructed to wear them full time for the first 6 months and nights only thereafter. Instructions were provided for home hygiene, as well as for maintenance of the retainers.

Fig. 18: *Gingivectomy and frenectomy were performed to improve tissue esthetics.*

Fig. 19:
Four pictures show a coordinated panoramic radiograph and intraoral left buccal view of pre-treatment and posttreatment conditions.

Discussion

Delay bonding of the lateral incisors

1. Blocked-in lateral incisors: Create space before bonding

An impaction is usually accompanied with space loss in the dental arch, and adequate space should be provided before attempting to undergo surgical exposure and to align the impacted tooth into position. In the present case, the dental arch was too crowded and the lateral incisors were blocked behind the central incisors. Not bonding the blocked lateral incisors in the early stage not only allowed them to move freely but also made it easier to bond the brackets in a more ideal position later in the treatment. Furthermore, as the UL2 was not engaged on the fixed appliance, it was free to move spontaneously out of the path of movement while the impacted UL3 was being recovered.[5] An effective approach for space development is to use a fixed appliance with an open coil spring. An open coil spring measuring 1-1.5 bracket width longer than the original space was utilized in the 1st month of treatment. Reactivation could be done by changing the open coil spring to a new and longer one at every appointment. However, an easier way is to simply compress the same open coil spring again and fixate it with flowable resin cured on the archwire. Once adequate space was created with the open coil spring, low-torque brackets were bonded on the UR2 in the 7th month and UL2 in the 11th month. Low-torque brackets were selected for labial root movement to control the flaring effect during leveling. Bite turbos (glass ionomer cement occlusal bite raisers) were placed on the occlusal surfaces of the mandibular first molars to create interocclusal space for greater freedom of tooth movement of the blocked-in lateral incisors.[8] The posterior bite turbos were removed three months later when the blocked-in lateral incisors were corrected (Fig. 8).

2. Root resorption control

The most common side effect of treating impactions is root resorption of the adjacent teeth, the incidence of which is reported to be around 27% up to 49.5% (Fig. 26).[9,10] However, in a study where the adjacent teeth were not bonded with the brackets while the canine was moving toward the occlusal plane, the prevalence of lateral incisor root resorption dropped to 7.8%.[11] Therefore, it is suggested to delay bonding brackets on the teeth

Fig. 20: *Posttreatment facial and intraoral photographs*

near the eruption pathway of the impacted tooth. Once the tooth is not restrained by a fixed appliance and the traction force of the archwire, its root is free to move out of the way when the impacted canine is emerging, resulting in decreased risk of root resorption.[12] However, pre-existing root resorption cannot be recovered. The full-fixed appliance was later bonded when the canine was properly positioned in the arch for final alignment. In the present case, the UR2 was not bonded with brackets until the 7th month of treatment. The UL2 was bonded with a bracket in the 11th month of treatment. Only a little root resorption was found in the panoramic radiograph (Fig. 12). However, considering that slight root resorption of UL2 was found in the pre-treatment CBCT image, the amount of root resorption was deemed little to none during the treatment process (Fig. 5).

Fig. 21: *Facial and intraoral photographs at 5-year follow-up*

Fig. 22: *Posttreatment panoramic radiograph*

Fig. 23: *Posttreatment study models*

Fig. 24: Posttreatment cephalometric radiograph

Surgery design

1. Surgical flap design

The key to selecting the correct surgical flap design is to precisely locate the impacted canine using cone beam computed tomography (CBCT) prior to surgery. CBCT images can help clinicians to (a) plan for proper surgical access, (b) decide whether to perform with buccal or palatal/lingual access, and (c) achieve a clear understanding of the amount of bone surrounding each tooth. After a thorough CBCT analysis (Fig. 5), the surgical approach selected was the vertical incision subperiosteal tunnel access (VISTA) technique devised by Zadeh[12] and modified by Chang.[14] The combined application of the modified VISTA technique with

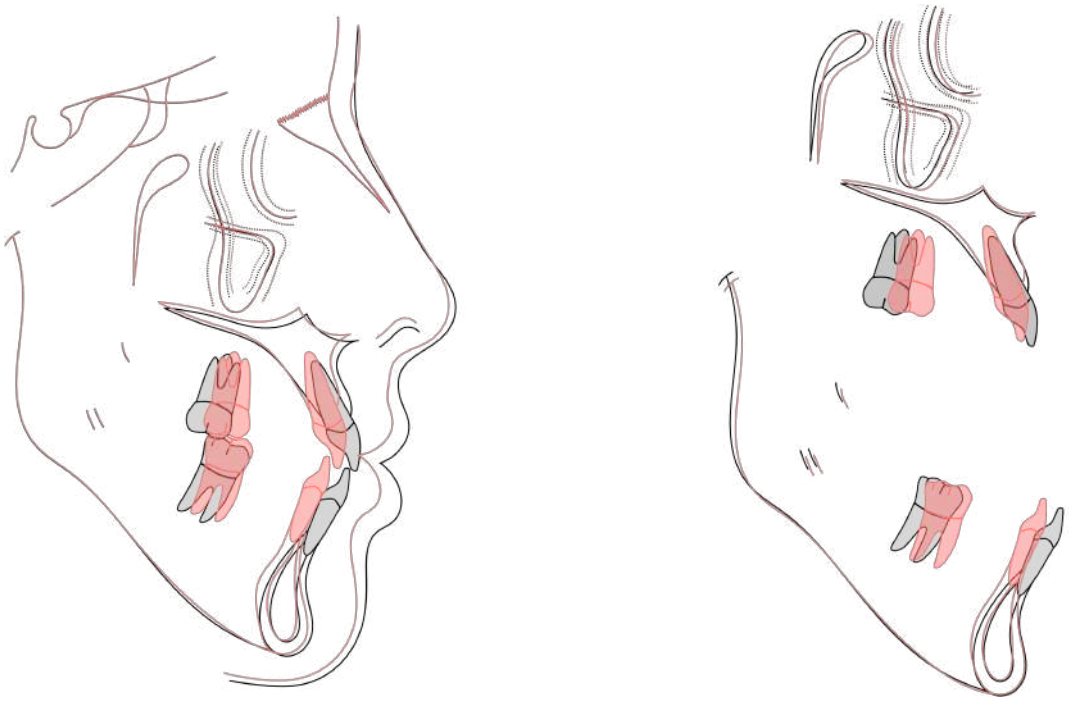


Fig. 25:
Superimpositions of the cephalometric tracings before (black) and after (red) treatment. Retrusion of the lower incisors could be due to closing extraction space with mild crowding on the lower arch. Around 70% of the retraction was done by retracting the lower anteriors in order to improve the Class III lip profile.

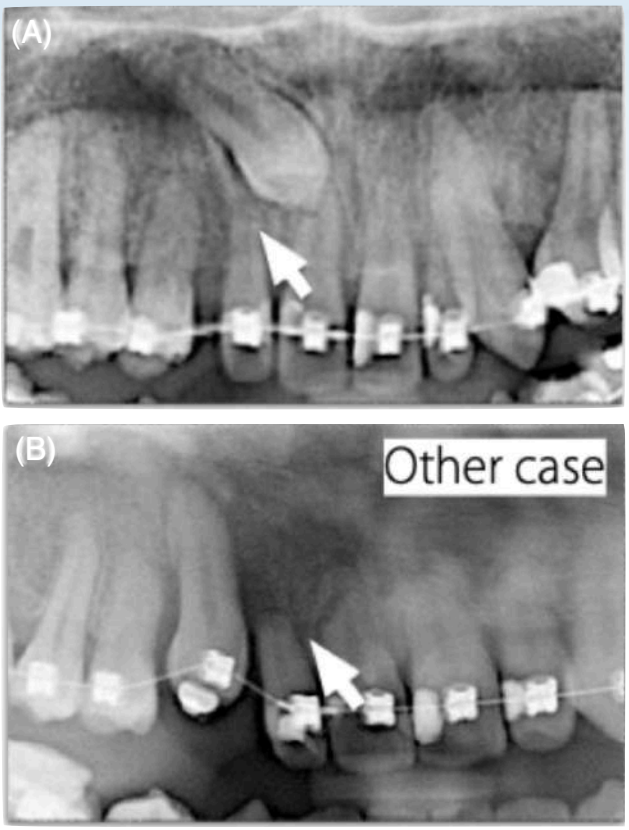


Fig. 26: *Two radiographs from another case showing:*
(A) The right central and lateral incisors, which are in the eruption pathway of the impacted canine, are bonded with brackets and engaged on an archwire; and
(B) severe root resorption (white arrow) of the right central and lateral incisors is noted after the eruption of the impacted canine into the arch.

IZC OBS anchorage and 3D lever arm mechanics will be discussed in the next section - Mechanics: Force system design.

With this minimally invasive approach, the labially impacted canines were retracted and extruded within the submucosal space. This avoided impingement on the adjacent lateral incisor that might result in extensive root resorption.[15,16]

The following modified VISTA surgical steps were performed (Fig. 27):

1. Periodontal probe was used to locate the impacted canine with the help of CBCT.

2. An initial vertical incision was made with a no. 15 surgical scalpel between the central and lateral incisors to expose the crown of the impacted canine.

3. Mucogingival flap was reflected with a surgical curette and periosteal elevator to detach the periosteum.

4. The surrounding bone around the impacted crown was removed with a #5 carbide round bur down to the cementoenamel junction (CEJ).

5. A second vertical incision was made on the vestibular side of the extraction space for the power chains to exit.

6. The surface of the impacted canine crown was etched and bonding agent was applied in order to bond the button on the labial surface of the exposed enamel.

7. Bone was removed in the proposed path of canine traction which facilitated tooth eruption and up-righting without bone obstruction. Note that it is recommended to remove the bone in the tunnel after bonding the button in order to control the bonding quality, which could be affected by excessive bleeding when removing the bone.

8. An OBS (2x14-mm, OrthoBoneScrew®, iNewton, Dental, Inc., Hsinchu City, Taiwan) was inserted in the left infrazygomatic crest (IZC), and a 3D

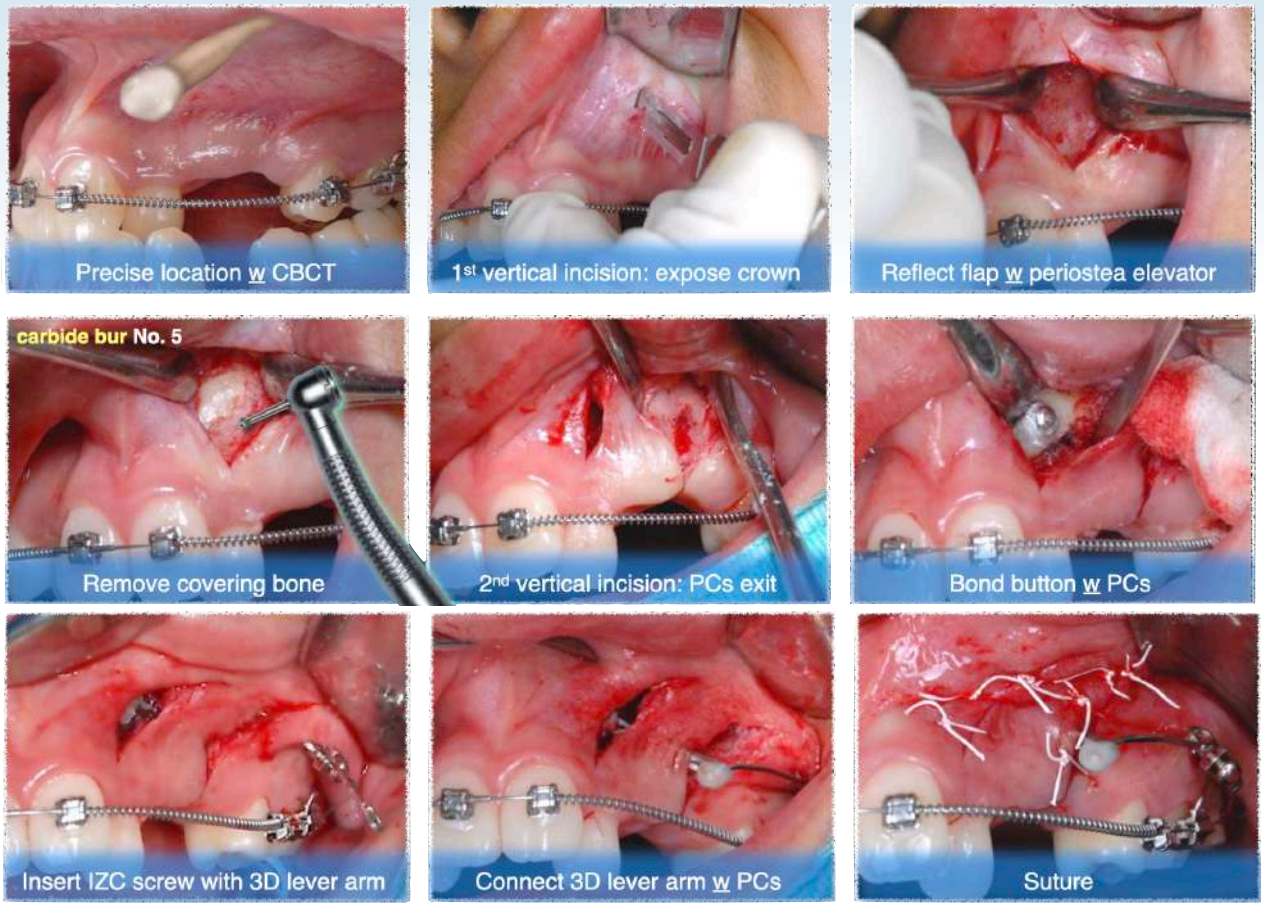


Fig. 27: *The panel of 9 intraoral photographs documents the step-by-step surgical exposure procedure. See text for details.*

lever arm was inserted into the rectangular hole as the anchorage device.

9. Power chains were attached from the button on the impacted canine to the 3D lever arm.

10. The two vertical incisions were sutured to ensure minimal damage of the mucosa.

2. Mechanics: Force system design

There are two keys to the force system design: stable anchorage and properly designed mechanics.

(1) Stable anchorage: IZC screw

Stable anchorage is essential for the traction of the impacted tooth. When compared to using teeth and archwires as anchorage, a method which may distort the occlusion and the arch, the use of miniscrews provides an independent anchorage that will not affect any other teeth or the occlusion. Moreover, since the miniscrew is installed inside the bone, it provides a stronger and more stable force for the impaction. The location to insert the miniscrew is around the mucogingival junction (MGJ) of the infrazygomatic crest (IZC) bone, which

is located between the first and second molars (Fig. 28).

(2) Properly designed mechanics: 3D lever arm

The 3D lever arm is made with a 0.019x0.025" SS archwire segment with a helix in the body (for power storage) and a U shape at the end (for power chains to be easily attached). After inserting the 3D lever arm through the dedicated rectangular hole in the head of the miniscrew, it is then activated by connecting the end side (U shape) to the button attached on the crown of the impacted tooth using power chains or ligature wires (Fig. 29).

The force system of the 3D lever arm provided 3D traction: backward, outward, and downward, which is absolutely essential for treating deep impactions. The outward force can avoid direct impingement of the canine crown movement against the root of the lateral incisor, which can further reduce the chance of root resorption of the lateral incisor. The load of the 3D lever arm is adjusted with three jaw pliers or by simply tightening the power chain at each phase of the impaction movement.

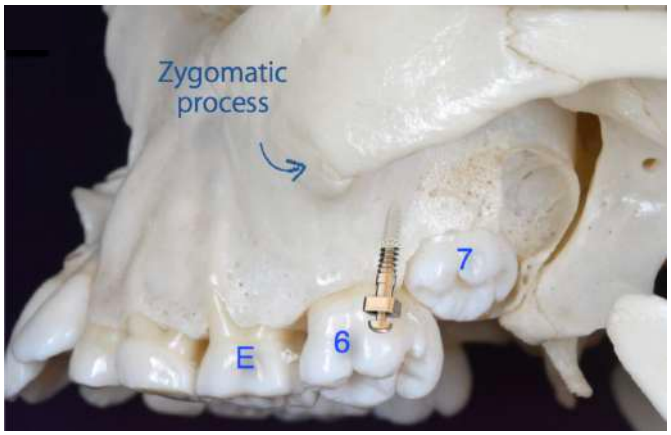


Fig. 28:
The bone screw is inserted around the mucogingival junction (MGJ) of the infrazygomatic crest (IZC) bone that is buccal to the root of first and second maxillary molars

Settle the occlusion (5-year follow-up)

The occlusal contacts achieved were not a perfect result at the end of the treatment (Fig. 20). However, by cutting the posterior part of the clear retainers (Essix ACE®), the occlusal contacts were settled naturally through the occlusal force as noted at the 2-year follow-up (Fig. 30). However, for every plus there is a minus. The progression of the posterior crossbite on the left hand side is shown through 1- to 5-year follow-up (Fig. 30). The reason might be due to cutting the posterior part of the clear retainer at too early a stage, which resulted in the posterior segment returning to its original state. Delayed cutting of the posterior segment of clear retainer or overcorrection by expanding the maxillary arch and wearing criss-cross elastics could have prevented the posterior crossbite from developing.

Conclusions

A maxillary canine impaction with the canine tip between the roots of central and lateral incisors is a complex and challenging task for orthodontists. The VISTA surgical exposure is a unique approach for submucosal movement of the impaction. A skeletal anchorage using OBS with a 3D lever arm provides an independent force system for retracting the impaction. Root resorption and torque loss during the recovery process can be controlled by delaying bonding the adjacent teeth

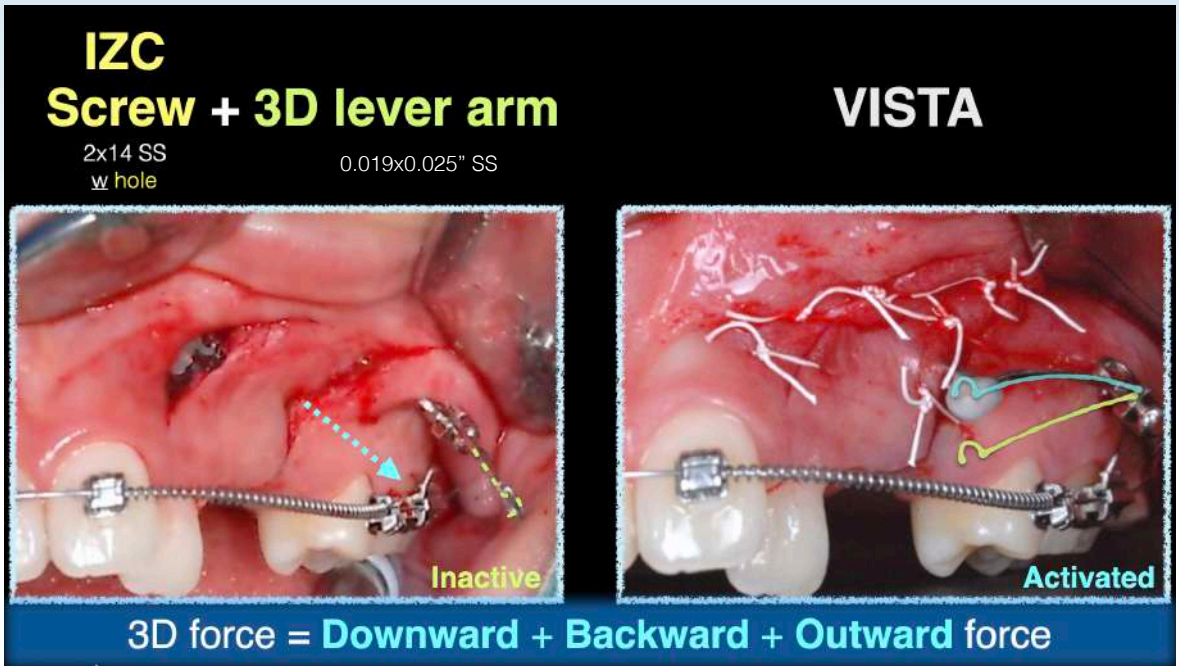


Fig. 29:
Left: inactive 3D lever arm (green dotted line) indicating the direction of the force is downward, backward, and outward (blue arrow). Right: activated 3D lever arm (blue) attached to impacted canine through button and power chains.

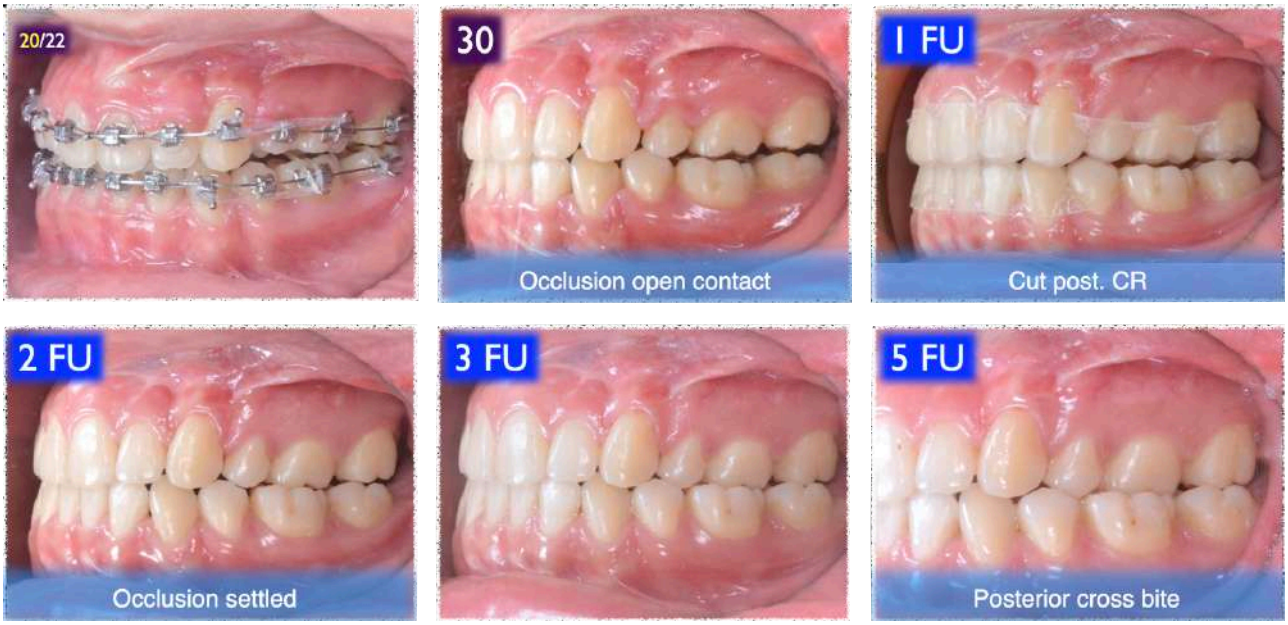


Fig. 30:
The panel of 6 intraoral photographs shows the occlusal contacts settling down naturally through the occlusal force as noted at the 2-year follow-up by cutting the posterior part of the clear retainers at the 1-year follow-up. The posterior crossbite progression was shown through 5 years of follow-up.

and with bracket torque selection to compensate for the mechanics.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE **47**

OVERJET

0 mm. (edge-to-edge)	=	
1 - 3 mm.	=	0 pts.
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm.	=	3 pts.
7.1 - 9 mm.	=	4 pts.
> 9 mm. 9.5mm	=	5 pts.

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

Total = **8**

OVERBITE

0 - 3 mm.	=	0 pts. 0mm
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. 3mm lower arch
3.1 - 5 mm.	=	2 pts.
5.1 - 7 mm. 6mm (upper)	=	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 ____ pts.

Total = **4**

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = **4**

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° 10 x 2 pts. = 20

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

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

SN-MP= 48°
1 to MP= 75°

Total = **20**

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

Identify: Surgical exposure and orthodontic traction of the impacted canine into the arch

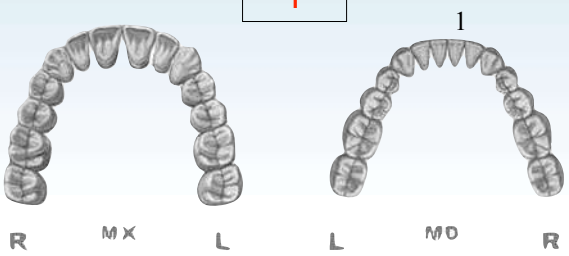
Total = **4**

Cast-Radiograph Evaluation

Total Score: 16

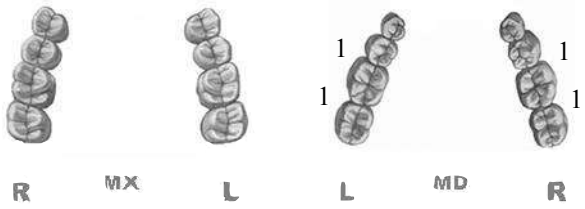
Alignment/Rotations

1



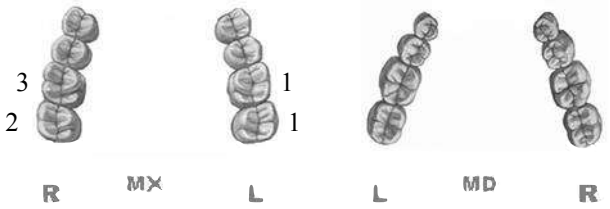
Marginal Ridges

4



Buccolingual Inclination

7

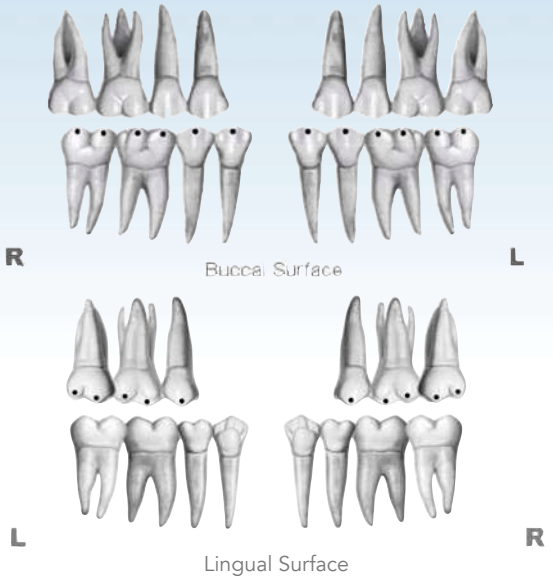


Overjet

3

Occlusal Contacts

0

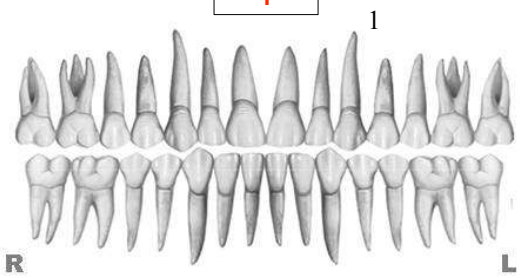


Occlusal Relationships

0

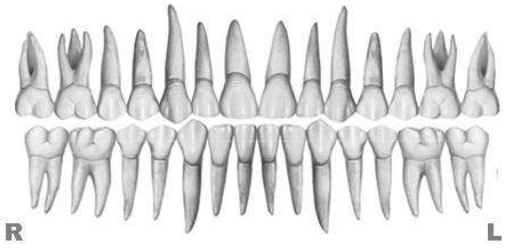
Interproximal Contacts

1



Root Angulation

0



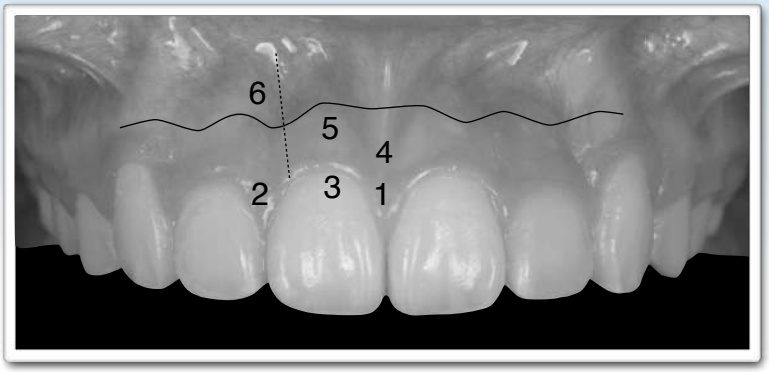
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 4

1. Pink Esthetic Score

Total = 0

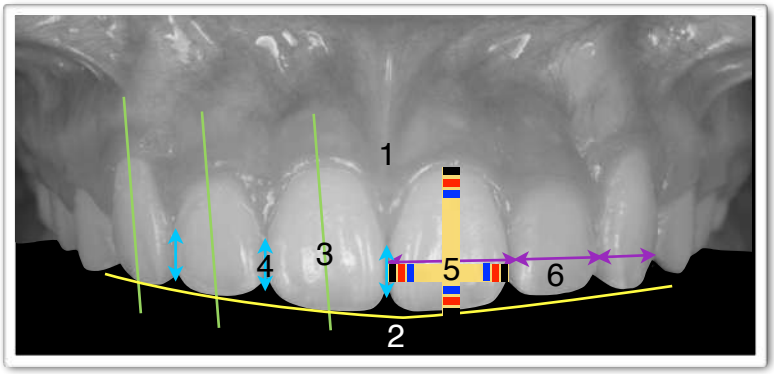


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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 = 4



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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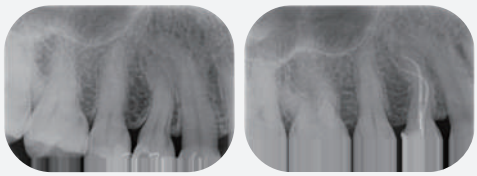
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Class II Excessive Overjet and Deep Bite with a Congenitally Missing Lower Incisor

Abstract

Introduction: *An 11-year-old female presented with chief complaints of flared upper central incisors and protrusive lips.*

Diagnosis: *The cephalometric analysis revealed a skeletal Class II relationship (SNA, 84˚; SNB, 76˚; ANB, 8˚) and proclined upper incisors. An intraoral assessment revealed a congenitally missing lower right lateral incisor, large overjet, deep overbite, and lower midline deviation 3 mm to the right. There was 4-5 mm of crowding in the lower anterior dentition. The Discrepancy Index (DI) was 23.*

Treatment: *A Damon® system appliance with passive self-ligating brackets was applied to correct the dental malocclusion after extracting both upper first premolars. Asymmetrical extraction of the lower left central incisor was carried out due to the congenitally missing lower right lateral incisor. Space closure and midline correction were accomplished with elastomer chains and Class II elastics. The active treatment time was 28 months.*

Results: *Improved dentofacial esthetics and occlusal function were achieved after treatment. The Cast-Radiograph Evaluation (CRE) was 27, and the Pink and White esthetic score was 3. Neither significant root resorption nor periodontal problems were noted.*

Conclusions: *This case report demonstrates the use of passive self-ligating appliances to resolve a severe anterior overjet with deep bite without using an orthodontic bone screw. (J Digital Orthod 2023;72:56-70)*

Key words:
Skeletal Class II, excessive overjet, deep bite, congenitally missing lower incisor, proclined anterior teeth, midline deviation

The dental nomenclature for this case report is a modified Palmer notation with four oral 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, e.g., a lower right lateral incisor is LR2.

Introduction

Congenitally missing teeth are defined as the developmental absence of one or more teeth in the primary or permanent dentition, excluding the third molars.[1] The diagnosis depends on a thorough clinical examination and panoramic radiographs.[2] The etiology is multifactorial. Both environmental and genetical factors can contribute to its occurrence. Factors such as infection, trauma, drugs, and gene associated syndromes such as cleft lip, cleft palate, ectodermal dysplasia, and Down syndrome can disturb tooth germ formation.[3] Sometimes these factors can delay formation of the tooth germ, allowing surrounding tissues to close the space needed for tooth development and resulting in a missing tooth.[4]

The prevalence of congenitally missing teeth differs between continents and races. It is not frequent in the primary dentition, ranging between 0.1% to 2.4%. In the permanent dentition (excluding the third molars) it ranges between 0.15% to 16.2%. Women

Yi-Hsuan Lin,
Training Resident, Beethoven Orthodontic Center (Left)
Joshua S. Lin,
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)

are usually more affected,[5] and the male-to-female ratio is about 2:3.[6] Among Asians, the mandibular incisors are the most commonly missing (60%), followed by maxillary second premolars (10%) and maxillary lateral incisors (8%).[7] Congenitally missing teeth are more commonly bilateral, rather than unilateral, and there is a higher prevalence in the anterior segment, but there is no difference between right and left sides.

A Class II occlusion with a large overjet is difficult to treat using only traditional orthodontic treatment

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

methods. The condition is characterized by protrusive and proclined upper anterior teeth, which results in lip protrusion and increased facial convexity. A beak-like facial profile with lip protrusion is the main characteristic of these patients, and facial esthetics is the main reason to seek orthodontic treatment. Gum impingement caused by an anterior deep bite is problematic for patients. The etiology of a large overjet is multifactorial. Skeletal patterns are predominantly genetically determined, and oral behaviors such as thumb-sucking, lip trap, and anterior tongue posture can alter the development process and may be the etiology of malocclusion. Conventional treatments for patients with a severe overjet may involve headgear and orthognathic surgery.[8,9]

This case report demonstrates the treatment of a patient with a congenitally missing lower right lateral incisor and a large overjet with a Class II molar relationship. No temporary skeletal anchorage devices (TSADs) such as bone screws were used. Reducing the dental and soft tissue convexity resulted in a satisfying outcome.

Fig. 2: *A close-up shot of the proclined upper anterior teeth and large overjet*

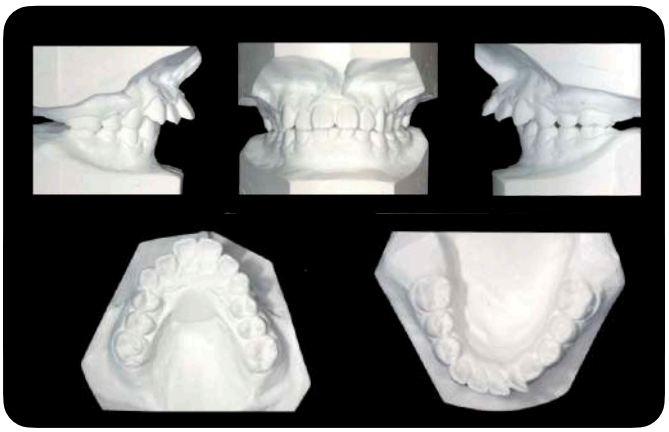

Fig. 3: *Pre-treatment dental models (casts)*

Diagnosis and Etiology

An 11-year-old female presented for orthodontic evaluation with misaligned teeth, a large overjet, and protrusive lips (Figs. 1-3). Medical and dental histories were non-contributory. From the cephalometric analysis, a convex profile with protrusive upper and lower lips to the E-line were noted (Fig. 4; Table 1). A clinical examination revealed a large overjet, a deep curve of Spee in the lower arch, and palatal impingement. The upper and lower dental midlines were not coincident due to the congenitally missing LR2, which was clearly shown in the panoramic radiograph (Fig. 5). The temporomandibular joint (TMJ) morphology was normal in the open and closed positions (Fig. 6), and there were no signs or symptoms of temporomandibular dysfunction (TMD).

The American Board of Orthodontics (ABO) Discrepancy Index (DI) was 37 points, as shown in Worksheet 1 at the end of this report.[10] The patient had no known contributing habits, so the etiology of the malocclusion appeared to be an interaction of environmental (lip trap) and hereditary (missing incisor) factors.

Fig. 4: *Pre-treatment cephalometric radiograph*

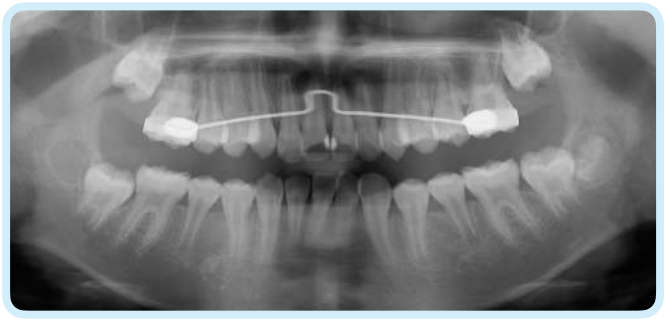

Fig. 5: *Pre-treatment panoramic radiograph*

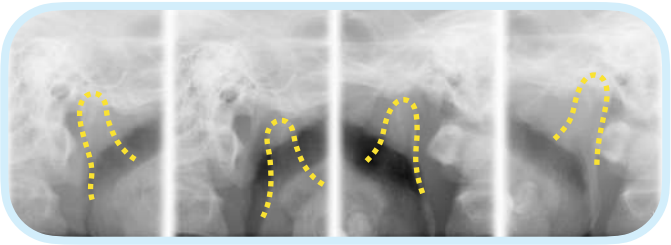

Fig. 6 :
Transcranial radiographs of the temporomandibular joints (TMJs) prior to treatment are shown. From left to right are: right TMJ closed, right TMJ open, left TMJ open, and left TMJ closed. The mandibular condyles are outlined in yellow.

CEPHALOMETRIC SUMMARY			
	PRE-TX	POST-TX	DIFF.
SKELETAL ANALYSIS			
SNA° (82°)	84°	79°	5°
SNB° (80°)	76°	77°	1°
ANB° (2°)	8°	2°	6°
SN-MP° (32°)	34°	34°	0°
FMA° (25°)	27°	27°	0°
DENTAL ANALYSIS			
U1 TO NA mm (4 mm)	9.5	4.5	5
U1 TO SN° (104°)	120°	101°	19°
L1 TO NB mm (4 mm)	6.5	4.5	2
L1 TO MP° (90°)	97°	96°	1°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	8	1	7
E-LINE LL (0 mm)	8	2	6
%FH: Na-ANS-Gn (53%)	53%	55%	2%
Convexity:G-Sn-Pg' (13°)	15°	7°	8°

Table 1: *Cephalometric summary*

Treatment Objectives

1. Improve esthetics by correcting facial convexity and retracting the lips to the E-line.
2. Correct the anterior large overjet and deep bite to an ideal occlusion.
3. Correct the Class II canine and molar relationships to a Class I occlusion.
4. Correct the midline discrepancy.

Treatment Plan

Traditional treatment for a large overjet (OJ = 13 mm) was orthognathic surgery. Since the patient was very young and her mother was worried about the risks of surgery, they were strongly opposed to surgical treatment and mentioned that only conservative approaches combined with extraction would be considered.

According to Chang's extraction decision chart, extraction is the first choice for a case with flared central incisors and protruded lips (Table 2). Since the patient was open to extraction, extractions of UR4 and UL4 were planned in order to correct the anterior crowding and flaring. LL2 extraction was also scheduled after the anterior overjet decreased to within a normal range for midline correction. Space closure by retracting the upper and lower arches also retracts the lips. A series of bite turbos (BTs) expedite the leveling of the curve of Spee. They are placed first on the lower molars and then on the upper incisors. Class II elastics are indicated to protract the mandible and rotate the occlusal plane clockwise, in order to correct the sagittal discrepancy. Bilateral infrazygomatic crest (IZC) bone screws were also considered as an option if further overjet correction was necessary. Both fixed and clear retainers were to be prescribed for retention of the arches after active treatment. The previously inserted upper trans-palatal arch appliance (TPA) was removed before the treatment commenced (Fig. 1).

	Ext	Non
1. Profile	Protrusive	Straight
2. Md.angle	High	Low
3. Bite	Open	Deep
4. Ant. Inclination	Flaring	Flat
5. Crowding	> 7 mm	Non
6. Decay/ missing	Present	?
7. P't perception	OK	No
8. Etc		

Table 2: *Chang's Extraction Decision Table*

Treatment Progress

A 0.022-in slot Damon Q® fixed appliance (Ormco, Glendora, CA) with passive self-ligating (PSL) brackets was selected along with all specified archwires and orthodontic auxiliaries. To meet the patient's esthetic demands, Damon™ Clear brackets were used on the upper anterior teeth. Before active orthodontic treatment started, the patient was referred to have the UR4 and UL4 extracted. Two weeks later, Damon™ Clear 0.022-in PSL brackets (Ormco, Glendora, CA) were bonded on the upper arch, utilizing standard-torque brackets in the anterior segment and high-torque brackets on the canines, and a 0.014-in CuNiTi archwire was engaged. One month later, the lower arch was bonded with brackets, using low torque for the lower anterior teeth. Two bite turbos (BTs) constructed with FUJI II glass ionomer cement (GIC) were installed on LR6 and LL6 to prevent bracket interference. Early light short Class II elastics (Parrot, 5/16-in, 2.0 oz; Ormco) were applied on both sides to protract the mandible and extrude the lower molars. They were bilaterally attached from U3 drop-in hooks and extended to L6 hooks.

Early alignment of the upper and lower arches was achieved with progressive 0.014x0.025-in CuNiTi and 0.017x0.025-in TMA archwires. In the 6th month, two resin BTs were bonded on the palatal surfaces of UR1 and UL1. Class II elastics (Fox, 1/4-in, 3.5 oz; Ormco) were applied on both sides to accelerate the reduction of the excessive overjet.

In the 8th month of treatment, figure-eight ties were applied from canine to canine in the upper arch in order to fix the anterior teeth as a segment. A four-ring power chain was placed bilaterally from the maxillary canines to the maxillary 1st molars to close the extraction spaces.

In the 12th month of treatment, the brackets on LR3, LR1, LL1, and LL3 were repositioned to correct the axial angulation. LL7 was bonded with a bracket since it was then fully erupted. In the 15th month, the overjet decreased to 0 mm, and the patient was referred for LL1 extraction. In the 16th month, a more rigid 0.016x0.025-in SS archwire was used for final space closure. An additional 12 months were required to detail the occlusion.

The treatment progress is documented in a progressive series of intraoral photographs in the frontal, right buccal, left buccal, maxillary occlusal, and mandibular occlusal views (Figs. 7-11). After 28 months of active treatment, all fixed appliances were removed, and fixed retainers were delivered on the maxillary anterior 2-2 and the mandibular lingual 3-3, respectively. Removable clear overlay retainers were provided to maintain both arches. Posttreatment records were collected: intra- and extra-oral photographs, panoramic and lateral cephalometric radiographs, as well as casts (Figs. 12-16).

Results Achieved

The facial esthetics and intermaxillary occlusion were both significantly improved after 28 months of active treatment (Fig. 12). The canine and molar relationships were improved to Class I. The posttreatment panoramic radiograph documented acceptable root parallelism (Fig. 15). The superimposed cephalometric tracings illustrated that the UR6 and UL6 were protracted 5 mm due to the closing of the extraction spaces using elastic forces (Fig. 13). The axial inclination of the upper incisor (U1-SN) decreased 19° after treatment (120° to 101°), and the axial inclination of the lower incisors (L1-MP) was tipped only slightly lingually (97° to 96°). The upper and lower lips were both retruded following the retraction of the anterior segments. The mandibular plane angle (SN-MP) was well-maintained. The facial convexity decreased form 15° to 7° (Table 1). The Cast-Radiograph Evaluation (CRE)[11] score was 27 points, as shown in the supplementary Worksheet 2. The Pink and White dental esthetic score[12] was 3 points (Worksheet 3). The patient was pleased with the final result.

Discussion

Extraction considerations for treating cases with congenitally missing teeth

Treatment plans mainly depend on the number and position of missing teeth, the type of malocclusion, severity of crowding, and facial profile.[13] For young and adolescent patients, bone growing potential

***Fig. 7**: Treatment sequence from the frontal view is shown in months (M): 0M, 4M, 8M, 12M, 16M, 19M, 22M, and 26M.*

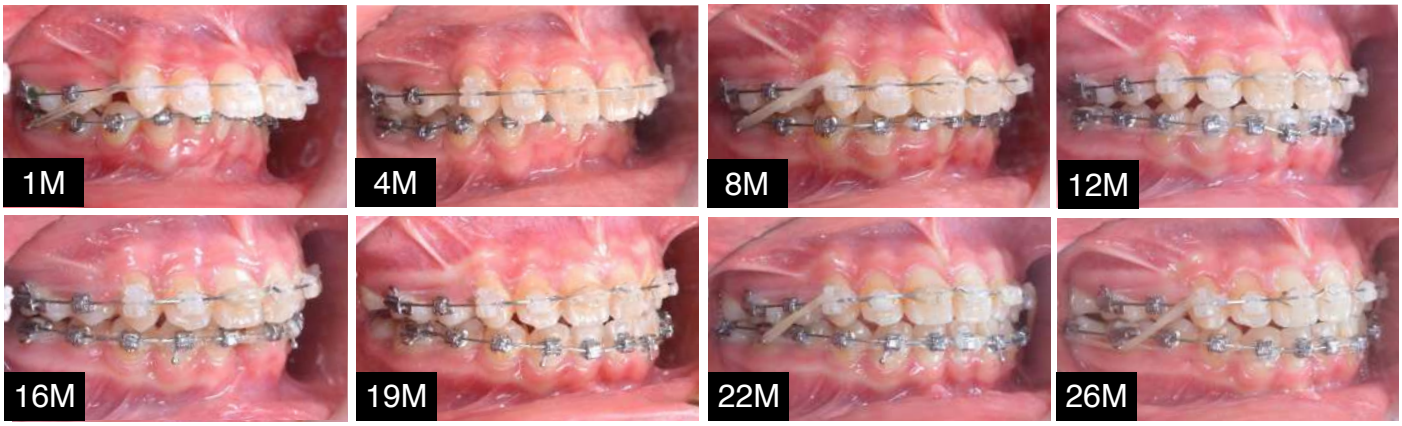

***Fig. 8**: Treatment sequence from the right buccal view is shown in months (M): 1M, 4M, 8M, 12M, 16M, 19M, 22M, and 26M.*

***Fig. 9**: Treatment sequence from the left buccal view is shown in months (M): 1M, 4M, 8M, 12M, 16M, 19M, 22M, and 26M.*

Fig. 10: *Treatment progress from the maxillary occlusal view is shown in months (M): 0M, 4M, 8M, 12M, 16M, 19M, 22M, and 26M.*

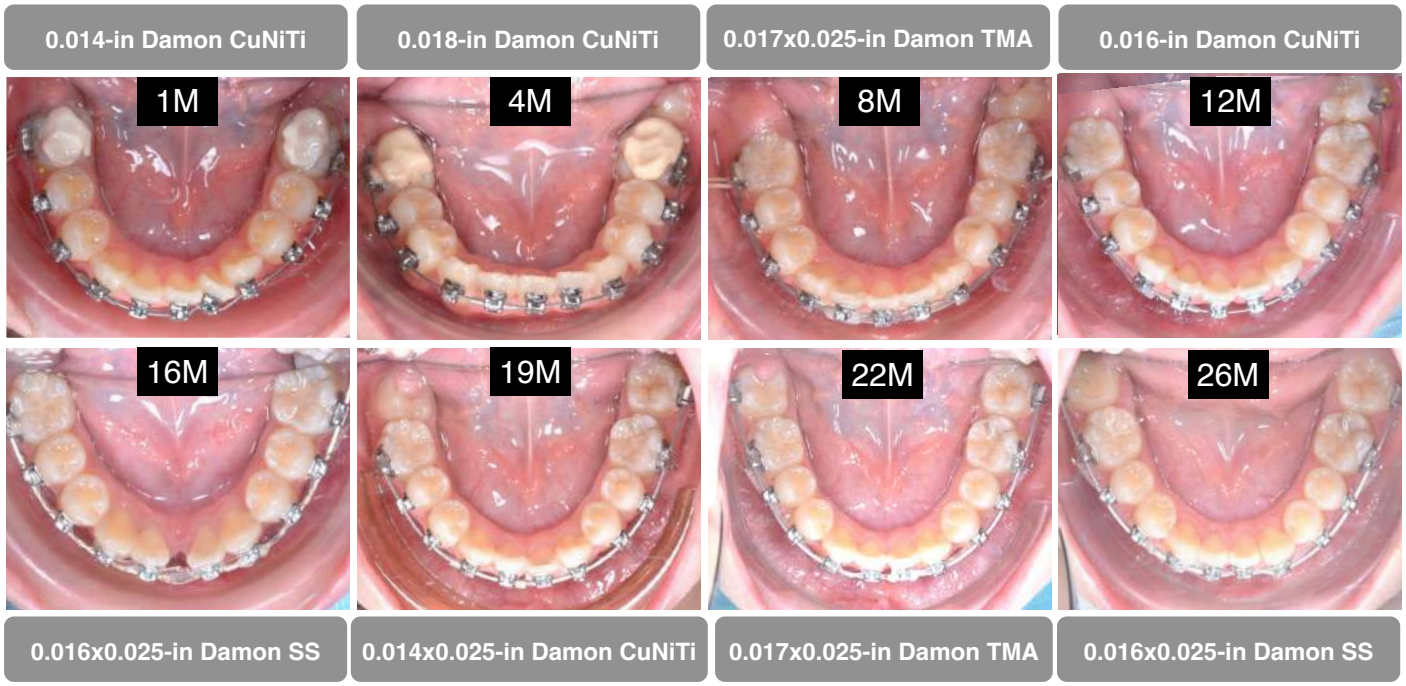

Fig. 11: *Treatment progress from the mandibular occlusal view is shown in months (M): 1M, 4M, 8M, 12M, 16M, 19M, 22M, and 26M.*

must also be taken into consideration. The edentulous space can be either left open for further restoration or closed by orthodontic means.[14] Dental midline, molar relationships, and teeth conditions such as caries, root canal treatments, and periodontal disease must also be considered. Keeping the arches symmetrical by balancing bilateral tooth numbers is often preferred by many patients.

In this case, the unilateral congenitally missing tooth combined with crowded anterior teeth would often require extracting the opposite tooth, in order to relieve the crowding and balance bilateral tooth numbers for the purpose of symmetry. The initial treatment plan was to extract LL2 which was symmetrical to the congenitally missing LR2. However, after 15 months of alignment, the lower anterior teeth flared out, which decreased the overjet to 0 mm, and became much more prominent in the central area, especially with obvious gingival recession. The lower dental midline was deviated 3 mm to the right. Since the patient's three lower anterior incisors looked similar in size

Fig. 12: *Posttreatment facial and intraoral photographs*

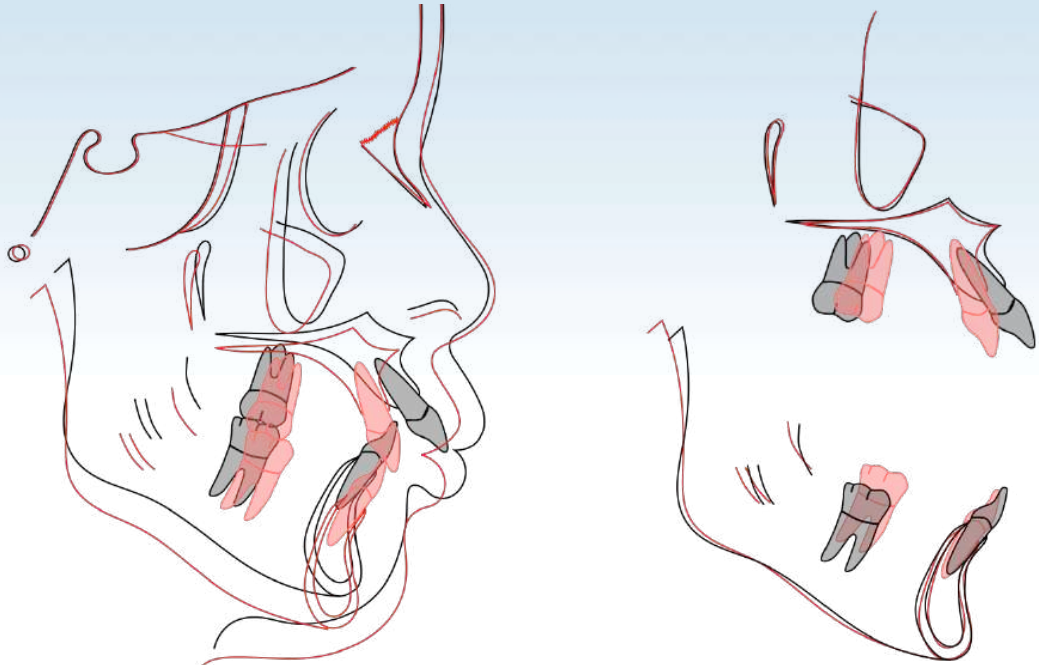

Fig. 13:
Pre-treatment (black) and posttreatment (red) cephalometric tracings are superimposed on the anterior cranial base (left), the maxilla (upper right), and the mandible (lower right). The incisors were retracted, and protrusion was reduced.

Fig. 14: *Posttreatment cephalometric radiograph*

Fig. 15: *Posttreatment panoramic radiograph*

Fig. 16: *Posttreatment dental models (casts)*

and shape, the actual treatment plan changed to extract LL1 instead of LL2, followed by space closure with both sides symmetrical. This made the treatment process much easier for midline correction, and the lower anterior teeth were corrected to a straighter angulation.

Bite turbos combined with Class II elastics

Anterior bite turbos are very useful when opening a deep overbite; they serve as vertical stops at the desired vertical dimension of the occlusion. They provide space for the posterior teeth to spontaneously extrude to desired positions on the occlusal plane, and the biting force exerted on them results in a vertical load, which intrudes both upper and lower incisors. They can also be employed to level the curve of Spee and correct a deep overbite. In this case, the upper anterior BTs kept the vertical occlusion vertical during extraction space closing, to avoid deepening the bite.

For patients with a large overjet, anterior BTs also serve as an anterior positional guide, and when combined with Class II elastics, which further guide the mandible forward efficiently, they enable repositioning of the mandible in a more forward position, thereby decreasing the overjet. Anterior BTs should be bonded more gingivally and should be long enough in the initial stages to allow the patients to occlude on them more easily.

For some patients, posterior BTs may also be necessary to help them get used to their new forward occlusal position and raise their bite to prevent hitting the brackets.

Anterior BTs are usually made with composite resin, and posterior BTs are constructed with glass ionomer cement. The advantages of BTs are that they are easy to use, work full-time, and require zero patient cooperation. However, placing them on endodontically treated teeth should be avoided, to prevent potential tooth fracture.

In this case, extracting the upper bilateral first premolars opened the space to retracted the upper anterior teeth, which further decreased the overjet and returned the flared upper anterior teeth to a normal upright position. Combining the BTs and Class II elastics effectively solved the deep overbite and brought the large overjet back to a normal occlusion.

Conclusions

This large overjet with anterior deep bite and congenitally missing tooth was treated to an acceptable result. With Chang's Extraction Decision Table (Table 2), a feasible treatment plan was completed with a pleasant outcome without headgear or surgery. In retrospect, the treatment time could have been decreased by using buccal shelf miniscrews. The occlusion was stable at the 3-year follow-up (Fig. 17).

Fig. 17 *Posttreatment 3 year follow-up photos show that the occlusion was stabled.*

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 23

OVERJET

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

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

Total = 5

OVERBITE

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

Total = 5

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. Per tooth

Total = 0

CROWDING (only one arch)

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

Total = 2

OCCLUSION

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

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. Per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

Each degree > 6° 2 x 1 pt. = 2

SN-MP

≥ 38° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

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

Total = 6

OTHER (See Instructions)

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

Identify:

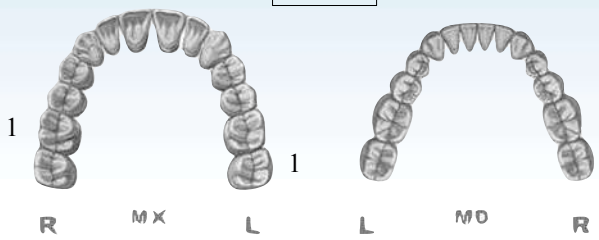
Total = 5

Cast-Radiograph Evaluation

Total Score: 27

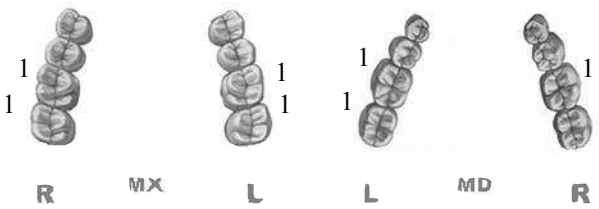
Alignment/Rotations

2



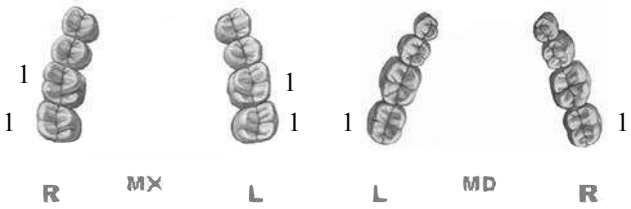
Marginal Ridges

7



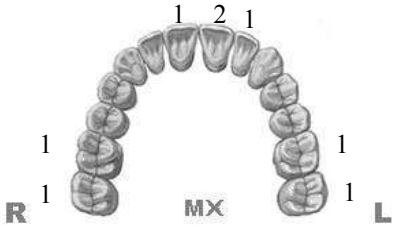
Buccolingual Inclination

6



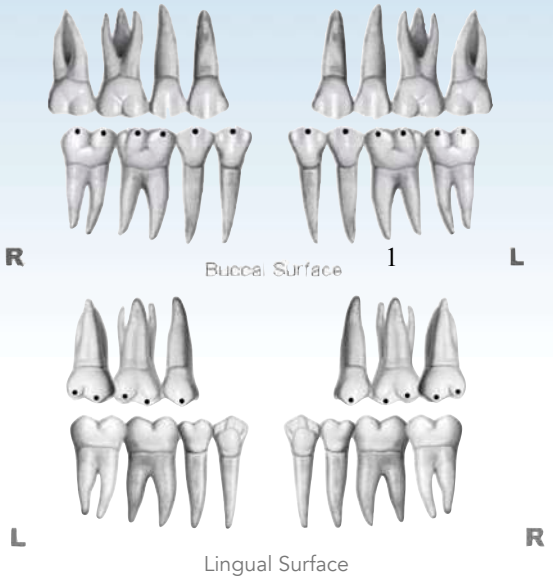
Overjet

8



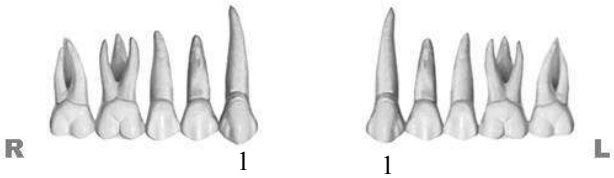
Occlusal Contacts

1



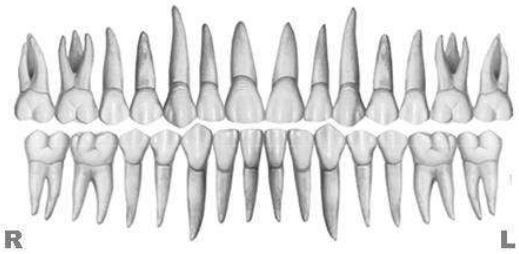
Occlusal Relationships

2



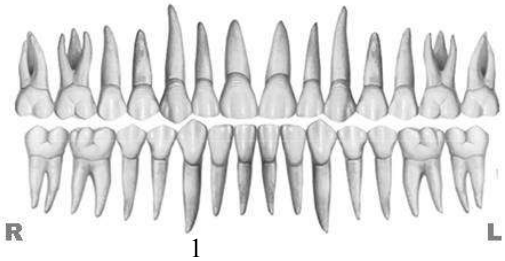
Interproximal Contacts

0



Root Angulation

1



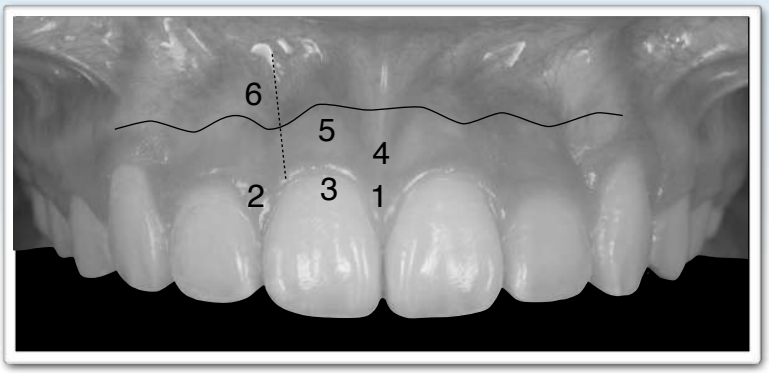
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 3

1. Pink Esthetic Score

Total = 0

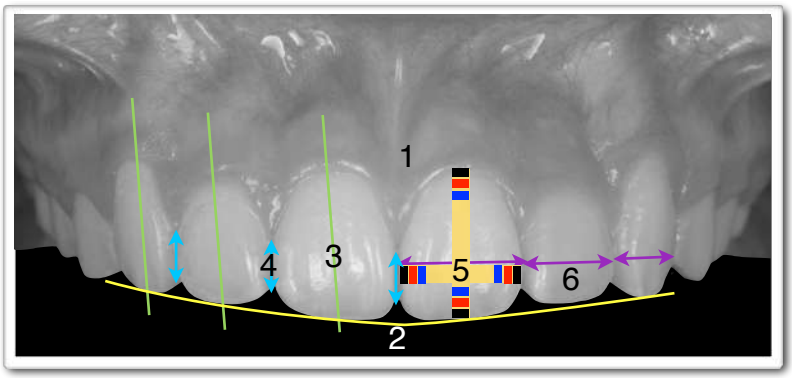


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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 = 3



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

2023-2024 第十五年度

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：

2023　4/18、5/16、6/13、7/11、8/15、9/12、10/3、11/7、12/19

2024　1/9、3/12

- **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**

全新的第十五年度 2023-24 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。

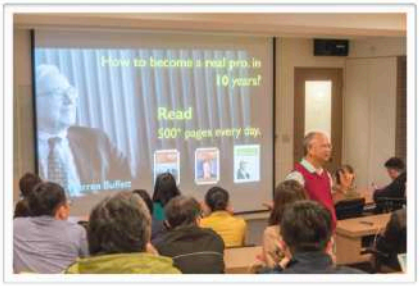
每月一次的課程之中，包含了：

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。

2023-24 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。



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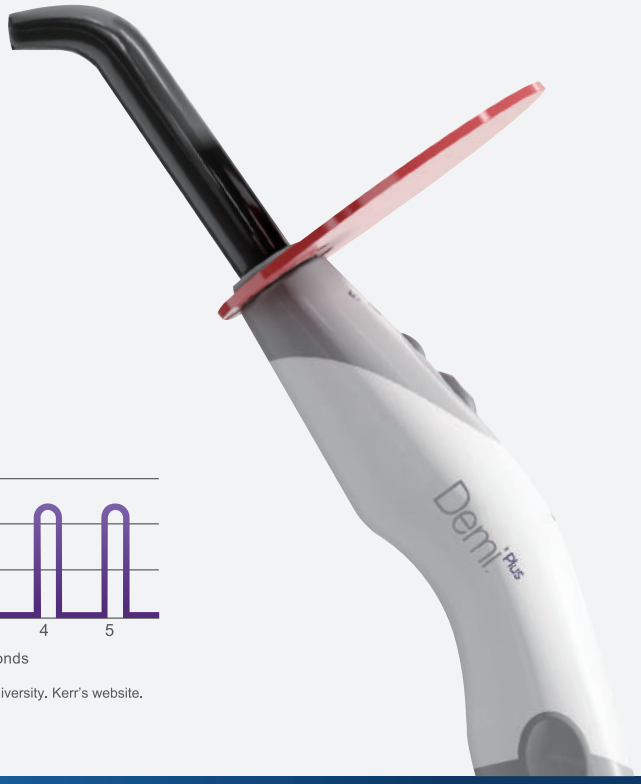

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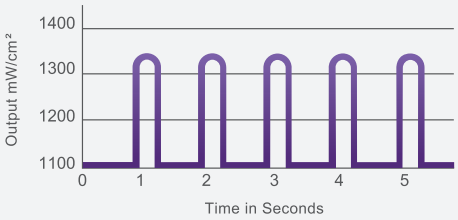

Source: Nova Southeastern University. Kerr's website.

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Volume	8ml/bottle	6ml/bottle	5ml/bottle	5ml/bottle
Filler	48%	15%	7%	15%
Film Thickness	Not Indicated for Indirect	5-10 microns	5-10 microns	5-10 microns
Etch	Total-Etch	Total-Etch	Self-Etch, Total-Etch	Self-Etch, Total-Etch
Delivery	Bottle, Unidose™	Bottle, Unidose™	Bottle, Unidose™	Bottle, Unidose™
Recommend	The Gold Standard Best for IDS	Optimal Simplification Steps for Total-Etch	Aesthetic with Harmonize Composite	Best with NX3 Cement for BPR

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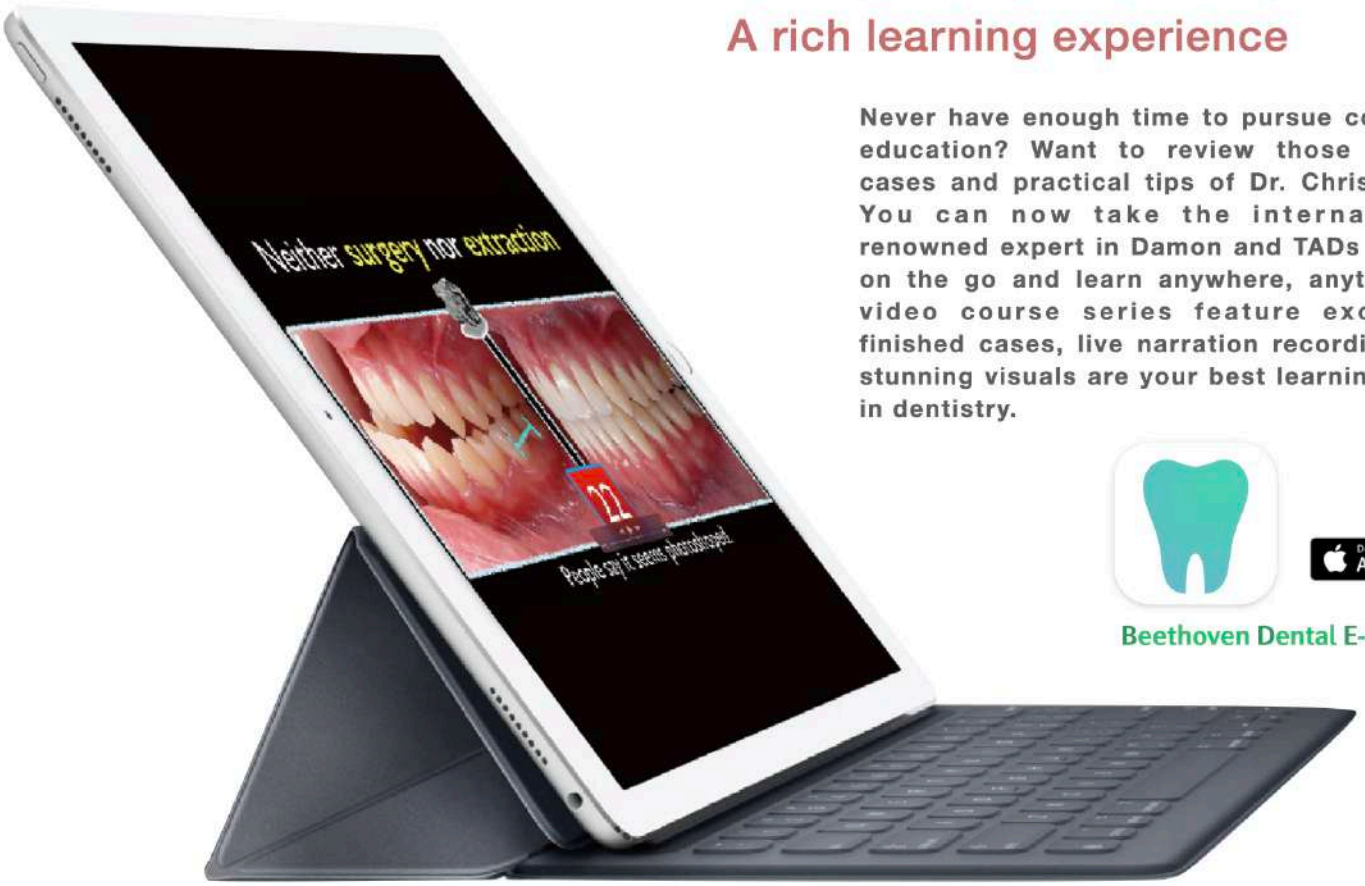

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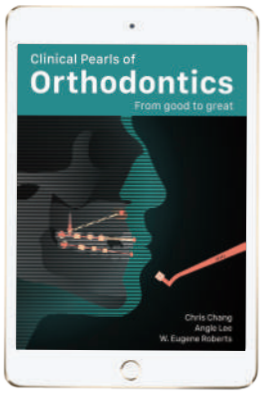

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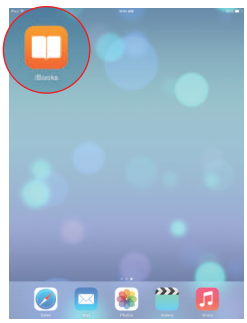

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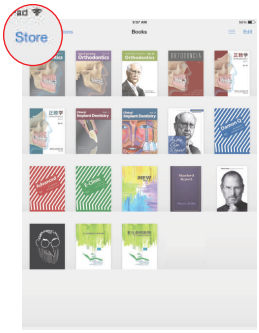

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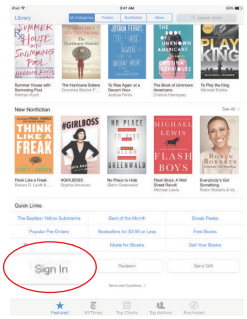

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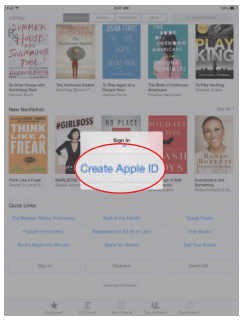

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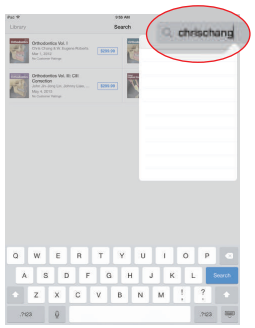

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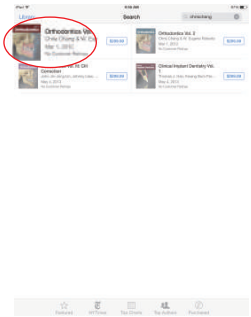

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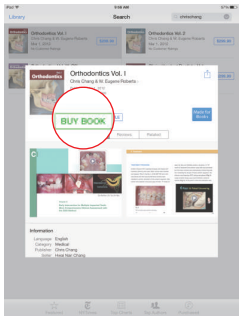

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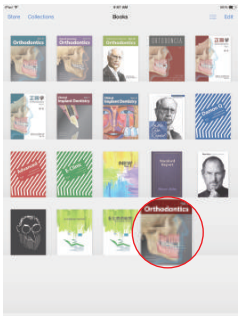

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New Release!

In early October, 2023, Dr. Chang was invited by Digital Academy to give a 2-day lecture in Istanbul, Turkey. After the lecture, the organizer arranged a trip to the ancient city of Cappadocia, where Dr. Chang and Shufen, his wife and trusty right-hand woman, enjoyed the extraordinary scenery on a hot air ballon ride. The experience was truly a blessing!