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An impacted UL3 was recovered with the VISTA technique. A 1.5x8-mm OrthoBoneScrew® was inserted interdentally between the roots of UL1 and UL2, with an elastic chain stretched from from the impacted UL3 and attached to the bone screw to apply traction to move the impacted tooth anteriorly (upper figures). After around one month, the impacted UL3 was uprighted. Reactivation is accomplished by engaging the second loop in the chain and trimming the disengaged loop with surgical scissors (lower figures).

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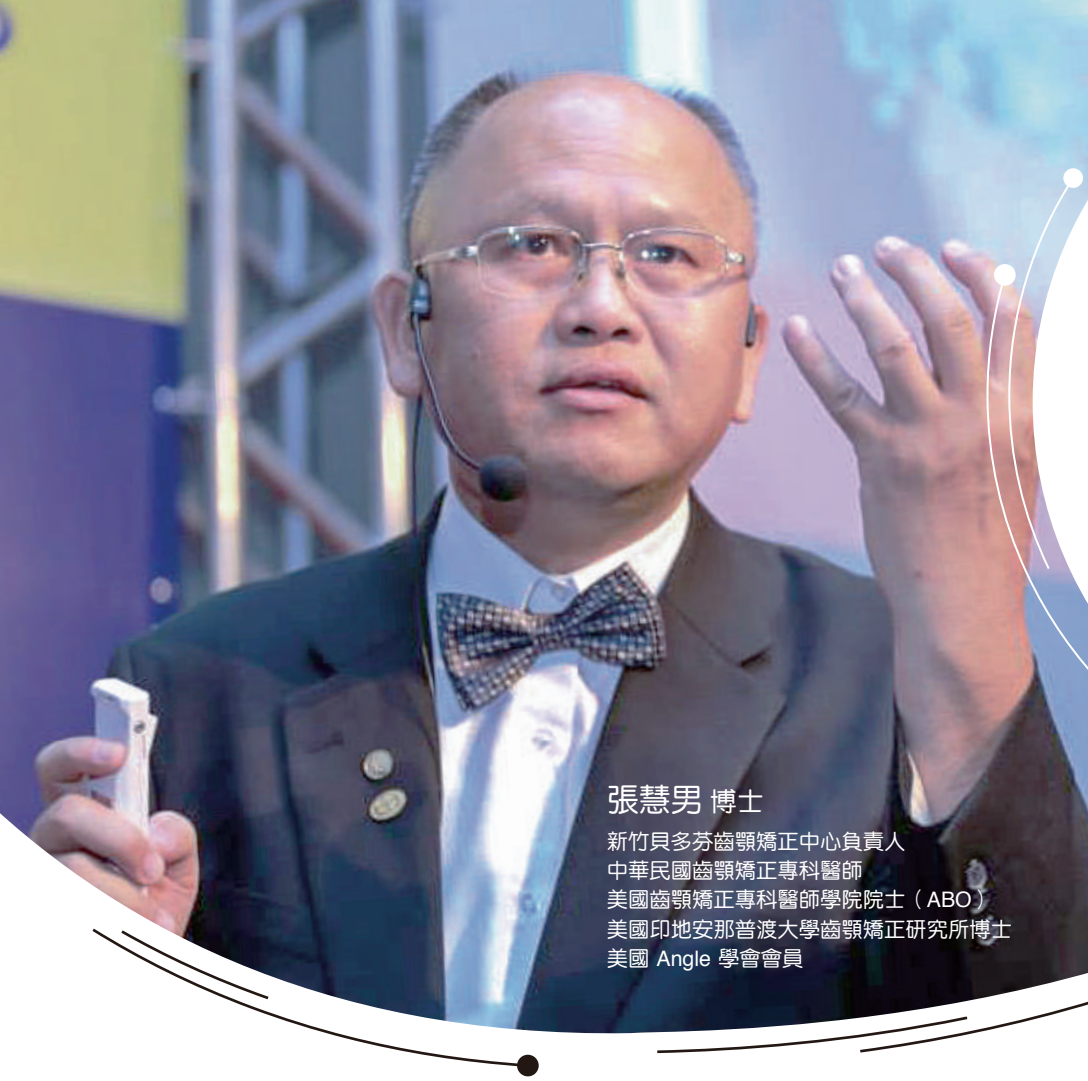

2022
熱愛學矯正

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

張慧男 博士

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Damon Master

(Thu) 9:00-5:00 中文授課

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

Excellent Finishing

(Tue) 9:00-12:00 中文授課

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

International Workshop

(Digital Orthodontics, OBS & VISTA)

English Class

The workshop provides a 3 day, advanced hands-on program to experienced Damon users. The program includes world-class lectures, model and surgical hands-on workshops and clinical observation on patient care and clinic management.

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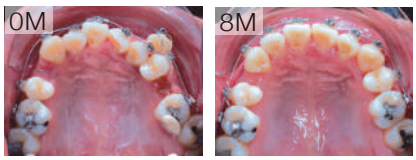
2022	A班	B班		A班	B班
Module 1 -	4/14	6/9	Module 7 -	8/18	9/22
Module 2 -	4/28	6/30	Module 8 -	9/15	10/20
Module 3 -	5/12	7/14	Module 9 -	9/29	11/3
Module 4 -	6/2	7/28	Module 10 -	10/13	12/1
Module 5 -	6/16	8/4	Module 11 -	11/10	12/15
Module 6 -	7/21	9/1			

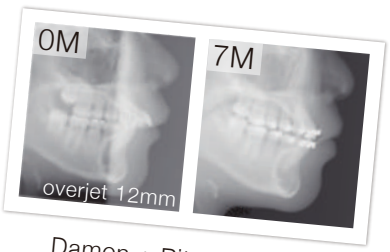
Finishing XIV

Module 1 -	5/10	Module 7 -	11/15
Module 2 -	6/7	Module 8 -	12/6
Module 3 -	7/12	Module 9 -	1/10/23'
Module 4 -	8/16	Module 10 -	2/7
Module 5 -	9/6	Module 11 -	3/7
Module 6 -	10/4		



Damon + .014 Cu NiTi

Damon Clear



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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"There is nothing like writing to force you to think and get your thoughts straight."
– Warren Buffett

This quote above encapsulates exactly what writing means to me. During the last 30 years of my orthodontic journey, I have always considered writing to be the one skill that has enabled me to meticulously organize my thoughts. It will therefore come as no surprise to you that case report writing is a fundamental and crucial part of our clinic's residency training.

In this edition of JDO, we are focusing primarily on the VISTA technique, with Dr. Joy Cheng's publication of a case with impacted and transposed canines treated with VISTA and bone screws (*reprinted with kind permission of International Journal of Orthodontics*), as well as Dr. Jeff Lee's report of a labially-impacted canine managed with VISTA, connective tissue graft, IZC screws, and a 3D lever arm. Last but not least, Dr. Joshua Lin's Clinical Tips section provides a comprehensive overview of maxillary impaction management.

I am so glad that we started this journal 15 years ago, as it has served as a great platform for our own doctors to present their written studies. Still now, we never stop striving for improvements in our writing skills, as well as case analyses. Our JDO is literal proof of all those years of accumulated hard work.

I am furthermore thrilled to announce that the Universität of Duisburg-Essen, Germany, contacted us last December to discuss the possibility of making Beethoven one of three world-wide prerequisite courses for studying towards their Master's Degree in Specialized Orthodontics. A compulsory part of the Master's is obviously writing a thesis, which sounds and is in fact very arduous, even for many seasoned orthodontists. Luckily, here at Beethoven, we have been training ourselves for at least 15 years. Therefore, I encourage doctors, especially of the younger generation, to work towards this academic milestone with the help of our experienced lecturers. I am sure that this will be a life-changing journey for you all as orthodontists.

Finally in our Taiwanese lifestyle section, we are focusing on free-flight training, not only for birds, but also, metaphorically speaking, for humans. We discuss how trust plays an indispensable role in bird training, and how the process has inspired me in training my own residents.

I wish each and every one of you a prosperous and healthy 2022, and look forward to the time when we can again personally meet along our path to glory.

Chris Chang PhD, ABO Certified, Publisher of JDO

Class II Malocclusion with Impacted and Transposed Canines Treated with Modified Vertical Incision Subperiosteal Tunnel Access (VISTA) and Bone Screws

Abstract

Introduction: *A 11yr-8mo-old female presented with a chief complaint of unerupted bimaxillary right canines.*

Diagnosis: *The patient had a right end-on Class II and left full-cusp Class II dental malocclusion with an overjet of 8mm. A 100% impinging deep bite was also noted. This severe malocclusion was further complicated by an incompletely transposed and impacted maxillary right canine and a completely transposed and impacted mandibular right canine. The discrepancy index (DI) was 59.*

Etiology: *The cause of the severe impaction was a deviated path of eruption that may be related to over-retained primary canines.*

Treatment: *A right-sided infra-zygomatic crest (IZC) bone screw and a right-sided buccal shelf (BS) bone screw were used as anchorage for a modified vertical incision subperiosteal tunnel access (VISTA) submucosal procedure to retract unerupted bimaxillary right canines to their correct sagittal relationships, respectively. Bilateral IZC bone screws, Class II elastics, combined with anterior and posterior bite turbos (BTs) were used to correct the Class II malocclusion, excessive overjet, and deep bite.*

Outcome: *After 35 months of active treatment, this difficult malocclusion, with a Discrepancy Index of 59 points, achieved a Cast-Radiograph Evaluation score of 26 points and a Pink and White esthetic score of 4 points. The patient was very pleased with the treatment outcome. Final records were collected at the 1.5-year recall appointment. (J Digit Orthod 2022;65:4-24, reprinted with permission from Int J Orthod 2021;32(2):7-17)*

Key words: *Impaction, impacted and transposed maxillary canine, impacted and transposed mandibular canine, incompletely transposed impaction, completely transposed impaction, modified vertical incision subperiosteal tunnel access, VISTA, bone screw, closed eruption technique*

Introduction

Recovering severely displaced, impacted canines is among the most challenging clinical problems in orthodontics. An impacted canine can lead to strenuous tooth eruption and movement, which could thereby negatively influence its esthetics and functions.[1-4] Notably, the corrective treatment for a transposed impaction becomes an even greater challenge. The standard procedure to recover impaction includes surgical exposure and forced orthodontic eruption.[5,6] Kokich[7] has proposed three surgical methods for uncovering labially impacted maxillary canines: an excisional uncovering, a closed eruption technique (CE), and an apically positioned flap (APF). Accordingly, deep and high bony impactions require treatment using the latter technique, whereas horizontal bony impactions are more suitable for the last type. Previously, the anchorage for traction of the impacted canines has been achieved either through adjacent anchorage of teeth or through a main wire. If the deep impaction is severely displaced, it becomes impossible to move. In such a case, the anchorage for traction cannot

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



provide a three-dimensional force to pull back the impaction to the baseline position

Bone screws can help guide impacted canines with greater precision during eruption while avoiding unwanted movement of anchorage teeth.[7] Their other advantages include ease of placement and removal, minimal need for patient compliance, and cost effectiveness.[8] They constitute a strategic component to the treatment of impacted teeth.

Fig. 1: *Pre-treatment facial and intra-oral photographs*

The vestibular incision subperiosteal tunnel access (VISTA), as developed by Zadeh,[9,10] repositions the gingival margins coronally to correct periodontal defects in the maxillary anterior region (Fig. 2). In contrast, a modified VISTA approach, as developed by Chang,[10-14] exposes the crown of the canine surface and provides an exit tunnel for the power chain. Its advantage lies in its relief on the strain when creating a full thickness flap in the procedure, whereby bone screws play an auxiliary role as anchorage devices.

The current patient is a rare and difficult case because she had two impacted and transposed canines: maxillary right canine, an incompletely transposed impaction, and mandibular right canine, a completely transposed impaction.[15-17] The purpose of this case report is to document our use of a modified VISTA method combined with placement of bone screws for managing transposed, labial impacted canines.

Diagnosis and Etiology

A 11-year-8-month-old girl presented with her parents for orthodontic consultation to evaluate her unerupted bimaxillary right canines. Clinical examinations showed that primary right canines in both arches were over-retained. In addition, the overjet was 8mm, and the overbite was 100% impinging deep bite. Right end-on Class II and left full Class II molar relationships were noted. A 2mm diastema was noted between the maxillary central incisors. On average, a 1mm space was found between all mandibular teeth (Figs. 1 and 3).

A panoramic radiograph revealed that the apex of the maxillary right canine was located in the proper eruption site, but its vertical position was 12mm apical to the alveolar crest. Besides, its crown tip overlapped the distal root surface of the maxillary right central incisor. The impacted mandibular right canine was parallel to its adjacent teeth, but its crown and root structure overlapped the root of the mandibular right lateral incisor. The maxillary right canine was diagnosed as incomplete transposed impaction, and the mandibular right canine was diagnosed as complete transposed impaction (Fig. 4).[15-17]

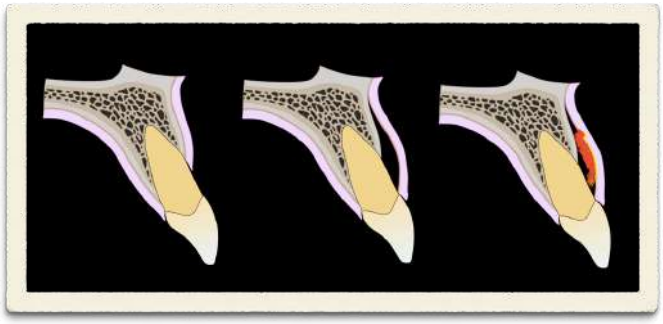

Fig. 2:
As shown from left to right, the VISTA procedure is a novel, minimally invasive approach for undermining the labial mucosa to correct soft tissue defects in the maxillary anterior region.

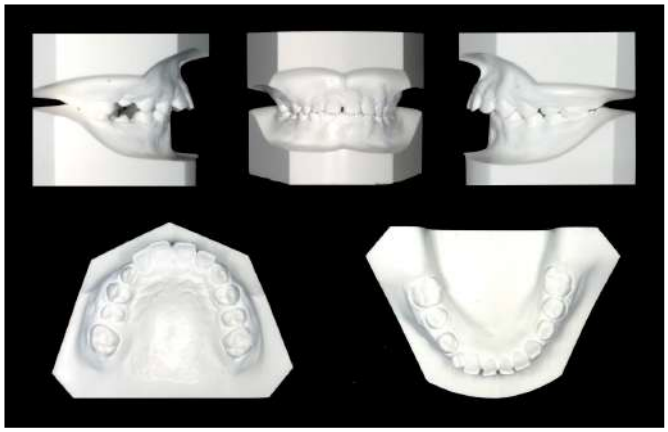

Fig. 3: *Pre-treatment study models (casts)*

Fig. 4: *Pre-treatment panoramic radiograph*

Lateral cephalometric analysis of the pre-treatment data indicated a low mandibular plane angle (15˚), a convex profile (G-Sn-Pg 26˚), and a protrusive upper lip (3mm to the E-Line). The bimaxillary incisors had increased axial inclination (U1 to SN 118˚, L1 to MP 116˚) (Fig. 5; Table 1). Pre-treatment CBCT images showed that the bimaxillary right canines are both labial impactions (Figs. 6 and 7). The American Board of Orthodontics (ABO) Discrepancy Index (DI) was 59 as shown in the subsequent worksheet.

Treatment Objectives

The treatment objectives were to align the bimaxillary impacted canines without causing detrimental effects on the adjacent incisors, to close all spacing, and to establish ideal overjet and overbite.

Treatment Alternatives

The ideal objective for a full fixed-appliance treatment would be to resolve the malocclusion and align the impacted cuspids. Two treatment plans were thus proposed: Option 1) would require surgical removal of the impacted canines, substituting them with the adjacent first premolar, and extracting the other two first premolars. This treatment option would warrant a shorter treatment time but would be detrimental to the patient's profile. On the other hand, Option 2) would involve a non-extraction treatment to align the transposed canines to their original positions. This would take more time to treat but would result in better esthetics and occlusion. After discussing the advantages and disadvantages of each option with the patient and her parents, we chose Option 2, the non-extraction treatment.

Treatment Progress

The treatment can be divided into two phases: the first phase to correct the impaction, and the second to complete the final alignment.

Fig. 5: *Pre-treatment cephalometric radiograph*

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA° (82°)	82°	82°	0°
SNB° (80°)	79°	79°	0°
ANB° (2°)	3°	3°	0°
SN-MP° (32°)	15°	17°	2°
FMA° (27°)	8°	10°	2°
DENTAL ANALYSIS			
U1 TO NA mm (4mm)	8	3	5
U1 TO SN° (104°)	118°	93°	25°
L1 TO NB mm (4mm)	3	1	2
L1 TO MP° (90°)	116°	115°	1°
FACIAL ANALYSIS			
E-LINE UL (-1mm)	3	-0.5	3.5
E-LINE LL (0mm)	0.5	-1	1.5
%FH: Na-ANS-Gn (56%)	52%	53%	1%
Convexity: G-Sn-Pg (13°)	26°	23°	3°

Table 1: *Cephalometric Summary*

Phase 1: Correct the impaction

A self-ligating fixed appliance (Damon Q®, Ormco Corporation, Brea, CA) was bonded on all maxillary permanent teeth, except for the maxillary right lateral incisor. Notably, the unbonded lateral incisor acted as a free body to avoid any interference with the path of retraction which might result in more root resorption. A 0.014-in CuNiTi archwire was then engaged. A closed coil spring was inserted between the brackets on the maxillary right central incisor and the maxillary right first premolar to create space for the impacted maxillary right canine.

One month later, the initial surgery to expose the impaction was incorporated with a modified VISTA procedure designed to coordinate with an orthodontic retraction mechanism anchored by an extra-alveolar OrthoBoneScrew® (OBS) (2x12-mm, iNewton, Inc., Hsinchu, Taiwan). The bone screw had been placed in the right infra-zygomatic crest (IZC). The first vertical incision was performed along the mesial line angle of the lateral incisor. Following the initial incision, a periosteal elevator was used to detach the periosteum and expose the impaction, after which the bone covering the crown was removed down to the cementoenamel junction (CEJ). A button was bonded to the crown of the impaction. The bone in the planned path of retraction was removed with a #4 carbide round bur to facilitate tooth movement. Then, a second incision was performed along the mesial line angle of the maxillary right first premolar to make an exit tunnel for a power chain. A power chain was attached from the button to the IZC screw. After engaging the force, the two vertical incisions were sutured using 6-0 nylon to ensure minimal damage to the mucosa (Fig. 8).[10]

The procedure to recover the impacted mandibular right canine is similar to that mentioned above. The modified VISTA procedure was applied to coordinate with an orthodontic retraction mechanism that was anchored by an extra-alveolar OBS (2x12-mm) placed in the right buccal shelf (BS) (Fig. 9). Primary bimaxillary canines were then removed.

During the 5th month, the incision around the exit tunnel for the power chain had healed well. The loop of power chain was cut to reactivate the retraction force (Fig. 10). During the 7th month, a

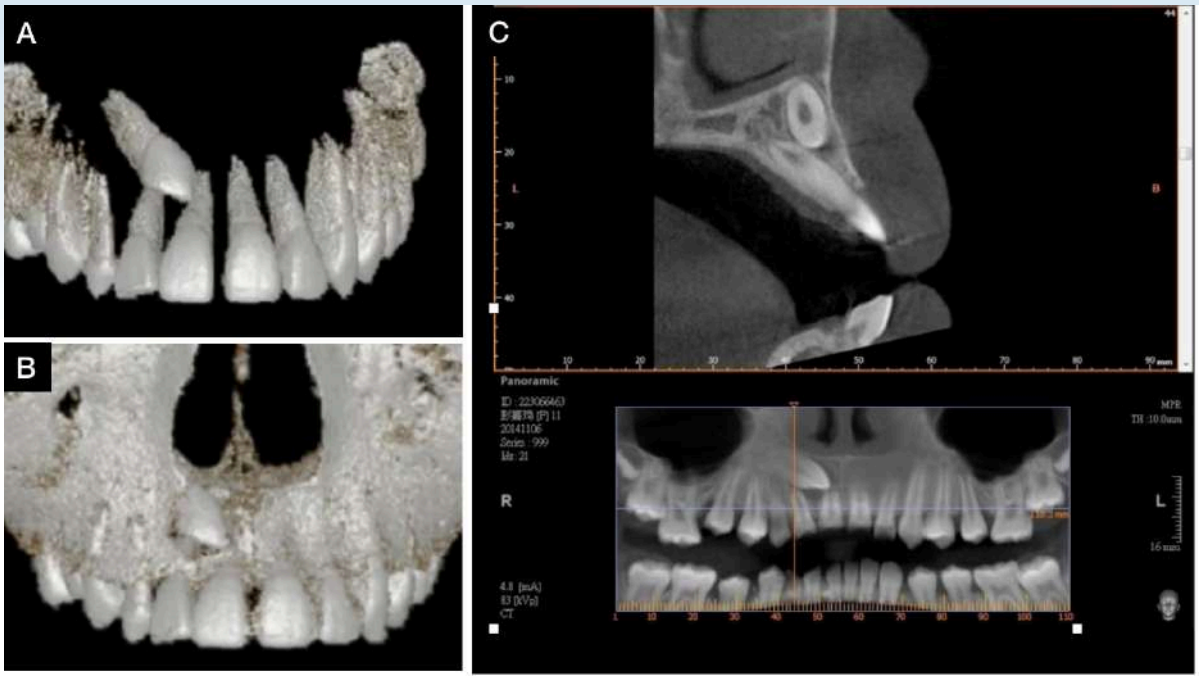

Fig. 6: *Pre-treatment CBCT*
A. 360º rotated animation around the impaction with the bone covering deleted. B. 360º rotated animation around the impaction covered with bone. C. Cross sectioned slice through the impaction

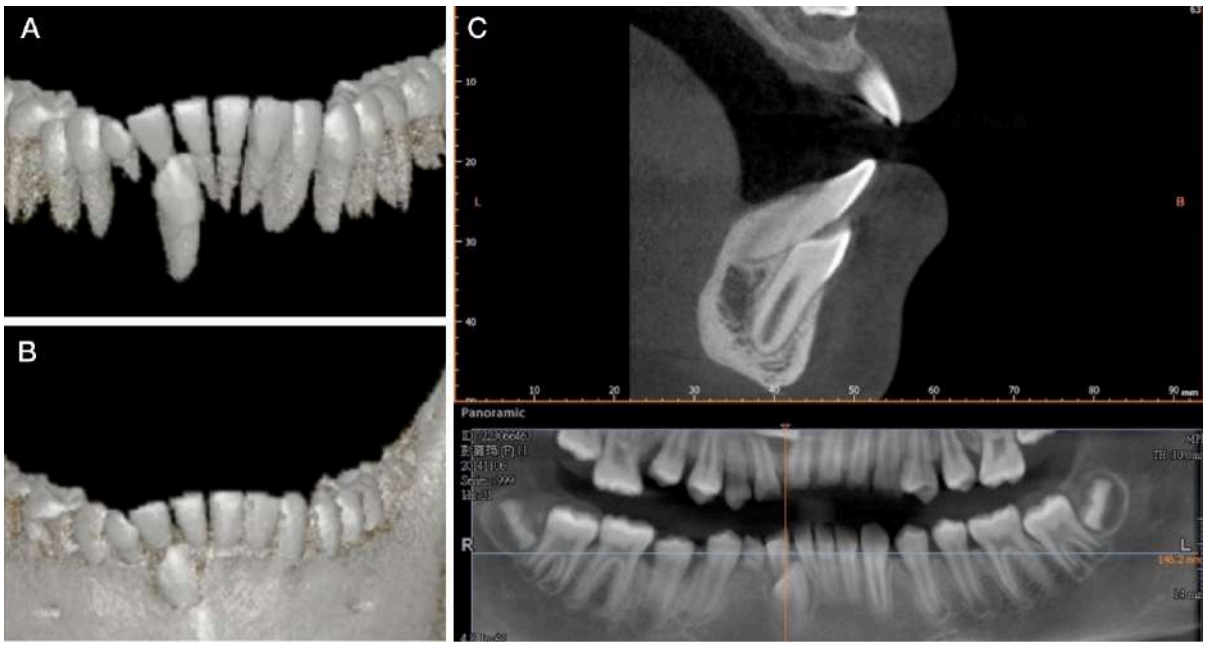

Fig. 7: *Pre-treatment CBCT*
A. 360º rotated animation around the impaction with the bone covering deleted. B. 360º rotated animation around the impaction covered with bone. C. Cross sectioned slice through the impaction

panoramic radiograph was taken to check the position of the two impacted canines. The mesio-distal position of impacted maxillary right canine was in the correct eruption position, but its vertical position was still far from the alveolar crest. The mandibular right canine crown went back into the oral cavity, but the apex was still located between the mandibular central and lateral incisors (Figs. 10 and 11). Subsequently, the right BS screw was removed, and a left IZC screw was installed.

During the 11th month, closed eruption technique was performed because of the unexposed maxillary right canine. The bone covering the maxillary right canine was removed to attach a ligature wire from the impacted crown to the main wire (Fig. 12). The track of tooth movement was recorded in Fig. 11.

Phase 2: Complete the final alignment

Also, during the 11th month, a self-ligating fixed appliance (Damon Q®, Ormco Corporation, Brea, CA) was bonded on all mandibular permanent teeth and the maxillary lateral incisor, standard torque brackets were selected for the lower incisors, and high torque brackets were chosen for canines. An 0.014-in CuNiTi archwire was engaged. Notably, the axis of the bracket had been tilted distally relative to the axis of the mandibular right canine, such that the apex could be shifted distally in order to correct for its transposed apex (Fig. 13).

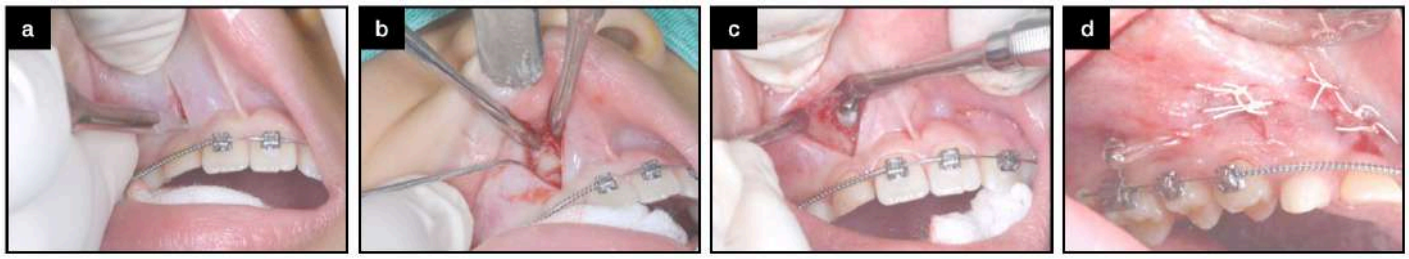

Fig. 8: *Procedure of the maxillary right canine surgery*
(a) The first incision was made along the mesial line angle of the maxillary right lateral incisor. (b) The bone covering the crown of the impaction was exposed, and then removed. (c) A button was bonded onto the crown of the impaction and all obstacles were removed. (d) a second incision was performed along the mesial line angle of the maxillary first premolar to establish a traction route for the power chain. The power chain was retracted from the IZC screw to the button. Finally, the two incision lines were closed with a 6-0 Nylon.

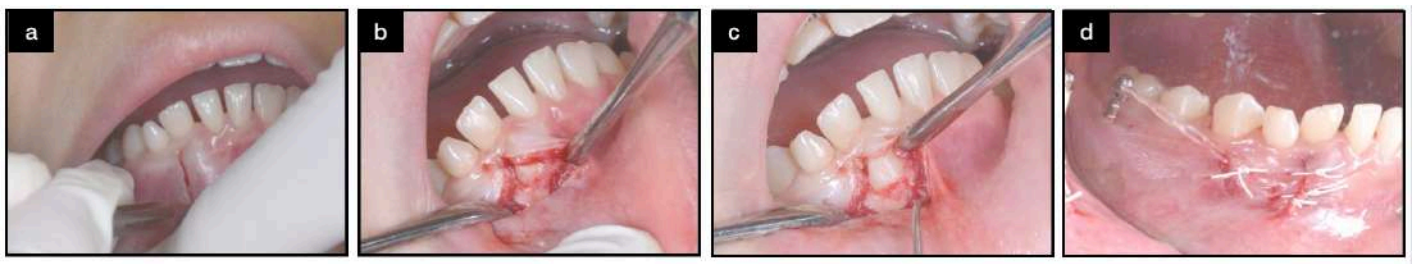

Fig. 9: *Procedure of the mandibular right canine surgery*
(a) The first incision was along the mesial line angle of mandibular right lateral incisor. (b) The bone covering the crown of the impaction was exposed, and then removed. (c) All obstacles were removed after the button was bonded onto the crown. (d) A second incision was performed along the mesial line angle of the mandibular first premolar to establish a traction route for the power chain. The power chain was retracted from BS screw to the button. Finally, the two incision lines were closed with a 6-0 Nylon.

Fig. 10: *Healing process after surgical exposure in 5th month, 7th month, and 9th month*

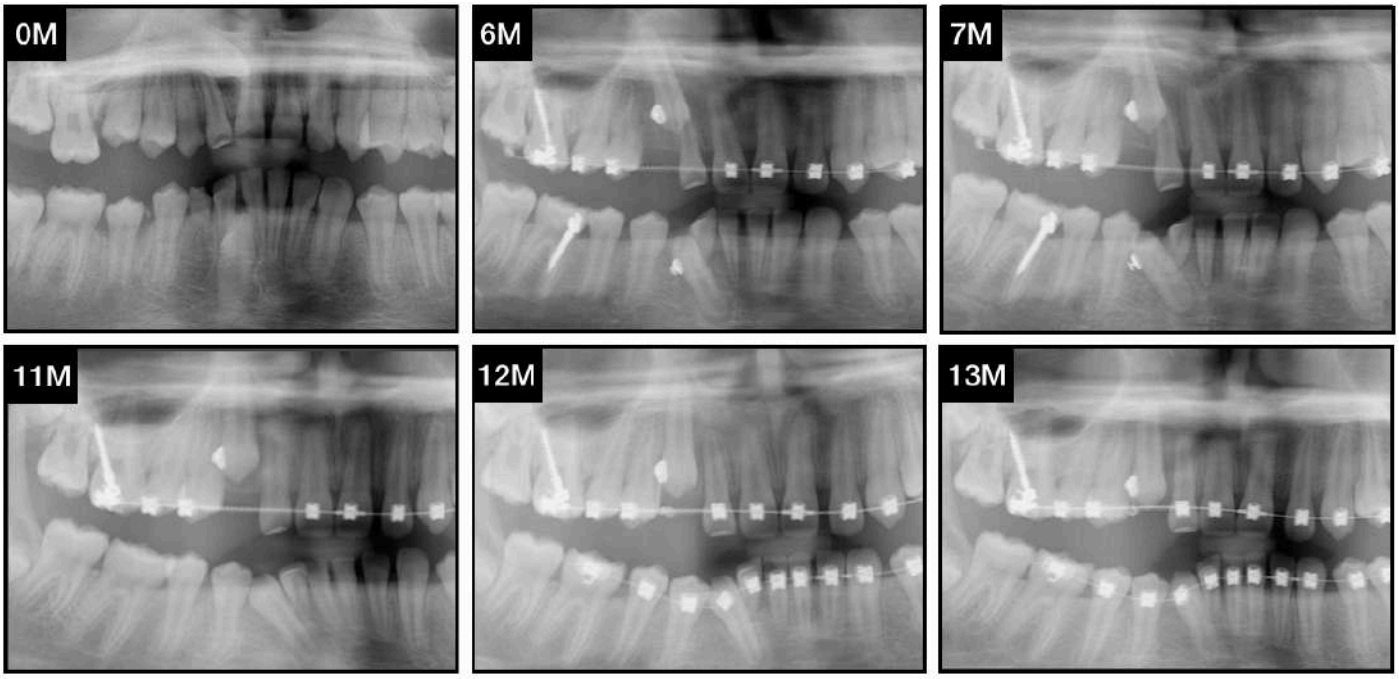

Fig. 11: *Track of tooth movement*

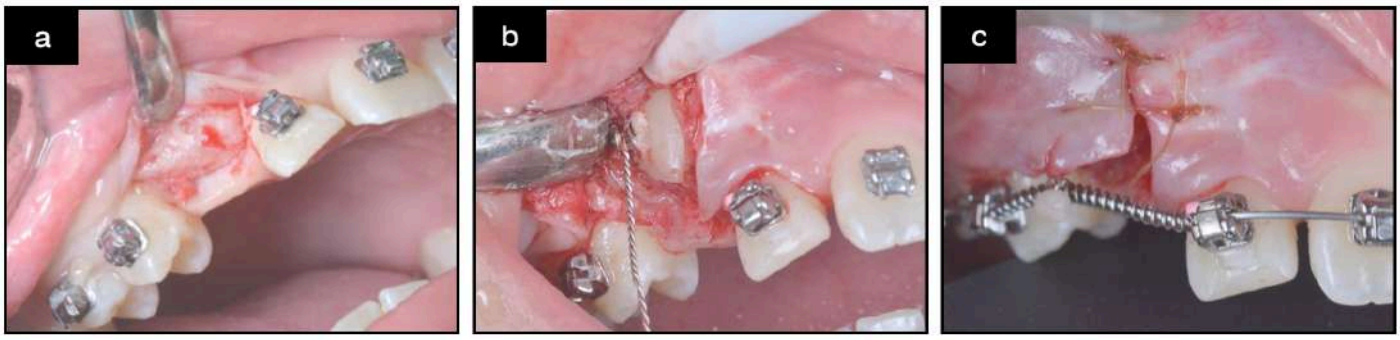

Fig. 12: *Procedure of the closed eruption technique in 11th month*

During the 14th month, the maxillary right canine had been finally completely recovered. A high torque Damon bracket was bonded. The sequence for the upper archwire was 0.014-in CuNiTi, 0.014x0.025-in CuNiTi, 0.017x0.025-in TMA, and 0.016x0.025 SS. The sequence for lower archwire was 0.014-in CuNiTi, 0.014x0.025-in CuNiTi, and 0.017x0.025-in TMA (Table 2).

During the 16th month, bite turbos were bonded on the occlusal surfaces of bilateral mandibular first molars to remove any occlusal interference. A canine Class II malocclusion was observed; as such, Class II elastics (Quail 3/16-in 2-oz, Ormco, Glendora, CA) were bilaterally worn from the upper canines to the lower first molars.

Fig. 13: *The axis of the bracket was tilted distally to the axis of mandibular right canine in order to move the apex distally.*

Alignment and leveling were completed in the 22nd month, but deep bite, 2mm overjet, and bilateral canine Class II relationships were still noted. In order to fix the above problems, the bite turbos were

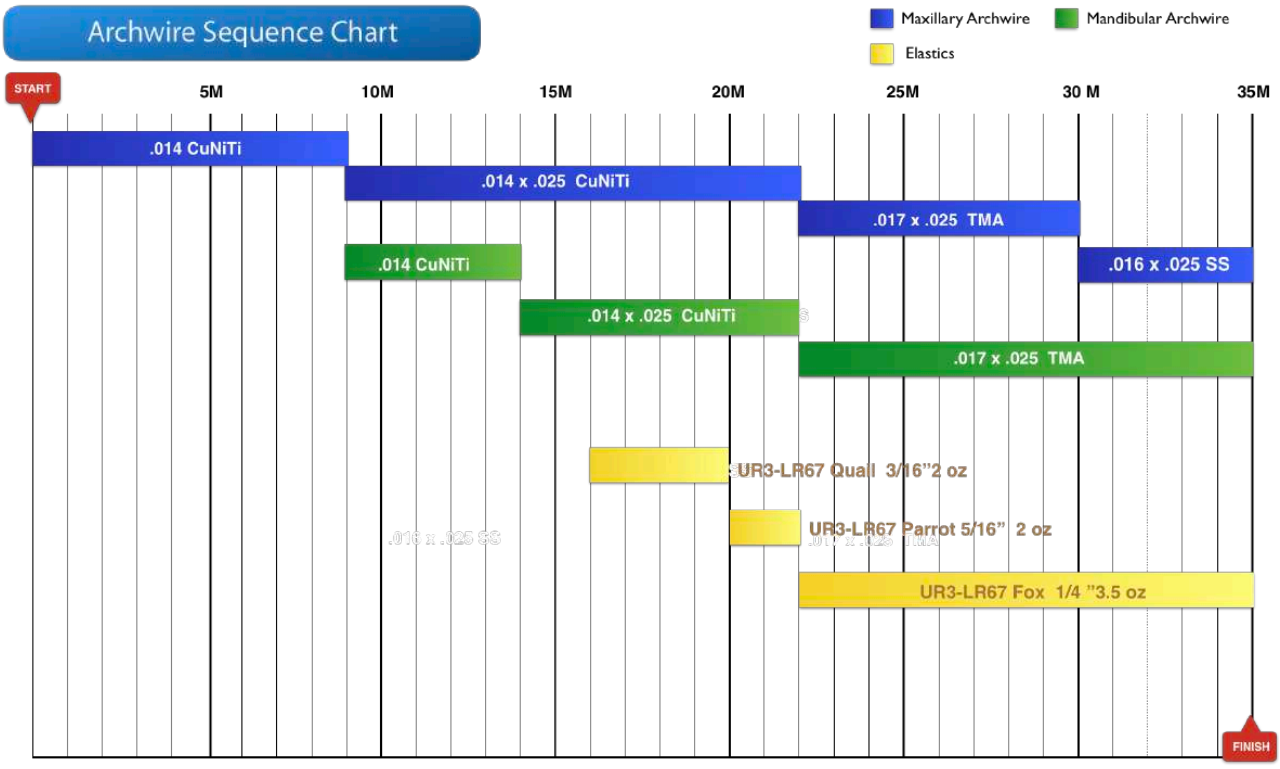

Table2: *Archwire sequence chart*

removed in the lower arch, and new ones were placed on the lingual surface of the bilateral maxillary central incisors. In addition, Class II elastics and bilateral IZC screw retraction were used. After 35 months of orthodontic treatment, all brackets were debonded, and a fixed retainer was bonded on the lower anterior incisors. Maxillary and mandibular clear overlay retainers were delivered for full-time wear for the first six months and nights only thereafter. The entire treatment sequence is documented in Figs. 14-18.

Treatment Results

The treatment results for this patient were excellent. All teeth have been well aligned in their proper positions (Figs. 19 and 20). Bilateral occlusal relationships are Class I with a normal overjet and overbite. All treatment objectives were successfully reached. A panoramic radiograph revealed good root parallelism (Fig. 21). The superimposed mandibular image of the post-treatment cephalometric data (Table 1) and the cephalometric

Fig. 14: *Frontal view of the treatment sequence is shown at treatment times in months (M): 1M, 12M, 14M, 18M, 22M, 25M,29M, and 32M.*

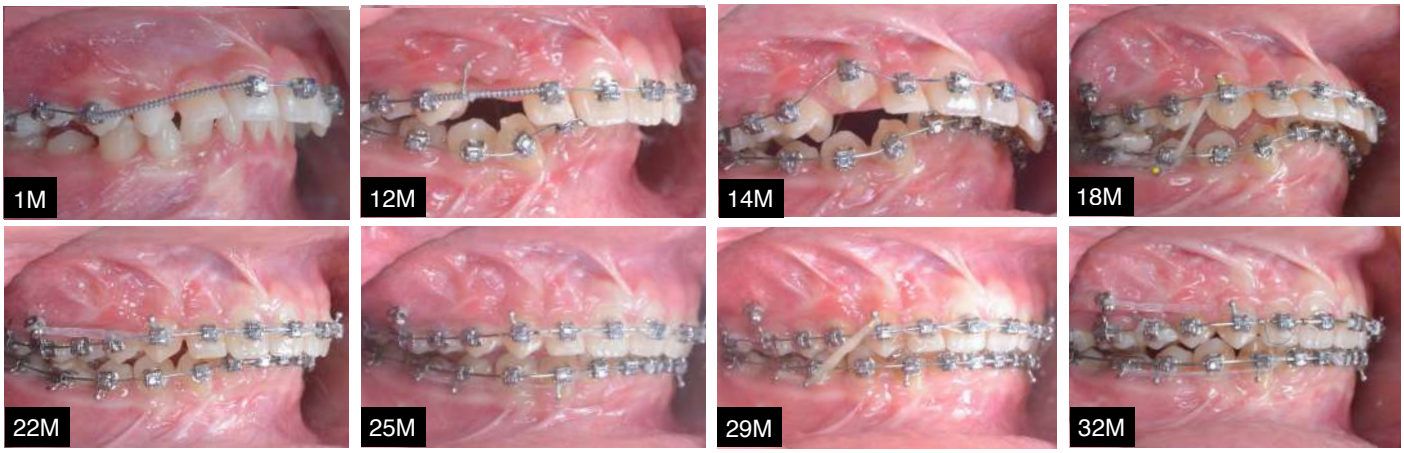

Fig. 15: *Right view of the treatment sequence. Note: the eruption procedure of the impacted bimaxillary right canines*

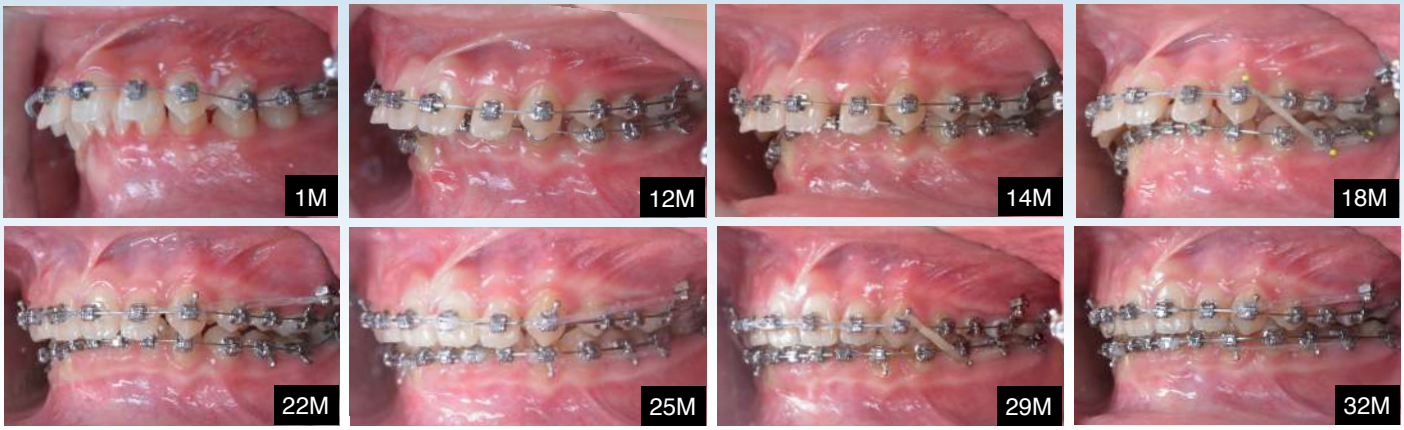

Fig. 16: *Left view of the treatment sequence. Note: the correction procedure for deep bite*

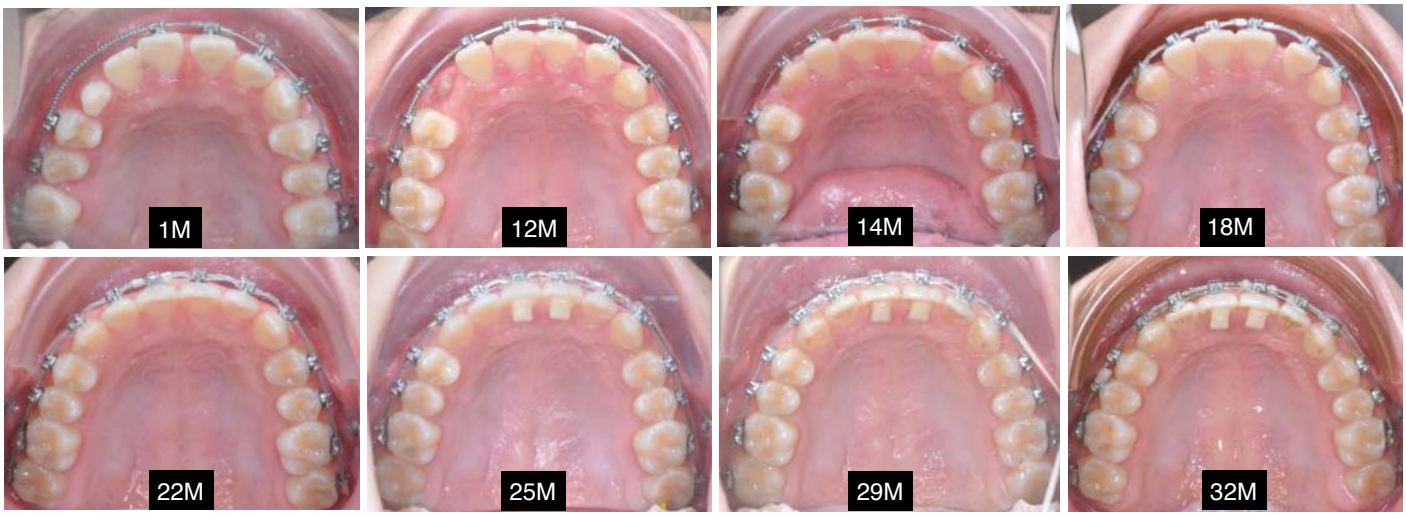

Fig. 17:
The progress of the upper arch is shown. Note: Bite turbos were boned on the lingual surface of bilateral maxillary central incisors to remove occlusal interference.

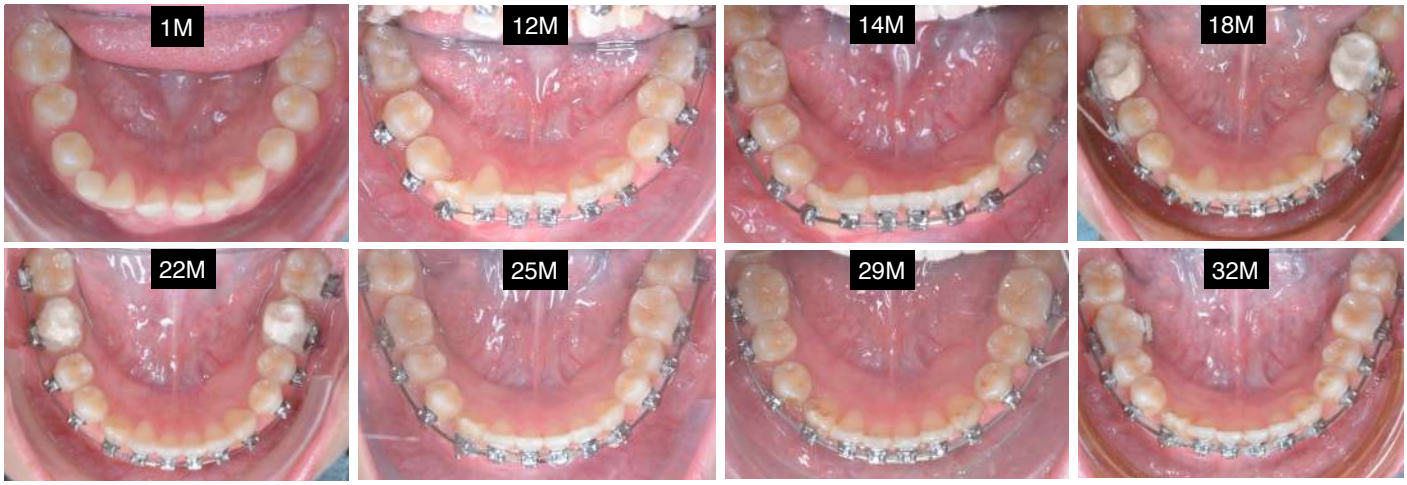

Fig. 18:
The progress of the lower arch is shown. Note: The correction procedure for distal-tilting mandibular right canine is at 12M, 14M, 18M and 22M.

superimpositions (Figs. 22 and 23) show the growth in condylar length that contributes to the increased facial height. The maxillary incisors have been retroclined by 25˚, and the mandibular incisors have moved vertically downwards. The patient was satisfied with her teeth and profile. The CRE score was 26 points as shown in the subsequent worksheet. Most of the points deducted were for the buccolingual inclination and occlusal contact. Four points were deducted from the P&W esthetic score, as documented in the supplementary worksheet at the end of this report. At the 18-month follow-up, intra-oral photographs show that the occlusion was still stable (Fig. 24).

Discussion

Phase 1: Correction of the impaction

According to Kokich's[7] article in 2004, there were three techniques which can recover impacted labial impactions: excisional uncovering, apically positioned flaps, and closed eruption (CE) techniques. For surgical exposure of a labial or intra-alveolar impaction of a maxillary canine, Kokich identified four

Fig. 19: *Post-treatment facial and intra-oral photographs*

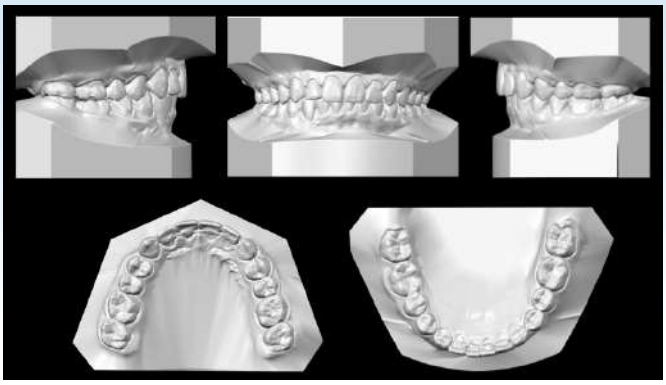

Fig. 20: *Post-treatment study models (casts)*

Fig. 21: *Post-treatment panoramic radiograph*

criteria which should be evaluated to determine the correct method for uncovering the tooth:

1. the labiolingual position of the impacted canine crown,
2. vertical position of the tooth relative to the mucogingival junction (MGJ),
3. the amount of keratinized tissue surrounding the impacted canine, and
4. the mesiodistal position of the canine crown.

When the impaction is apical to the MGJ, either an apically positioned flap (APF) or closed eruption technique may be chosen. The closed eruption technique is more appropriate than an APF when the impaction is in a high position.[18] APF is indicated for cases where the crown of the impaction is positioned mesially and over the root of the lateral incisor.

Fig. 22: *Post-treatment cephalometric radiograph*

For our patient, not only was her maxillary right canine highly impacted, but its crown tip also overlapped distal root surface of the maxillary right central incisor. Her mandibular right impacted canine was parallel to the adjacent teeth, but its crown and root structure overlapped the root of the mandibular right lateral incisor. Based on Kokich's criteria, neither CE nor APF can solve this dilemma. The main reason for this is that Kokich did not apply bone screws in his methods that provided a three-dimensional force to help the

tooth recover from such a deep and severely displaced impaction. Therefore, the surgical exposure of impacted canines was limited.

In addition to bone screws, the modified VISTA technique developed by Beethoven Orthodontic Center, originally devised by Zadeh[9] in 2011, provides a minimally invasive yet effective method to resolve such difficulty.

Presently, the criteria proposed by Kokich[7] to determine the correct method for uncovering the tooth has been modified to include the following three main criteria: 1. CBCT assessment of the labiolingual position of the impacted canine crown, 2. a proper design for surgical intervention, and 3. precise mechanical design of the force system.[10]

1. CBCT assessment of the labiolingual position of the impacted canine crown

Three dimensional CBCT imaging is essential for designing a treatment plan for the impacted canine, as it reveals the relationships between the impacted tooth, adjacent teeth, and the cortical bone. Three types of 3D images are required: 1. 360° rotated animation around the impaction covered with bone, 2. 360° rotated animation around the impaction with the bone covering deleted, and 3. cross-sectioned slices through the impaction.[19]

2. A proper design for surgical intervention

The design for surgical intervention is determined by the location of the apex, as well as the mesio-distal and vertical position of the crown tip.[20] APF is

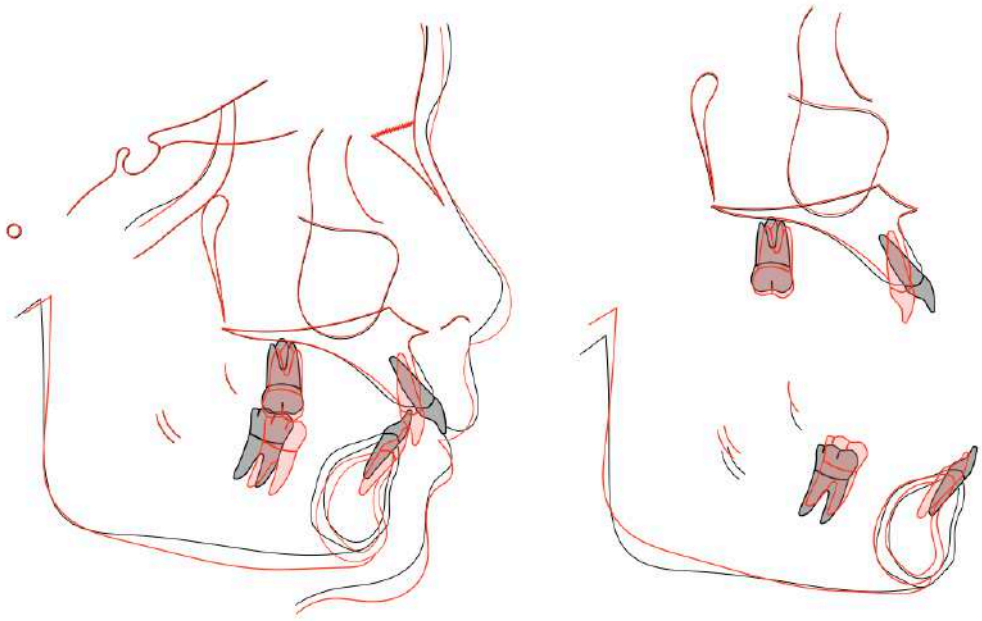

Fig. 23:
Superimposed tracings of the initial (black) and final (red) cephalometric films reveal the skeletal and dental changes that occurred during treatment. After treatment, mandibular growth, retroclination of upper incisors, and intrusion of lower incisors were observed.

Fig. 24: *18-month follow-up facial and intraoral photographs*

the most disadvantageous among the three techniques proposed by Kokich. Because high labial impactions were uncovered with an apically positioned flap, it would result in instability of the crown and possible reintrusion of the tooth after orthodontic treatment. This disadvantage is not observed in teeth uncovered with closed eruption technique.[7] Therefore, APF is seldom used in Beethoven's practice. The vestibular incision subperiosteal tunnel access (VISTA) method coronally repositions gingival margins to correct periodontal defects in the maxillary anterior region (Fig. 2).[7] This approach begins with a vestibular access incision which can be made through the periosteum to elevate a subperiosteal tunnel. The Beethoven group led by Chang[10-14] further adapted a modified VISTA technique for the surgical management of labially impacted, transposed canines. The modified procedure utilizes the same subperiosteal tunneling method to produce a path for submucosal retraction of the impacted

canine.[10-14] Either modified VISTA or CE is the present surgical technique used.

This procedure of the modified VISTA decreases invasive surgery, optimizes esthetic outcomes, and limits the threat of external root resorption.[10] Full-thickness flap (closed eruption technique) provides better visibility but results in shrinkage of flap and gingival recession.[21] In contrast, the modified VISTA method eliminates any substantial loss of gingival height because it does not reflect any flap. Its major drawback lies in its limited visibility related to the full-thickness flap and the surgery method and is therefore technique-sensitive.

3. Precise mechanics of force system

The force to retract impaction could be anchored in the main wire, molars, or bone screws. If the impaction is far away from the eruption site, the former two may result in archwire deformation and unwanted tooth movement. The independent force system of bone screws provides the necessary retraction force, without producing undesired side effects on other teeth.[10,18]

As mentioned previously, the patient had two canine impactions, both of which are labial impactions according to CBCT images. The cause of the severe impaction was apparently a deviated path of eruption that may be related to over-retained primary canines.[1] The impacted maxillary right canine, incompletely transposed impaction, was uncovered by the modified VISTA procedure and was retracted using an IZC screw. After ten months of retraction, the mesio-distal position of the impacted maxillary right canine was corrected, but its vertical position was still 3mm apical to the alveolar crest. At this moment, the IZC occlusal retraction was limited. Hence, the secondary surgical exposure, closed eruption technique was performed to expose the impacted crown. The bone surrounding the crown was removed, and a ligature wire was tied between the maxillary right canine button to the main wire. After three months, the impacted maxillary right canine was recovered, and a high torque bracket was bonded. The treatment then moved on to align all teeth. If the first surgical exposure had been performed with 3D lever arm[14] and bone screws were done, the secondary surgical exposure could have been avoided.

The impacted mandibular right canine, completely transposed impaction, was uncovered by modified VISTA and retracted by BS screws. After six months, the impaction was recovered; four months later, a full mouth fixed appliance was bonded on all lower teeth. In Fig. 18, the tip of mandibular right canine tilted distally at the 12th month. The axis of the bracket was tilted distally relative to the axis of mandibular right canine in order to move the apex distally to correct its transposed apex. The axis of mandibular right canine was corrected successfully during the 22nd month.

Phase 2: Alignment of all dentition

When considering whether to extract or not for the eruption site, the patient's craniodental relationship should be taken into consideration. The current patient was diagnosed as having proclined anterior incisors with an 8mm overjet, but the skeletal relationship was Class I. Spacing was noted over bimaxillary arch, and incomplete growth of her nose and mandible was also found, due to the fact

she was only 11 years old. As a result, non-extraction procedure was chosen. IZC screws, along with bite turbos and Class II elastics were used to solve the Class II malocclusion, deep bite, and 8mm overjet.

Conclusions

The treatment of impacted and transposed teeth constitutes a challenge for clinicians. For our patient with two severely impacted and transposed canines, we found it necessary to apply the following steps in devising her treatment:

1. assessing the labio-lingual position of the impacted canine crown using a three dimensional image (CBCT),
2. a proper design for surgical intervention, and
3. a precise mechanics of force system design.

Subsequently, we found that a modified VISTA method, together with application of bone screws, benefitted the patient mainly because of its minimal invasiveness, more solid recovery, and also limitation of subsequent morbidity.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE: 59

OVREJET

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

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

Total = 4

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 = 0

OCCLUSION

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

Total = 6

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. Per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP

≥ 38° = 2 pts.

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

≤ 26° = 1 pt.

Each degree < 26° 11 x 1 pt. = 11

1 to MP ≥ 99° = 1 pt.

Each degree > 99° 17 x 1 pt. = 17

Total = 30

OTHER (See Instructions)

Supernumerary teeth	_____	x 1 pt.	= _____
Ankylosis of perm. Teeth	_____	x 2 pts.	= _____
Anomalous morphology	_____	x 2 pts.	= _____
Impaction (except 3rd molars)	2	x 2 pts.	= 4
Midline discrepancy (≥ 3mm)		@ 2 pts.	= _____
Missing teeth (except 3rd molars)	_____	x 1 pt.	= _____
Missing teeth, congenital	_____	x 2 pts.	= _____
Spacing (4 or more, per arch)	1	x 2 pts.	= 2
Spacing (Mx cent. diastema ≥2mm)		@ 2 pts.	= 2
Tooth transposition	_____	x 2 pts.	= _____
Skeletal asymmetry (nonsurgical tx)		@ 3 pts.	= _____
Addl. treatment complexities	3	x 2 pts.	= 6

Identify: One highly incomplete transverse impaction, one complete transposed impaction

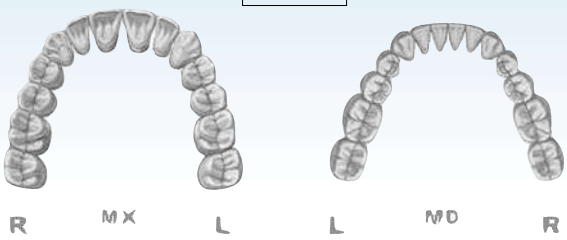
Total = 2

Cast-Radiograph Evaluation

Total Score: 26

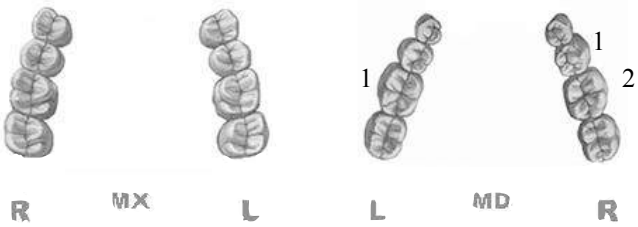
Alignment/Rotations

0



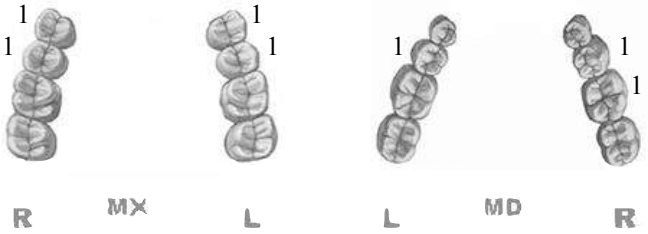
Marginal Ridges

4



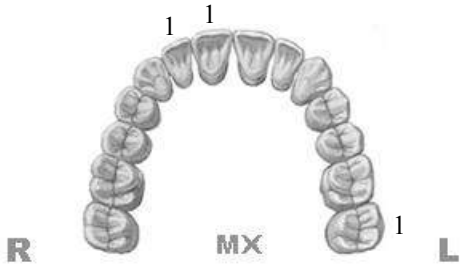
Buccolingual Inclination

7



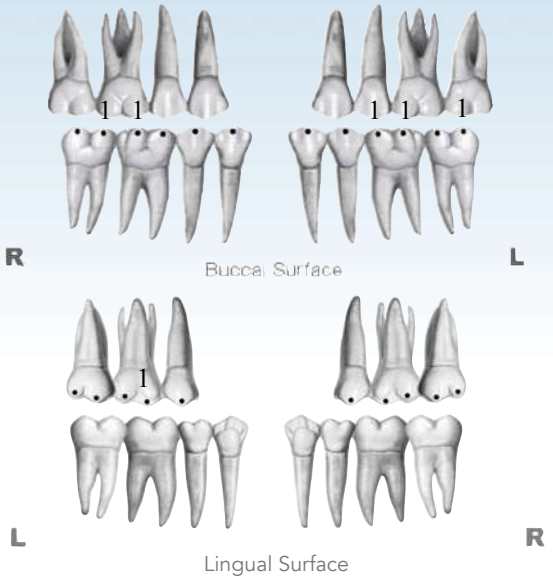
Overjet

3



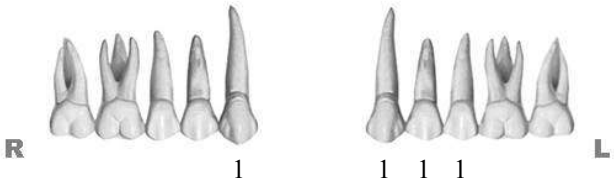
Occlusal Contacts

6



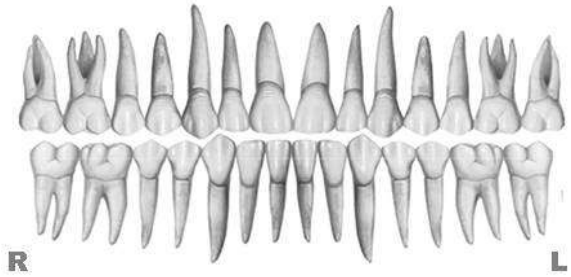
Occlusal Relationships

4



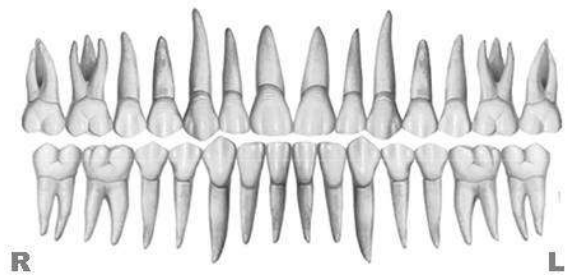
Interproximal Contacts

0



Root Angulation

0



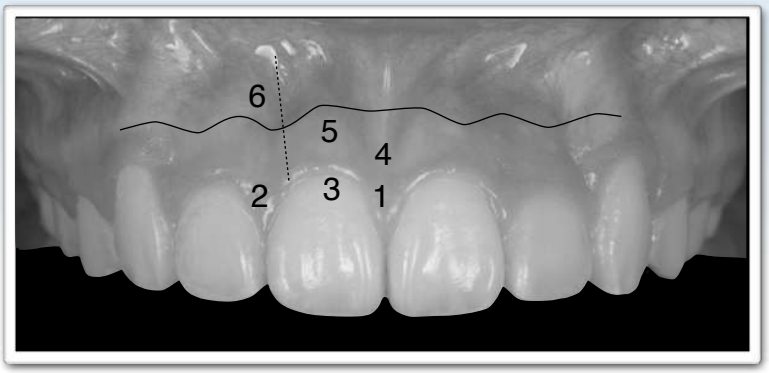
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score = 4

1. Pink Esthetic Score

Total = 0

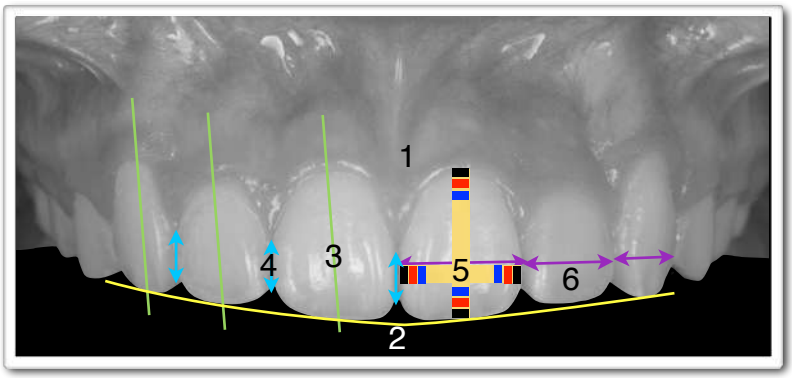


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

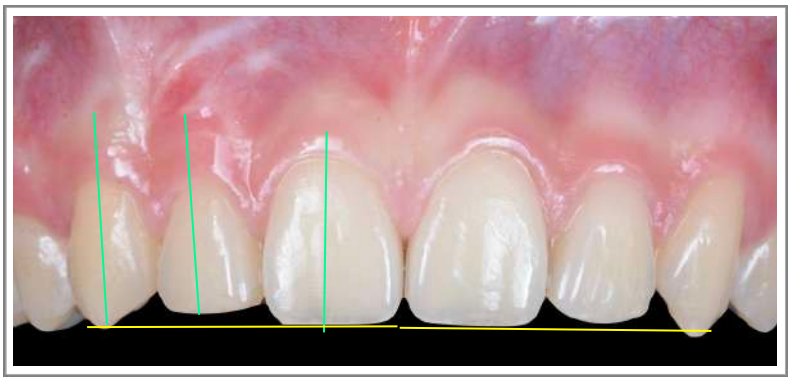
1. M & D Papillae	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	(0)	1	2
5. Root Convexity (Torque)	(0)	1	2
6. Scar Formation	(0)	1	2

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

2022 Beethoven

Clinical Education

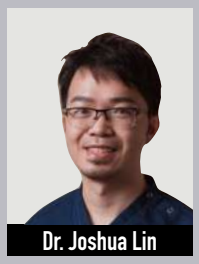
全新課程

Beethoven Clinical Education 主要針對修習過 Damon Master Program、且想要繼續獲取更進階臨床與學術訓練的醫師所專門設計的課程。此訓練課程除了包含**診間見習**之外，還新增了**學術文章寫作與演講的訓練**。醫師不僅可以於貝多芬矯正中心就近學習張慧男醫師的診間技術與經驗，也加入了**骨釘與 VISTA 術式**等操作課程，亦同時培養醫師**期刊寫作與高效簡報**的技巧。

修習完 Damon Master Program 與本課程，且完成**兩篇案例報告**文章後，就可取得赴**德國碩士班進修資格證書**。此系列課程能讓醫師在進入德國碩士班之前，做好最充分的準備。


Dr. Chris Chang


Dr. Bill Su


Dr. Joshua Lin

ABO Writing Training

Medical Writing Training-1 3/17

Medical Writing Training-2 3/31

Medical writing skills are crucial for clinicians, educators and researchers. This training contains academic medical writing on case reports. Participants will have a chance to publish articles for journals like Journal of Digital Orthodontics (JDO).

Presentation Workshop 4/7

The presentation workshop designed to help participants utilize the most frequently used presentation tools in Keynote to manage patient clinical records and create simple but effective patient communication presentation.

VISTA & 4 other Minor Surgeries for Orthodontic Practice

VISTA Hands-on Workshop 4/21

The VISTA (vertical incision subperiosteal tunnel access) surgical techniques for impacted cuspids will discuss the following topics:

1. VISTA with screw placement
2. VISTA with connective tissue graft
3. Suture technique

TADs & Surgeries Hands-on Workshop 4/21

The workshop covers bonding on a typodont, TAD placement, and 4 minor surgeries for orthodontic practice.

Chairside Learning （視疫情狀況另行公佈）

Participants will have a chance to conduct chairside learning and observe clinical treatment process in Beethoven Orthodontic Center.

時間：週四全天 (9 am - 5 pm)

新竹市建中一路 25 號 2 樓 (金牛頓藝術科技)

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Dental Clinic Established 1996
Beethoven

International Workshop

Digital Orthodontics, OBS, VISTA

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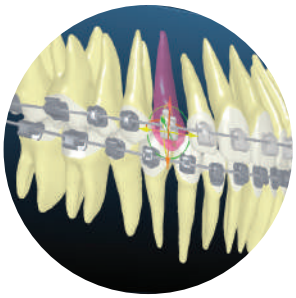
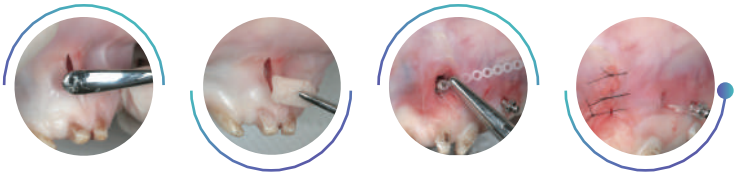


INSIGNIA™

OBS

Beethoven's International Workshop is designed for doctors who provide orthodontic treatment using the Damon and Insignia System. This workshop is consisted of lectures, hands-on workshops as well as chair-side observation sessions. Participants will have the opportunity to observe clinical treatment, didactic lectures, live demonstration and gain hands-on practice experiences involving TAD placement, indirect bonding, CBCT-enhanced digital treatment planning for Insignia.



VISTA Vertical Incision Subperiosteal Tunnel Access

Registration:

Day 123 USD 3,600 Early bird rate: $100 off (advanced registration two months prior to the course date)

Day 4 USD 600 Early bird rate: $100 off (advanced registration two months prior to the course date)

For more information and registration, visit

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course@newtonsa.com.tw
+886-3-5735676 #218 Annie

Course Schedule

Day 1 **Chair–side observation**

Day 2 **Insignia Lecture, Chair–side observation**

Chris' Lecture:
Digital Orthodontics with TAD

Day 3 **VISTA Lecture & workshop**

Chris' Lecture:
VISTA for Impacted Cuspids

* The topics for VISTA workshop:

1. VISTA with screw placement
2. VISTA with connective tissue graft
3. Suture technique

Prof. Dr. Paulo Fernandes Retto, Portugal

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

Digital Orthodontics, OBS & VISTA

Day 4 **Keynote workshop** (Optional)

by Newton's A team

1. Patient clinical records management
2. Patient communication presentation
3. Basic animations and visual aids

Dr. Rungsi Thavarungkul, Thailand

"If you think this is a computer course that will show you step–by–step how to use the application, please reconsider. If you want to improve communication in your practice, and with patients, this 8–hour course is definitely worth it."

KEYNOTE

THE LECTURER

Dr. Chris Chang

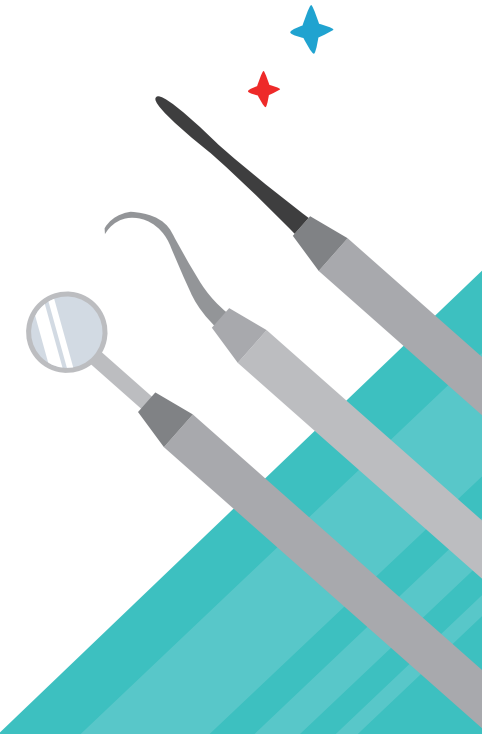
CEO, Beethoven Orthodontic and Implant Group. He received his PhD in bone physiology and Certificate in Orthodontics from Indiana University in 1996. As publisher of Journal of Digital Orthodontics-*A journal for Interdisciplinary dental treatment*, he has been actively involved in the design and application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

YONG CHIEH 湧傑 | HuFriedyGroup The Best In Practice

熱門器械年度回饋

2022

01.01 - 06.30



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Managing a Labially-Impacted Canine with VISTA, Connective Tissue Graft, IZC Screws, and a 3D Lever Arm

Abstract

History: *A 13year-2month-old male presented with chief complaints (CC) of an unesthetic smile and diastema.*

Diagnosis: *The upper right deciduous canine (URc) was retained, and the UR3 was labially impacted. An oblique direction of canine eruption wedged the impaction between the keratinized mucosa and the adjacent incisor. His lower facial height was within normal limits (WNL) (%FH: Na-ANS-Gn 53%), but the profile was more convex than normal (Convexity: G-Sn-Pg' 20˚). Bilateral molars were in full-cusp Class II malocclusion. Mandibular retrusion (SNB 76˚) and a normal mandibular angle (SN-MP 33˚) were noted. Bilateral incisors were prominent (U1 to NA 9mm, U1 to SN 118˚, L1 to NB 6.5mm, L1 to MP 99˚). The Discrepancy Index (DI) was 37.*

Etiology: *The severely impacted UR3 was apparently due to a deviated path of eruption, which may be related to improper development of the tooth, and/or limited space in the arch.*

Treatment: *Following extraction of the URc, all teeth except the UR2 were bonded with a Damon Q® passive self-ligating (PSL) bracket system. Vertical incision subperiosteal tunnel access (VISTA) technique was performed to produce a submucosal space for retracting and extruding the impacted UR3. A button was bonded on the UR3, and a power chain was attached. The elastomer chain exited the mucosa through a more distal incision, and traction was applied with a custom lever arm, anchored by an OrthoBoneScrew® (OBS) inserted into the right infrazygomatic crest (IZC). The impaction was retracted into a normal position between the UR2 and UR4. Once the UR3 was extruded and approached the occlusal plane, the UR2 was bonded. The VISTA technique can be used in combination with a connective tissue graft (CTG) to treat UR3 gingival recession defects. A slow traction procedure, with regular periodontal maintenance, was performed to avoid a premature perforation of the labial alveolar plate. Both arches were detailed and finished.*

Outcomes: *Facial esthetics was improved. After 33 months of active treatment, the UR3 was well aligned. The supporting labial gingiva matured and keratinized without any additional root resorption. Final alignment and dental esthetics were excellent, as evidenced by an ABO Cast-Radiograph Evaluation (CRE) score of 24, and an IBOI Pink and White esthetic score of 8.*

Conclusions: *The VISTA approach with an OBS-anchored 3D lever arm for submucosal retraction of maxillary canine impactions is an ideal procedure for the critical esthetic zone. Differential soft and hard tissue biomechanics protect an unrestrained lateral incisor while the impacted canine is being recovered. (J Digital Orthod 2022;65:30-47)*

Key words:
Tooth movement, eruptive force, differential biomechanics, impacted maxillary canine, vertical incision subperiosteal tunnel access (VISTA)

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 the four oral quadrants: UR, UL, LR and LL. The teeth are numbered 1-8, and deciduous teeth are a-e from the midline in each quadrant, e.g., a lower right first molar is LR6 and a upper right deciduous canine is URc.

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

Periodontists are often called on by orthodontists to expose an impacted tooth,[1] which is essential for orthodontic treatment to be successful. The cuspids are generally one of the last teeth to erupt into the arch and are adversely affected by: 1. loss of space, 2. over-retained deciduous teeth, and 3. facial or palatal deflection of the lateral incisor. The prevalence of impacted canines in adolescents ranges from 0.2-2.8%.[2] Third molars are more commonly impacted than canines, but their recovery (*if indicated*) rarely presents significant esthetic and functional challenges. Recovering severely displaced, impacted canines is among the most challenging clinical problems in orthodontics.

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

Coordinating treatment phases is very important for achieving the desired outcome: proper alignment, periodontal stability, and long-term esthetics. Compromised surgical and biomechanical procedures may result in complications and unpredictable outcomes.[3] Studies have shown an impacted canine prevalence of 0.27-2.4% is second only to third molars.[2] For North American patients, about two thirds of the impacted canines are located palatally, while the rest are positioned labially or within the alveolus. In contrast, for Chinese adolescents, about 50-68% of impacted canines are on the labial side.[2] Labial impactions are clinically more difficult to manage since root resorption and gingival recession are prone to occur during the recovery process.

History, diagnosis, and Etiology

A 13year-2month-old male presented with an acceptable facial profile and an impacted UR3. The maxillary midline was shifted 3mm to the right (*Figs. 1 and 2*), and there was bilateral irregularities in the maxillary lateral incisor and canine regions (*Figs. 2 and 3*). A clinical examination revealed an impinging overbite and a 9mm overjet (*Figs. 2 and 3*). No contributing medical and dental histories were reported, but some late facial growth was expected. The deciduous upper right canine (*URc*) was retained with no mobility. Crowding of 9mm was noted in the lower arches. The cephalometric and panoramic radiographs, as well as the cone-beam computerized tomography (*CBCT*) of the head revealed that the UR3 was a complex impaction (*Figs. 2-5*). There was no history of significant trauma, dental problems, or medical disorders. The etiology appeared to be a deviated UR3 eruption path.[4] Severe transposed labial impactions are best managed with Zadeh's VISTA procedure,[5] modified by Chang et al.[6] for submucosal retraction of the transposed impaction.

Treatment Alternatives

The ideal objectives for full fixed appliance treatment is to resolve the malocclusion and align the impacted cuspid. Three options were considered (*Fig. 6*):[7]

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

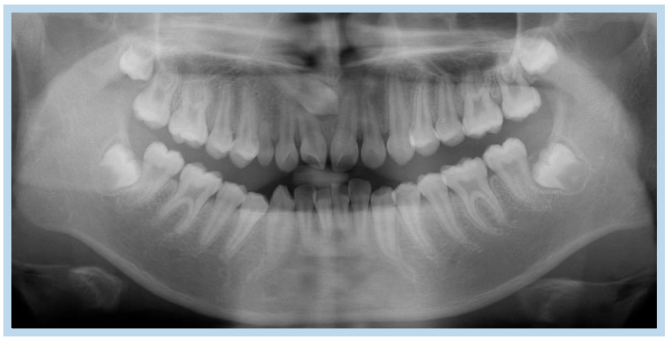

Fig. 3: *Pre-treatment panoramic radiograph*

Fig. 4: *Pre-treatment lateral cephalometric radiograph*

Fig. 5:
CBCT cut through the long axis of the UR2 showing labial impingement of the impacted UR3 (white arrow). See text for details.

1. Extract all four 1st premolars and the URc, then, use the modified VISTA and OBS 3D lever arm technique to align the impacted UR3.

Option 1: Extraction of premolars allows the lips to be retracted, but his profile was already good and extraction may cause the profile to become too concave. Specialized surgery and mechanics are required to recover the impacted canine.

2. Extract UL4, LR4, LL4, URc, and the impacted UR3. Substitute UR3 with UR4.

Option 2: As mentioned above, extraction of the premolars and the deciduous canine may cause the profile to be too concave. Extracting the impaction rather than recovering it would decrease treatment time, but substituting the UR4 for the missing UR3 would result in an unesthetic outcome and functional compromise.

3. Extract only the deciduous canine. Use the modified VISTA and OBS 3D lever arm techniques to align the impacted UR3.[8]

Option 3: Extracting only the URc and recovering the impacted UR3 could achieve a minimally invasive treatment. Good dental esthetics and function are expected.

Rationale: After discussing the pros and cons of each option with the patient and his parents, Option 3 was selected. This treatment was divided into two phases to firstly correct the impaction and then complete the final alignment.

Treatment Progress

A passive self-ligating (*PSL*) fixed appliance (*Damon Q®, Ormco Corporation, Glendora, CA*) was bonded

on all upper teeth except for the UR2, URc and a 0.014-in CuNiTi achwire was engaged. Low-torque brackets were chosen for the upper anterior segments to control the flaring incisors (*decreased axial inclination*) during alignment. In the 2nd month of treatment, surgical intervention was indicated. The preferred surgical approach (*Fig. 7*) was the VISTA technique of Zadeh modified by Chang et al.,[8] which combined IZC bone screw anchorage and 3D lever-arm mechanics (*Fig. 8*) with simultaneous upper right deciduous canine extraction. The CBCT imaging (*Fig. 5*) showed the precise location of the impaction, so the initial vertical incision was performed between the central and lateral incisors to expose the crown of the impaction (*Fig. 9A*). A periosteal elevator was then used to detach the periosteum and expose the UR3. Bone covering the crown was removed down to the cementoenamel junction (*CEJ*). The impacted canine was carefully luxated with an

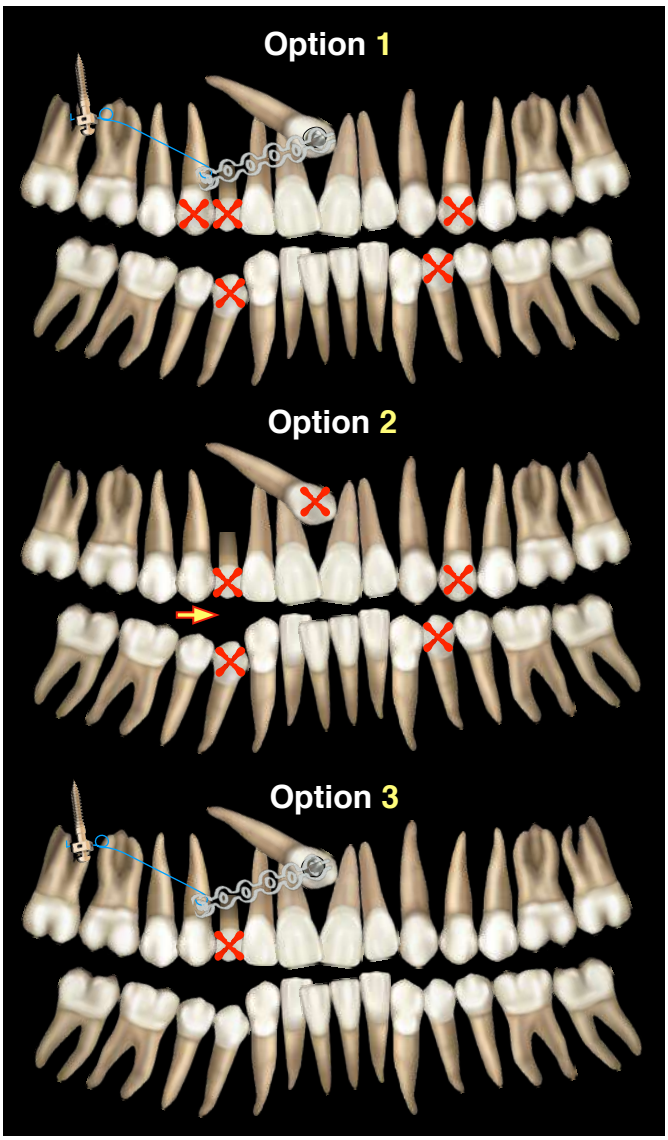

Fig. 6: *A three-part diagram shows three treatment approaches. See text for details.*

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA° (82°)	81°	80°	1°
SNB° (80°)	76°	75°	1°
ANB° (2°)	5°	5°	0°
SN-MP° (32°)	33°	33°	0°
FMA° (25°)	26°	26°	0°
DENTAL ANALYSIS			
U1 TO NA mm (4mm)	9	3	6
U1 TO SN° (104°)	118°	96°	22°
L1 TO NB mm (4mm)	6.5	7	0.5
L1 TO MP° (90°)	99°	112°	13°
FACIAL ANALYSIS			
E-LINE UL (-1mm)	0	-3	3
E-LINE LL (0mm)	-0.5	-1.5	1
%FH: Na-ANS-Gn (53%)	53%	53%	0%
Convexity:G-Sn-Pg' (13°)	20°	20°	0°

Table 1: *Cephalometric summary*

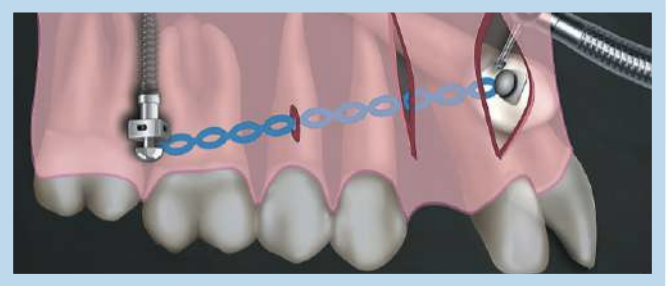

Fig. 7:
The VISTA technique is modified for submucosal retraction and uprighting of a labially positioned and transposed canine impaction. See text for details. Illustration is kindly provided by Dr. Rungsi Thavarungkul.

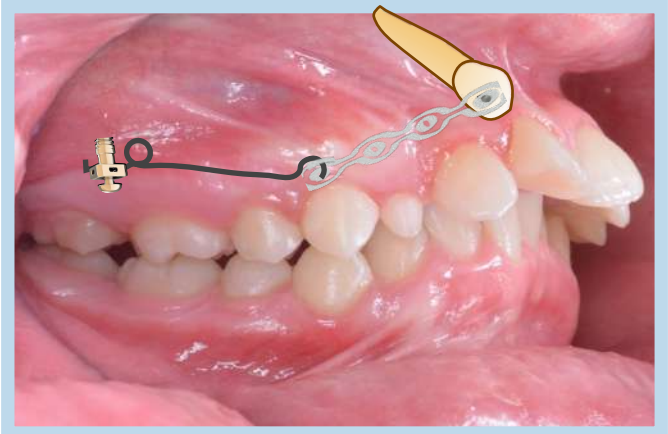

Fig. 8:
Diagram superimposed on an intraoral photograph illustrates the design of the implant recovery mechanism in the sagittal plane. The UR3 impacted against the UR2 root is accessed with a VISTA vertical incision, and a button is bonded on the labial surface. A grey chain of elastics applies distal and occlusal traction to the UR3, via a 3D lever arm inserted into the hole on an IZC OBS. See text and subsequent figures for details.

elevator to rule out ankylosis, and then a button was bonded in the center of the exposed enamel. A power chain was attached to the button, a second vertical incision was made in the vestibule superior to the edentulous space, higher than the normal UR3 position, and the power chain exited the submucosal tunnel (*Fig. 9B*). Subperiosteal decortication, of the alveolar bone surface in the UR3 retraction path was achieved with a #4 round carbide bur. An OrthoBoneScrew® (*OBS*) (*iNewton, Inc., Hsinchu City, Taiwan*) was inserted into the right infrazygomatic crest (*IZC*) and a 3D lever arm was inserted into the rectangular hole of the anchorage device (*Fig. 9C*). Finally, the power chain that was attached to the impaction delivered a distal traction force via the lever-arm anchored by the IZC OBS. Following activation of the mechanism, the two vertical incisions were sutured to ensure minimal damage to the mucosa (*Fig. 10*).

After the surgery, all erupted teeth were aligned in the upper arch, except for the UR2. The archwire sequence was: 1. 0.014-in CuNiTi, 2. 0.014x0.025-in CuNiTi, and 3. 0.017x0.025-in TMA. An open coil spring between UR1 and UR4 was used to open space.

The power chain was continually tightened at monthly appointments, and gradually the teeth could be seen moving slowly in the right direction. In the 11th month of treatment (*9 months after surgery*), the canine crown and button were visible beneath the transparent gingiva (*Fig. 11*). In the 12th month, the canine was more extruded, and the immature gums were removed. In the 13th month, the maxillary archwire was changed to a 0.016x0.025-in stainless steel wire. In the 17th month, a low torque bracket was bonded on the UR2 after the crown of the impacted canine was retracted. In the 18th month of treatment (*16 months after surgery*), a PSL fixed appliance was bonded on all lower teeth. Low torque brackets were chosen for the lower anterior segments and 0.014-in CuNiTi archwires were engaged on both arches. A high torque bracket was bonded on the UR3. Posterior

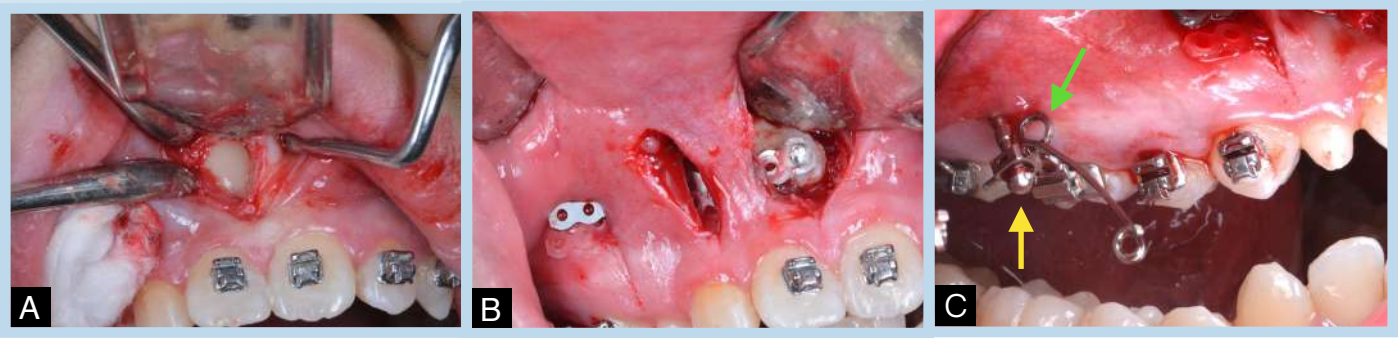

Fig. 9:
A. The first incision was made in the mucosa covering the crown of the impacted canine and the periosteal elevators were used to reflect the incision and expose the crown for bonding the button.
B. A second incision was then made at the site where the power chain exits the soft tissue (arrow).
C. An OBS (yellow arrow) was inserted in the IZC to anchor the 3D lever arm and the distal end of the 3D lever arm was inserted in the hole of the OBS (green arrow)

Fig. 10:
A. The power chain attached to the UR3 was activated by the 3D lever arm in the direction of the yellow arrow. B. The two incisions were then sutured for primary healing. C. The buccal view of the mechanics is illustrated with a drawing superimposed on the post-operative photograph. Purple lines show 1st and 2nd sutured incisions and a chain of elastics show the line of traction. Note both ends of the lever-arm are secured with bonded resin. See text for details.

bite turbos were placed bilaterally on the mandibular 1st molars to prevent biting the LR7 and LL7 brackets. In the 20th month, the canine erupted to the level of the occlusal plane, but its buccal gingiva was immature and bright red in color. The keratinized gingiva on the buccal side was not sufficient. At this time, another OBS was inserted into the left infrazygomatic crest, and bilateral IZC screws were used to retract the upper arch.

In the 23rd month of active treatment, a follow-up root coverage surgery was performed. After a baseline examination, the surgical site was anaesthetized. A subepithelial connective tissue graft was cut from the roof of the palate under the flap (*Fig. 12C*). Recipient sites were prepared by thorough scaling, root planing and demineralizing of the root surface with 20% EDTA. The VISTA approach began with a vestibular access incision mesial to the recession defect. A subperiosteal tunnel was created, exposing the facial osseous plate and root dehiscence. This tunnel was extended at least one or two teeth beyond the teeth requiring root coverage so as to mobilize gingival margins and facilitate coronal repositioning with a microsurgical periosteal elevator. Additionally, the subperiosteal tunnel was extended interproximally under each papilla as far as the

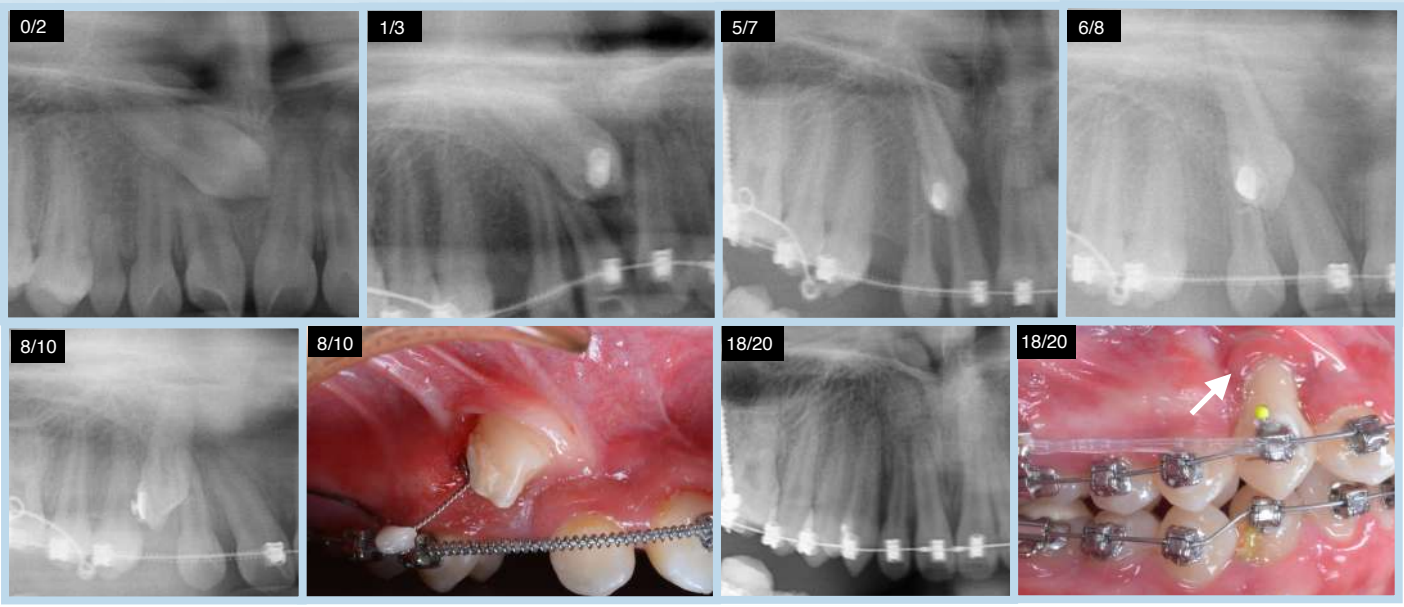

Fig. 11: *A panel of radiographs showing progress in the recovery of the impacted UR3*
Each radiograph is labeled with a code designating the time in months since VISTA surgery and initiation of traction (first number), and the number of months into active treatment (second number). ***(0/2)*** *is the immediate post-operative radiograph for the surgery performed two months into treatment.* ***(6/8)*** *shows the position of the UR3 after six months of traction, which corresponds to the eight month of treatment.* ***(8/10):*** *The radiograph and photograph show UR3 correctly positioned in the sagittal plane, and there were no obstructions for extrusions. The UR3 crown is visible underneath the overlying gingiva, which is immediately coronal to the MGJ. Note the line of traction for the lever-arm is buccal and occlusal.* ***(18/20):*** *The radiograph and photograph show the UR3 extruded to the occlusal plane. Brackets were bonded on the UR2 and UR3, and a CuNiTi archwire was used to align the arch. Note the large red area of immature, non-keratinized gingiva (white arrow). See text for details.*

embrasure space permitted, without making any surface incisions through the papilla. Once coronal advancement of the gingival margin had been established, the freshly prepared connective tissue graft was trimmed and adjusted to cover the dehiscence on the root through the subperiosteal tunnel (*Figs. 12D-F*). CTG was sandwiched between the underlying periosteum and the overlying coronally-advanced flap (*CAF*) and then stitched to the gum tissue surrounding the exposed root with the aim of providing enhanced blood supply (*Fig. 12G*). At the patient's one-month follow-up, the gingiva's condition around the UR3 was ideal (*Fig. 12H*). In the 26th month, both archwires were changed to 0.016x0.025-in SS wires.

Following 33 months of active treatment, all brackets were removed, and fixed retainers were bonded on the maxillary incisors (*UR2-UL2*) and the mandibular anterior segment (*LR3-LL3*). Maxillary anterior frenectomy and gingivectomy were performed with a diode laser to optimize the dental esthetics. The UR3 labial gingiva was a thick band of mature gingiva supporting the recovered UR3 (*Fig. 17*).

Lateral cephalometric radiograph (*Fig. 13*), post-treatment panoramic radiograph (*Fig. 14*), and model casts (*Fig. 15*) document the outcome following 33 months of active surgical and orthodontic therapy. The superimposition of pre- and post-treatment cephalometric tracings show

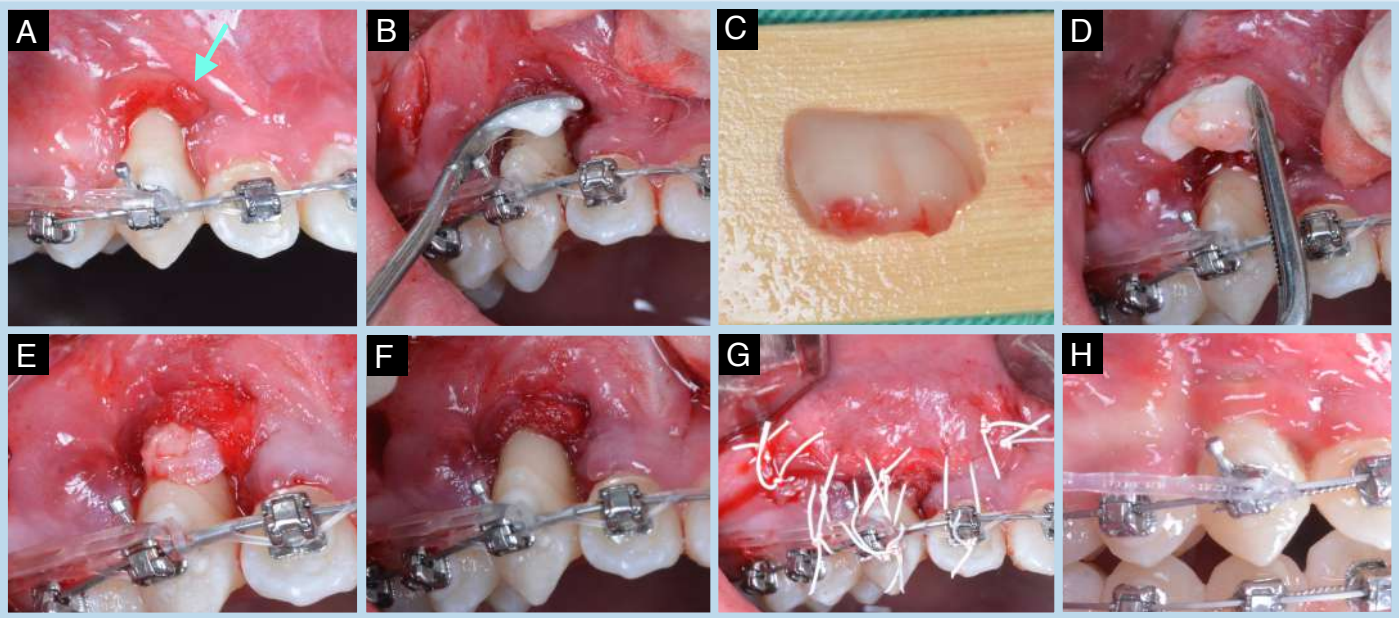

Fig. 12:
(A) *buccal gingiva was immature and bright red in color around UR3 (blue arrow).* ***(B)*** *Subperiosteal tunnel was created, exposing the facial osseous plate and root dehiscence. The root surface was conditioned with 20% EDTA.* ***(C&D)*** *Subepithelial connective tissue graft cut at the roof of mouth (palate) and tissue from under the flap.* ***(E-G)*** *CTG sandwiched between the underlying periosteum and the overlying CAF (coronally advanced flaps) and then stitched to the gum tissue surrounding the exposed root with the aim of providing enhanced blood supply to the CTG.* ***(H)*** *One month follow-up. See text for details.*

the late growth and dentofacial orthopedic changes associated with active treatment (*Fig. 16*).

Final Evaluation of Treatment

After 33 months of active orthodontic treatment, all teeth were well-aligned. The patient and his parents were very pleased with the outcome. The clinical examination revealed a well-maintained facial profile. The post-treatment facial and intraoral photographs show the recovered canine and adjacent UR2 were both stable, and no signs of re-intrusion, significant root resorption nor inflammation of the soft tissue were noted (*Fig. 17*).[1] The keratinized gingiva around the UR3 was acceptable, but requires long-term follow-ups to ensure that stability has

Fig. 13: *Post-treatment lateral cephalometric radiograph*

been achieved (*Fig. 12H*). The post-treatment panoramic film shows ideal axial inclination (*Fig. 14*). Superimpositions of pre- and post-treatment cephalometric tracings (*Fig. 16*) as well as cephalometric analysis (*Table 1*) document an acceptable post-treatment upper incisor torque (*axial inclinations*), which was decreased by 22 degrees. However, due to the complications of a non-extraction treatment for solving the crowding, the

Fig. 14: *Post-treatment panoramic radiograph*

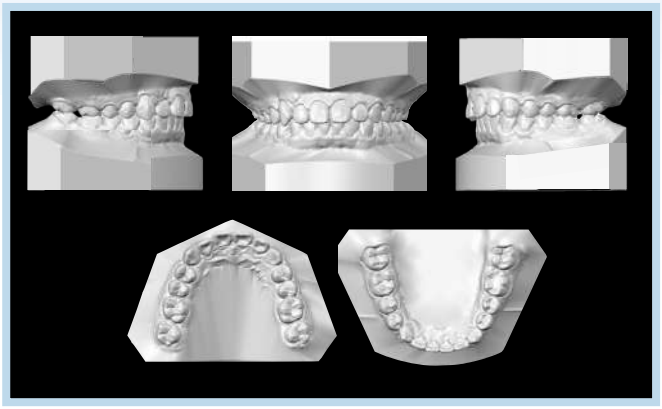

Fig. 15: *Post-treatment dental models (casts) radiograph*

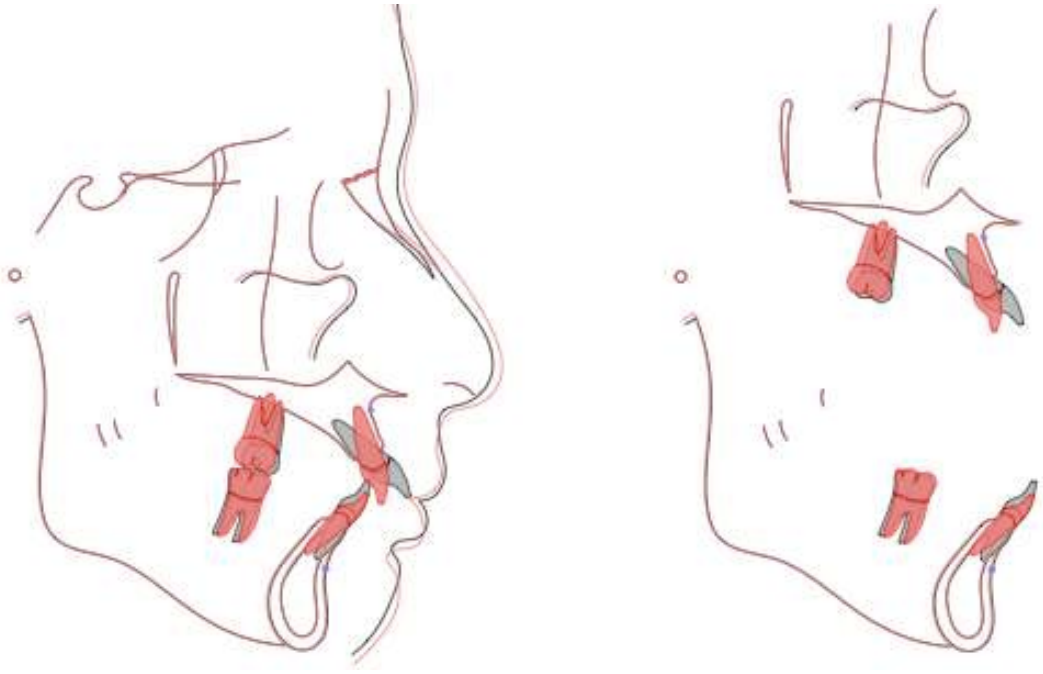

Fig. 16:
Superimposed cephalometric tracings show dentofacial changes after 33 months of treatment (red) compared to the pre-treatment position (black). The tracings reveal that post-treatment upper incisor torque (axial inclinations) was acceptable (Fig. 13), and had been decreased by 22 degrees. However, the axial inclination of the lower incisors, with an increase of 13 degrees due to the decision to solve crowing with a non-extraction treatment, was not satisfactory. The greatest improvement was the retraction and intrusion of the upper incisor, plus the flaring-out and intrusion of the lower incisor. The upper and lower posterior teeth were slightly retracted, and the mandibular plane angle was maintained. See text for details.

axial inclination of the lower incisors was increased by 13 degrees, which was not desirable. The greatest improvement was the retraction and intrusion of all the upper incisors as well as the flaring-out and intrusion of all the lower incisors. The upper and lower posterior teeth were slightly retracted, and the mandibular plane angle was maintained. Both pre-treatment and post-treatment data are within normal limits. There was slight growth of the mandible; nevertheless, the profile was well-maintained.

The American Board of Orthodontics (*ABO*) Cast-Radiograph Evaluation (*CRE*) score was 24 points, as shown in the supplementary CRE worksheet. The major residual discrepancies were occlusal relationships (*9 points*), marginal ridges (*7 points*), and alignment/rotations (*5 points*). The Pink and White dental esthetic score was 8 points as detailed in Worksheet 3 at the end of this case report. Further discrepancies were axial inclination, contact areas, tooth proportion, tooth-to-tooth proportion, root convexity, and midlines.

Fig. 17: *Post-treatment facial and intraoral photographs*

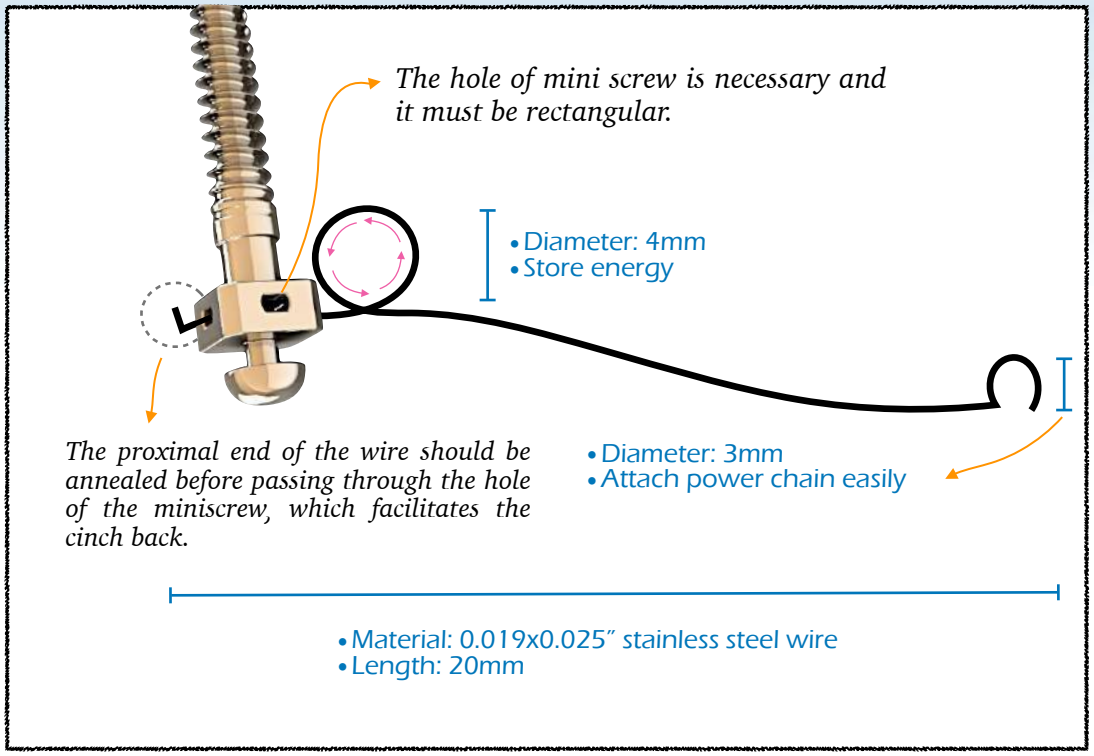

Fig. 18:
3D lever arm. The bending direction (purple arrow) of the helix is crucial. With the correct activation, it should deliver about the same force as a compression coil. See text for details.

Discussion

Torque Selection

Non-extraction leveling and aligning of a crowded dentition usually results in incisal flaring, which is intensified by the use of open coil springs to regain space for the impacted canines.[9] Bonding low torque brackets in the anterior segments of both arches decreases the flaring tendency. In the 14th month, the UR3 was pulled close to the main archwire. As it did not interfere with the UR2 root when moving, the UR2 was bonded with a low torque bracket, which was indicated to upright the tooth once it was aligned in the arch. A lateral force which moves a labially impacted canine into the arch is likely to tip the crown palatally, so a high torque bracket was indicated to flare out the canine once it was aligned in the arch.[10]

Infrazygomatic Screw (*IZC Screw*)

This screw plays a very important role. In the second month, an IZC screw was inserted in the upper right side, with the 3D lever arm applying traction to the impacted canine. An IZC screw without a lever arm is undesirable. If the main archwire, or a molar, is used as anchorage to pull, multiple complications such as occlusal canting or the bowing effect may occur, which may lead to failure in achieving the ideal molar relationship. There could even be insufficient anchorage to move the impaction.

IZC screws offer new horizons for dentofacial orthopedics since the location of the screws, buccal to the roots of the molars, is advantageous for moving the entire dental arch relative to the apical base of bone with determinate mechanics. Thus, conservative dentofacial orthopedics, with no extractions or orthognathic surgery, is capable of managing severe malocclusions by moving entire arches as segments. Modest bilateral forces of 200cN, applied to an entire arch as a segment, results in a relatively uniform PDL stress below the necrotic threshold. Avoiding PDL necrosis enhances the rate of tooth movement and reduces the risk of root resorption.[11,12]

VISTA and CTG in the management of gingival recession

Recent systematic reviews have identified advantages for autogenous subepithelial connective tissue grafts (*CTGs*) regarding root coverage and increased widths of keratinized tissue.[13] Additional studies examining sustained results of CTGs appear to further support the long-term efficacy of the CTG in maintaining root coverage.[5,14] Although considered as the current gold standard, there are a number of disadvantages when using CTG, including the need for harvesting at a distant donor site, limited tissue availability, and increased potential for post-harvesting morbidity. In patients with multiple contiguous gingival recession defects, these disadvantages are even more problematic, since optimizing esthetic results partly depends on the simultaneous treatment of all contiguous recessions.[5-7]

In this present case, the buccal gingiva was immature and bright red in color around the UR3 (*Fig. 12*). After the subperiosteal tunnel was created, exposing the facial osseous plate and root dehiscence, the root surface was then conditioned with 20% EDTA. A subepithelial connective tissue graft was cut at the roof of the mouth (*palate*) and tissue from under the flap and the CTG was sandwiched between the underlying periosteum. The overlying CAF (*coronally advanced flap*) was then stitched to the gum tissue surrounding the exposed root with the aim of providing enhanced blood supply to the CTG. One month later, the gingiva around the UR3 appeared healthy.

Multiple studies have documented simultaneous treatment of contiguous recession defects, primarily using large-envelope, coronally advanced, partial-thickness flaps, often including CTGs.[15] A number of studies have also described various tunnel approaches with CTGs or allografts that maintain papillary integrity and avoid vertical releasing incisions, while, at the same time, allowing for treatment of multiple contiguous recession defects.[16] Current tunnel preparation techniques primarily use an intra-sulcular approach to create either a sub- or supra-periosteal space to extend beyond the mucogingival junction. This allows graft tissue to be inserted under the gingival collar. The limitations of this tunnel access technique include the technically challenging nature of intrasulcular tunneling because of the need to obtain access through a small sulcular access point and the increased risk of traumatizing and perforating the sulcular tissues, which could potentially lead to unfavorable healing outcomes. As a consequence of these limitations, the approach of vestibular incision subperiosteal tunnel access (*VISTA*)[17] was developed to avoid some of the potential complications of intra-sulcular tunneling techniques.

3D Lever Arm

Utilizing a section of 0.019x0.025" SS wire, the 3D lever arm is fabricated with one helix and a 4mm diameter, U-shaped hook (*Fig. 18*) to secure a chain of elastics.[7] The terminal end of the wire is annealed before passing through the hole of the miniscrew to facilitate the cinch back bend. The length of the lever arm is ~20mm, which is sufficient for most labial impactions. A longer lever arm may be too flexible to deliver an adequate level of force. The direction of the helix depends on the mechanics; the helix should be loaded in the direction of the last bend.[8] The principle for helix force is to function like a compression coil in delivering a substantial force prior to deforming. Loaded as an extension coil (*opposite direction*), the helix would easily deform. That is why almost all spring-powered analogue watches are driven with compression coils. On the contrary, NiTi springs are effective as extension coil springs. The properties of NiTi and SS are quite different. NiTi wires have a low load-deflection rate, and they are difficult to deform (*bend*). SS is the opposite. It can be readily bent to almost any shapes, but it easily deforms unless it is loaded in the direction of the last bend, i.e., compression. If deformation occurs, the spring back property is greatly diminished. Contrary to NiTi, SS has a limited range of action prior to permanent deformation. For most orthodontic applications, SS is most effective when delivering compressive force.[18]

Conclusions

The VISTA method was designed as a flapless surgical technique to minimize trauma to soft tissue associated with gingival revisions.[14] It facilitates wound care, and the healing process is more comfortable for the patient. During the recovery process, adjacent teeth should not be bonded to allow them to physiologically move out of the path of canine movement. An OBS-anchored 3D lever arm must be precisely adjusted through multiple phases in order to recover labial impactions. An additional advantage is decreased tension of the wound edges which facilitate closure with direct loop interrupted sutures. The VISTA approach, as modified for the recovery of labial impactions, is more comfortable for the patient, enhances the wound healing process, and provides for submucosal retraction of a transposed tooth. This approach is well suited for surgical management of labial impactions in the esthetic zone. Various treatment options exist for the treatment of gingival recession, however, treatment of gingival recession is always a challenge. Hence, the VISTA technique presented in this case report is aimed at overcoming the shortcomings of other treatment options and achieving better results.[6]

Acknowledgement

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 37

OVREJET

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

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

Total = 4

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 = 7

OCCLUSION

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

Total = 8

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. Per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP

≥ 38° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

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

Total = _____

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

Identify: Surgical exposure was performed to cover the impacted maxillary canines.

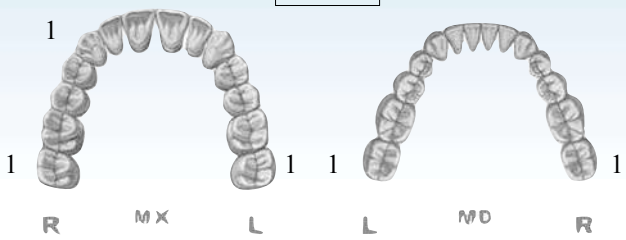
Total = 12

Cast-Radiograph Evaluation

Total Score: 24

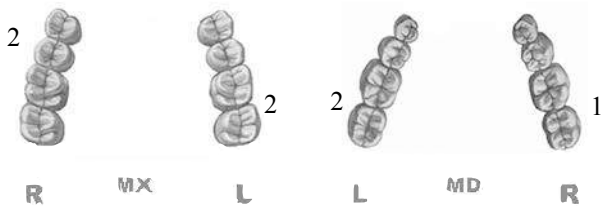
Alignment/Rotations

5



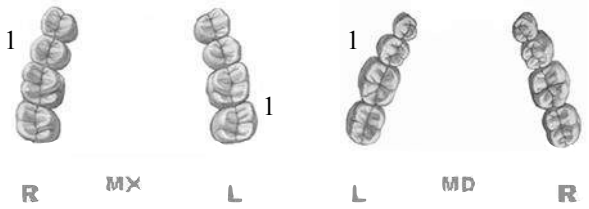
Marginal Ridges

7



Buccolingual Inclination

3

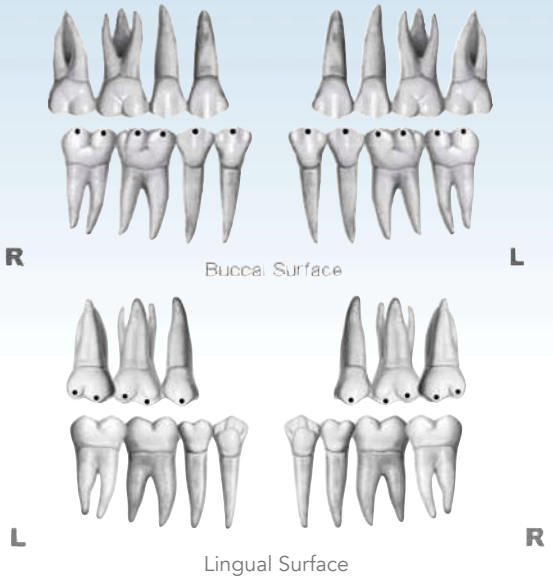


Overjet

4

Occlusal Contacts

0

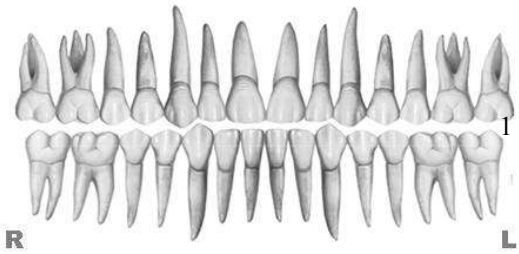


Occlusal Relationships

4

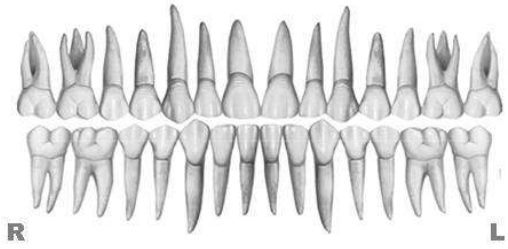
Interproximal Contacts

1



Root Angulation

0



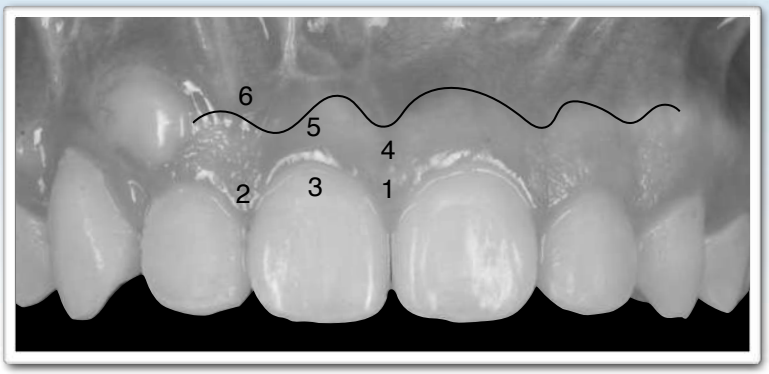
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

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

Total Score = 8

1. Pink Esthetic Score

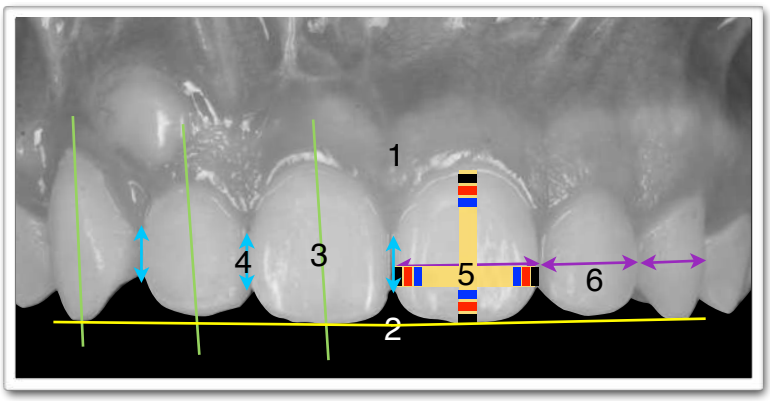
Total = 3



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

2. White Esthetic Score (for Micro-esthetic)

Total = 5



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

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Beethoven International
Orthodontic Specialty Course

德國國立杜易斯堡-埃森大學
IMC齒顎矯正專科碩士學位先修課程

Dr. Bill Su	Dr. Grace Chiu	Dr. Yulin Hsu	Dr. Shu Ping Tseng	Dr. Joshua Lin	Dr. Eric Hsu	Dr. Bear Chen	Dr. Lexie Lin
VISTA surgical techniques	Interdisciplinary approach	Early orthodontic treatment	Early orthodontic treatment	Treatment for impacted teeth	Research design	ABO DI & CRE	ABO case report

Beethoven International Orthodontic Specialty Course, 是德國國立杜易斯堡-埃森大學 IMC 齒顎矯正專科碩士學位所特別增設的先修課程，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、治療計劃擬定與執行技巧，亦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。

除包含原貝多芬矯正大師班的課程內容外，另外加入了骨釘與 VISTA 術式的操作課程，並新增了學術文章寫作與演講的訓練，讓醫師在進入德國碩士班之前，做好更充分的準備。

想要取得歐洲正式矯正碩士學位資格又苦惱時間不足的醫師，本先修課程是追求您目標的最佳途徑！

課程修畢即取得德國碩士班入學資格

全球目前只有三個機構擁有此先修課程資格，想要取得歐洲齒顎矯正碩士的台灣醫師，此課程為最有效率的選擇。

全新規劃的術式實作

本課程全新規劃的術式實作特別採用了由國際知名的西班牙臨床大師 Dr. Fernando Rojas-Vizcaya 所設計含阻生牙的新式牙齒模型，與歐洲課程接軌，臨床操作更易上手。

貝多芬矯正中心見習

本課程除了課堂演講與模型操作課程外，亦加入了貝多芬矯正中心見習。醫師可以就近觀察學習張慧男醫師矯治病患、病例思考以及與病患溝通的經驗與智慧。

Beethoven Dental Clinic Established 1996

03-5735676#217 Chester Yu

yuebucy@newtonsa.com.tw

Beethoven
Damon Master Program

Course Schedule

66hrs

Module 1

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

Module 2

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

Practice: Patient photo management

Module 3

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

Practice: Ceph tracing

Module 4

1. Excellent finishing
2. Retention & relapse

Practice: Ceph superimposition & measurement

Module 5

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

Practice: Case report demo

Module 6

1. Class III correction
2. Class II correction

Topic: Early orthodontic treatment

Computer training (Mac): 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)

Module 7

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

Topic: Modfied VISTA

Module 8

1. ABO DI, CRE workshop
2. Open bite

Topic: Modified 2X4 appliance in ortho treatment

Module 9

1. Implant-ortho combined treatment
2. Asymmetry

Topic: Interdisciplinary approach

Module 10

1. Minor surgeries in orthodontics
2. Digital orthodontics

Topic: Ortho-viewed interdisciplinary treatment

Module 11

1. Aligner & TADs
2. Keys to aligner learning

Topic: Pre-aligner treatment

Special lecture: 1:30-2:30 pm

*費用含課程視訊、iPad、課程電子書與材料。

+

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，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。

Beethoven
Clinical Education

此診間訓練課程除了包含診間見習之外，並新增學術文章寫作與演講的訓練。醫師不僅可以於貝多芬矯正中心就近學習張慧男醫師的診間技術與經驗，也同時培養醫師期刊寫作與高效簡報的技巧。

34hrs

Chairside Learning 6hrs

Participants will have a chance to conduct chairside learning and observe clinical treatment process in Beethoven Orthodontic Center.

ABO Writing Training

Medical Writing Training 12hrs

Medical writing skills are crucial for clinicians, educators and researchers. This training contains academic medical writing on case reports. Participants will have a chance to publish articles for journals like Journal of Digital Orthodontics (JDO).

Presentation Workshop 10hrs

The presentation workshop designed to help participants utilize the most frequently used presentation tools in Keynote to manage patient clinical records and create simple but effective patient communication presentation.

VISTA & 4 other Minor Surgeries for Orthodontic Practice

VISTA Hands-on Workshop 3hrs

The VISTA (vertical incision subperiosteal tunnel access) surgical techniques for impacted cuspids will discuss the following topics:

1. VISTA with screw placement
2. VISTA with connective tissue graft
3. Suture technique

TADs & Surgeries Hands-on Workshop 3hrs

The workshop covers bonding on a typodont, TAD placement, and 4 minor surgeries for orthodontic practice.

*全系列課程修畢，完成兩篇案例報告文章後，即可取得赴德國碩士班進修資格證書。

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Master Degree in Specialized Orthodontics

黃金陣容師資團隊

Scientific Director
德國國立杜易斯堡-埃森大學 IMC 口腔醫學院院長

Univ. Prof. Dr. Dr. Dr. h. c. mult. Ulrich Joos, FRCS, FDSRCS

德國國立杜易斯堡-埃森大學 IMC 口腔醫學院院長
德國明斯特大學口腔顎面外科醫院及門診部榮譽教授
英國皇家外科學會榮譽院士 (FRCS, FDSRCS)
德國外科基金會 DGS 創辦人
德國杜易斯堡 MVZ 醫療中心創辦人
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1972 年至 1979 年為其學術養成重要階段，先後完成牙醫、醫學學士，獲後感謝為口腔顎面專科醫師。1983 年於佛萊堡大學任教期間 (C3-Professor)，取得德國特許任教資格，並擔任歐洲及歐盟各國口腔顎面外科組圖學會的領導者，暫到顎面外科協會榮譽會員及匈牙利學術榮譽博士 (1980-1984)，法國口腔顎面等外科協會副主席 (1985)，1988 至2002 年期度擔任歐洲顱顎面外科協會主席，德國杜易斯堡-埃森大學 IMC 口腔醫學碩士學位委員會主席 (2003)，同年獲頒百出牙口腔顎面外科協會榮譽會員，海德拉巴裂 (口蓋裂裂) 協會國際顧問委員會榮譽會員 (2005)，匈牙利慕恩德大學榮譽博士及教授 (2012)，英國皇家外科學會榮譽院士 (2016)，30 年歐亞內培育超過300 名口腔顎面專科醫師。

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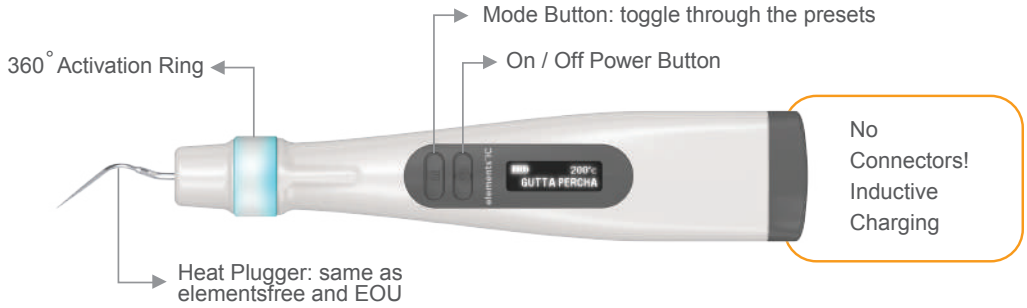

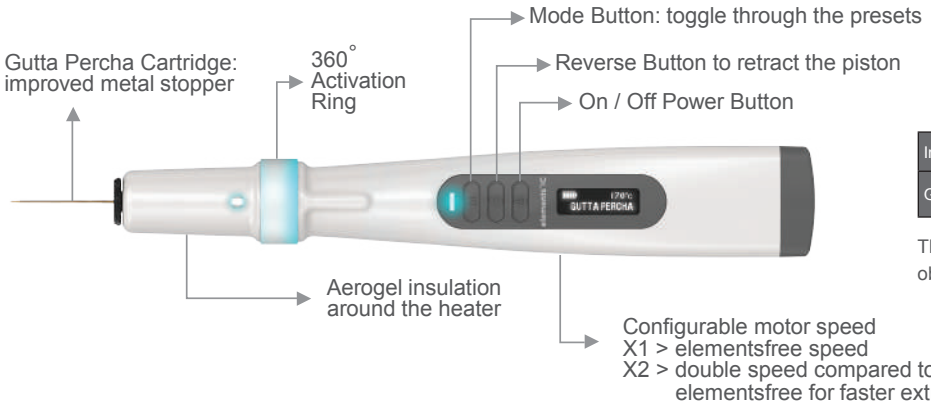

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Management of Maxillary Impactions: Four Surgical Techniques

(J Digit Orthod 2022;65:56-82)

A. Uncovering via Excision (E), the Open-Window Technique

Kokich et al.[1] suggested that a palatal impaction will spontaneously emerge after obstructing soft and hard tissue are removed along the desired path of eruption. The open window via excision (E) method is optimal for most palatal impactions. In addition to excising overlying soft tissue, bone obstructing eruption must be removed down to the cementoenamel junction (CEJ). In effect, the entire clinical crown must be exposed in the desired path of eruption. Post-operative (post-op) periodontal dressing is required for deep impactions to prevent healing tissue from covering the exposed crown and obstructing eruption. Adequately exposed teeth usually erupt into the oral cavity spontaneously. Since the entire palate is covered by attached mucosa, there is little problem in achieving an adequate keratinized gingiva to support a tooth recovered from the palate.[2] The following case demonstrates the step-by-step method for surgical exposure and recovery of a palatally impacted canine.[3,4]

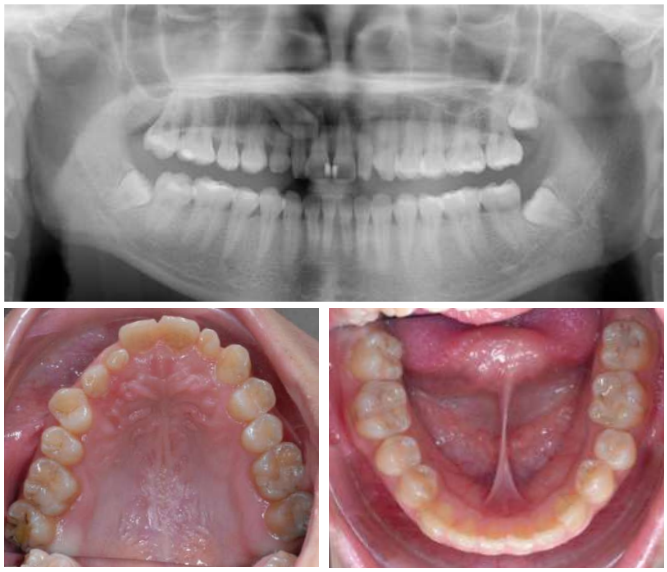

Fig. 1:
Pre-treatment panoramic radiograph and intraoral occlusal photographs show an impacted upper right canine (UR3) and a retained primary upper right canine (URc).

Case Report 1

A 19-year-old female had an impacted upper right permanent canine (UR3), and the associated deciduous canine (URc) was retained (Fig. 1). A cone beam computed tomography (CBCT) scan was utilized to determine the three dimensional (3D) location of the impaction. The CBCT slice revealed that the impacted UR3 was located palatal to the apical portion of the upper right lateral incisor (UR2) root (Fig. 2). This preoperative diagnosis was helpful for planning the treatment. The 3D position of the impaction relative to the roots of the incisors help determine the appropriate surgical approach (Figs. 3-6).

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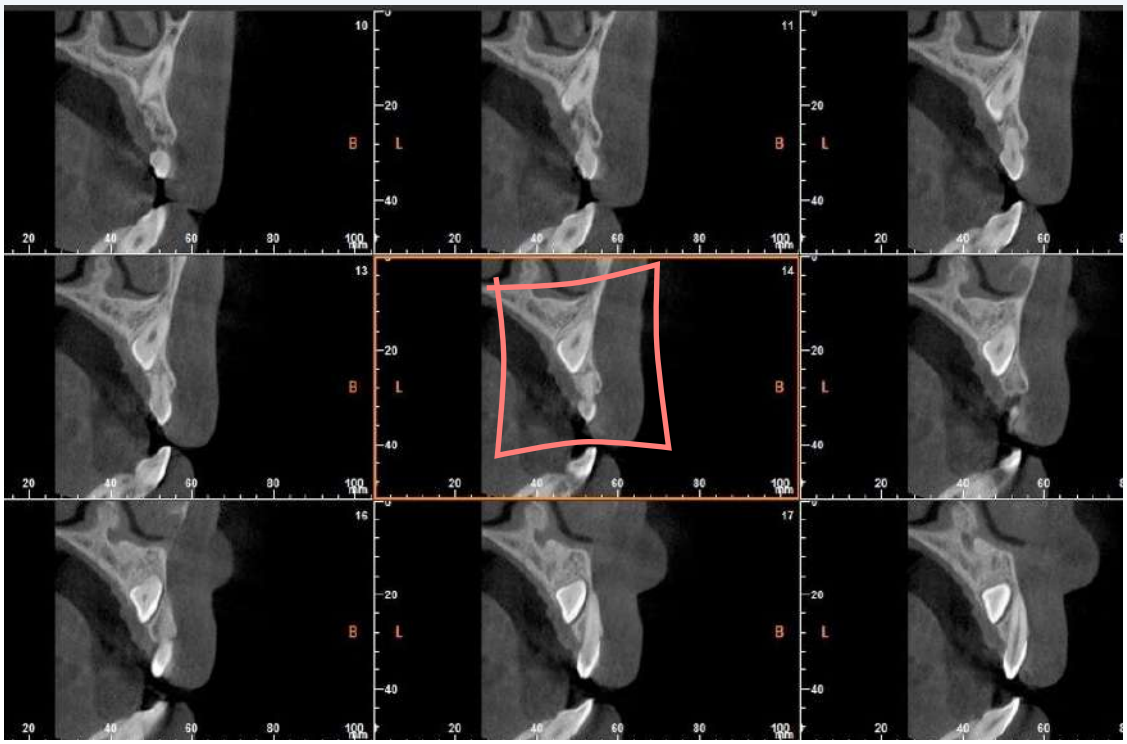


Fig. 2:
Pre-treatment CBCT slices provide precise documentation for the 3D position of the impacted canine: palatal side of the right lateral incisor (UR2) and partially covered with bone (pink square).

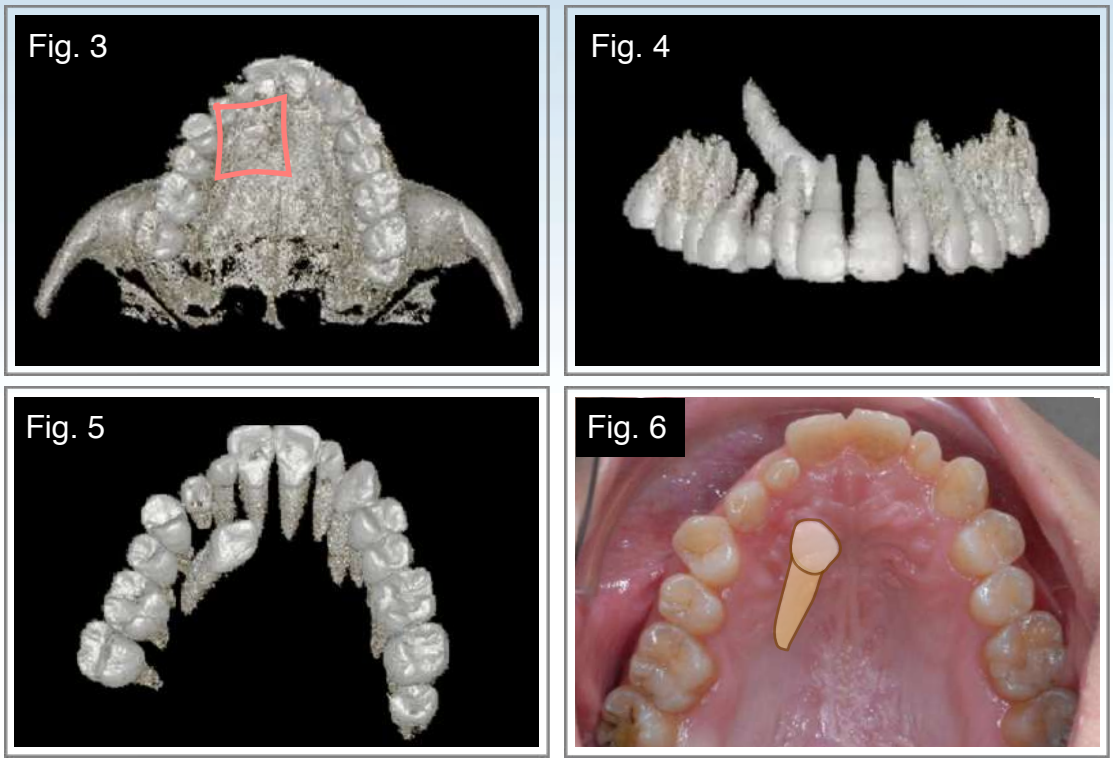
Treatment Plan Options

Option 1: Retain the impacted UR3 and restore the URc to simulate a permanent canine. The risks for this conservative approach are: 1. inadequate root structure of the primary tooth to sustain normal function for an appropriate clinical crown, and 2. impaction-related pathological complications such as root resorption of the adjacent teeth, cyst formation, decreased arch circumference, referred pain etc.[5,6]

Option 2: Extract the UR3 and restore the URc to the shape of a permanent canine. Complications due to a retained impaction are controlled, but prognosis for the restored deciduous canine is questionable because of a poor crown-to-root ratio to resist functional loading.

Option 3: Surgical exposure

1. Facilitate natural eruption if the canine has an acceptable axial inclination.



Figs. 3-6:
Three views constructed from the CBCT scan (3-5) provide documentation for the position of the canine impaction, which is shown as a drawing superimposed on the upper occlusal photograph (6). The upper left image (3) shows that the UR3 is a partial bony impaction (pink square).

2. The two-step approach is to create a lateral window for tooth eruption. The wound is packed with periodontal dressing to avoid obliteration of the desired path for eruption by healing tissue. After the canine has erupted spontaneously, a bracket is bonded on the crown.

3. A one-step approach is feasible when the orientation of an impaction permits bonding a bracket in a favorable location at the time of the surgical exposure.

For the current patient, surgical exposure provided a window for spontaneous eruption, but the attachment for orthodontic traction was not bonded until after the UR3 erupted.

Step-by-Step Surgical Procedure

Step 1. The incisive nerve was block anesthetized. An explorer was used to locate the impaction under the soft tissue and mark the crown (Fig. 7). The tactile feedback when probing a tooth and adjacent bone is distinct; an enamel surface is smooth and hard while bone is rough and easier to penetrate.

Step 2. An electrosurgical unit was used for a circular, soft tissue cut around the explorer penetration mark (Fig. 8). The electrocautery achieved along the wound edges resulted in excellent hemostasis (Fig. 9).

Step 3. A periosteal elevator and a surgical curette were used to elevate and remove the overlying soft

Step 1

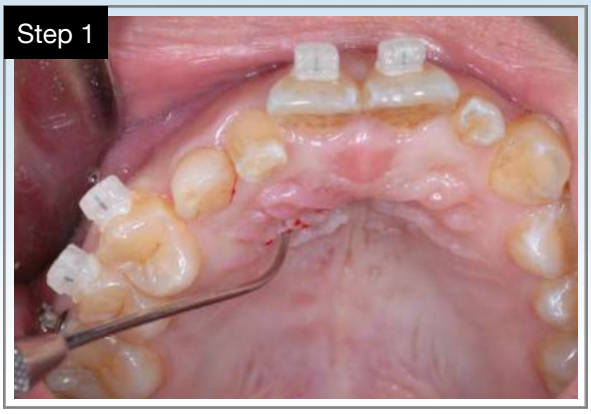


Fig. 7:
Under local anesthesia, a surgical explorer is used to mark the crown for the impaction.

Step 2

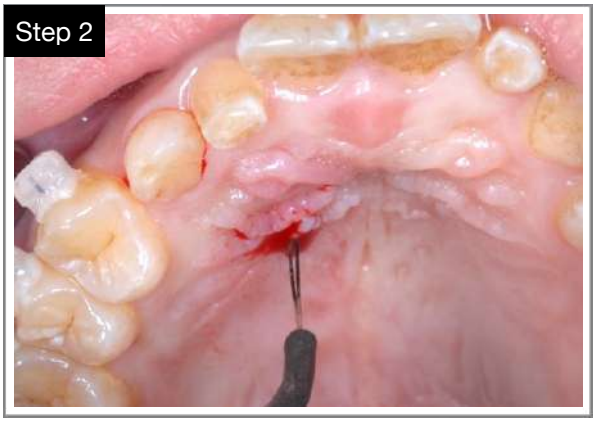


Fig. 8:
An electrosurgical unit was used to cut a circle around the probing mark.

Fig. 9:
Almost no bleeding occurred after using the electrosurgical unit.

Step 3

Fig. 10:
With a clear surgical view, a small part of the impacted UR3 could be seen penetrating the bone (white arrow).

Step 4

Fig. 11:
Bone covering enamel was removed with a carbide bur in a high-speed hand-piece.

Step 5

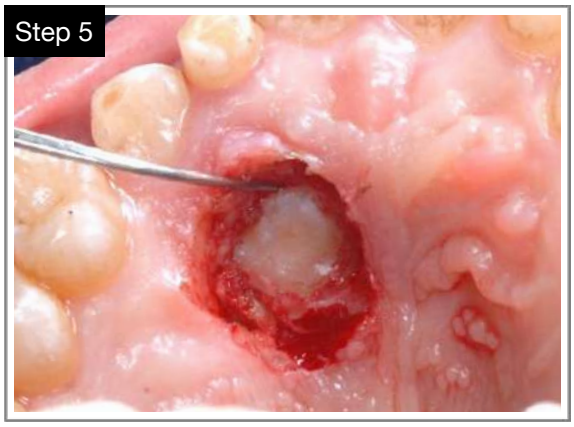


Fig. 12:
The perimeter of the exposed crown was probed with an explorer to ensure that no bone that would inhibit eruption was covering the crown.

tissue. The surgical area featured a smooth incision with minimal oozing (Fig. 10).

Step 4. The bone covering the crown was removed with a carbide bur in a high-speed hand-piece (Fig. 11). A carbide bur is more efficient for cutting bone than a diamond bur.

Step 5. Following hemostasis, an explorer is used to ensure that no bone is obstructing the planned path of movement for the impaction (Fig. 12).

Step 6. The soft tissue margins of the wound are trimmed as needed, bleeding is controlled with an electrosurgical unit (Fig. 13), and the cavity is irrigated with normal saline solution.

Step 7. COE-PAK® periodontal dressing is applied to the wound and pressed into the undercuts of the teeth for retention (Fig. 14). Before handling the COE-PAK®, surgical gloves were coated with petroleum jelly to avoid the dressing sticking to the gloves (Fig. 15).

Fig. 13:
Soft tissue bleeding was stanched with the electrosurgical unit.

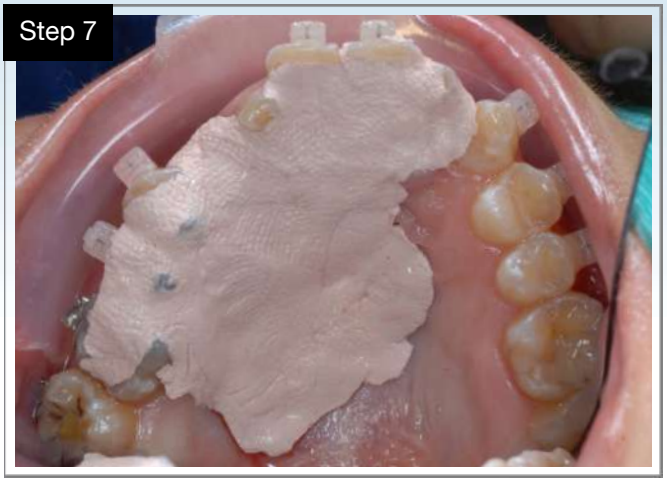


Fig. 14:
The wound was covered with the periodontal dressing COE-PAK®.

Fig. 15:
Glove finger tips were coated with petroleum jelly (Vaseline®) as needed from a reservoir applied to the back of a glove to avoid sticking to periodontal dressing as it is pressed into the dental undercuts.

Step 8. Moistened gauze was used to press the COE-PAK® to place to close the wound and control bleeding. The patient was provided an analgesic and post-operative instructions.

COE-PAK® was removed three days later. Epithelialization (healing) of the surrounding

mucosa was visible and exposed bone was covered with a thin layer of soft tissue. The surgical window was now surrounded by epithelium in preparation for spontaneous eruption of the impaction (Figs. 16 and 17).

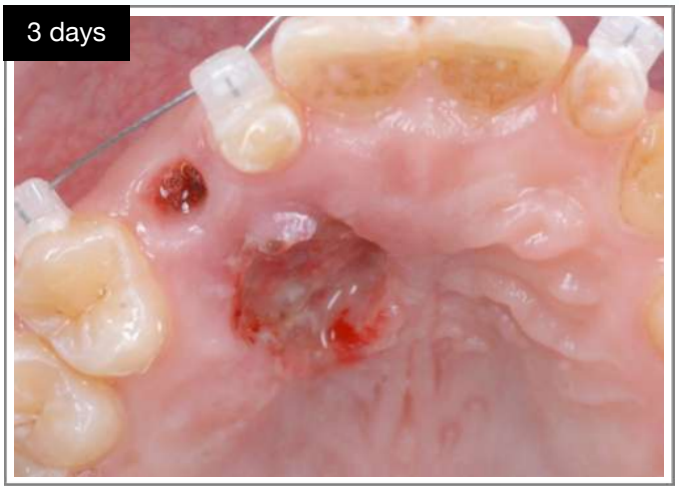


Fig. 16:
Three days post-op, the dressing was removed. The wound edges were covered with epithelium and no bone was exposed.

Fig. 17:
One week post-op, the window was stable and the crown was surrounded by epithelium.

Discussion of the Excision (E) / Open-Window Technique

Important tools to facilitate the uncovering of impactions are: 1. cone bean CT (CBCT) scan, 2. electrosurgical unit, 3. high-speed hand-piece with a carbide bur, and 4. COE-PAK® periodontal dressing.

Cone Bean CT Scan

Three-dimensional CBCT images (Fig. 2) are considered the standard of care for impaction recovery procedures. Three dimensional (3D) imaging is essential for assessing the position of a completely impacted tooth relative to the surrounding dentition, anatomic structures, bony encapsulation, and soft tissue covering. These data are necessary for selecting the appropriate surgical technique and the force system to precisely align an impacted tooth without damaging the roots of adjacent teeth. An additional consideration is planning a path of tooth movement that avoids dense cortical bone.[7] Moreover, any obstacles in the designed pathway of eruption should be removed during the surgical procedure.

Electrosurgical Unit

Electrosurgery (Figs. 8-10) allows the operator to control bleeding while removing the soft tissue covering the impaction. Different-shaped tips are available to accommodate the needs and preference of the clinician. Large amounts of tissue can be precisely removed and re-contoured because the spontaneous hemostasis provides a clear operative area.

High-Speed Hand-Piece with a Carbide Bur

Soft and hard tissue covering the impaction was carefully assessed preoperatively with CBCT imaging. The treatment plan selected was the open-window technique to create an unobstructed path of tooth movement for the impacted tooth. All obstacles were removed as needed. Dense bone, supernumerary teeth, and pathology (odontoma, cysts etc.) can prevent the spontaneous eruption of an impaction.[2,4,5] A high-speed hand-piece with a carbide bur (Fig. 11) was used to remove the dense bone covering the crown. Carbide burs are preferred over diamond burs for cutting bone.

Periodontal Dressing

Choosing an appropriate periodontal dressing material is probably the most important step in the entire surgical procedure. The goal for this operation is to create a path of eruption for the impacted tooth. The periodontal dressing, COE-PAK®, prevents ingrowth of the surrounding soft tissue and bone to cover the impaction, maintains the window for eruption, controls bleeding, and enhances patient comfort during the healing process (Fig. 14). The periodontal dressing was easily removed 3 to 5 days postoperatively (post-op) (Figs. 16 and 17).

Summary of Excision (E) / Open-Window Technique

Excision of tissue inhibiting eruption is best planned with CBCT imaging. Utilizing the precise surgical methods described above results in predictable recovery of most palatal impactions.

B. Apically Positioned Flap (APF)

An APF is a common periodontal surgery designed to decrease pocket depth, maintain an adequate zone of keratinized tissue, and lengthen the clinical crown for a prosthesis. A gingivectomy to uncover an impaction decreases the width of keratinized tissue, but an APF increases keratinized gingiva via a secondary healing process. Kokich[1] recommends an APF to uncover an impaction if it is at, or apical to, the MGJ.

Case Report 2

A 9-yr-old female with a high, labially-flared impacted right maxillary central incisor (UR1) was treated using the APF technique (Figs. 18 and 19). The adjacent UR2 erupted mesially into the space for the UR1, and the width of the surrounding keratinized tissue for the UR2 and UL1 was less than 1mm. Lateral intra-oral photographs (Fig. 20) show that the attachment of the labial frenum is very coronal, and that the width of keratinized gingiva is narrow between the UR2 and UL1.[7] This periodontal problem may lead to plaque accumulation, poor oral hygiene care, and gingival recession.

Treatment Plan Options

Option 1: Retain the impacted incisor and provide a removable partial prosthesis to restore esthetics, function, and phonetics. However, this restorative solution may not satisfy the patient's expectation

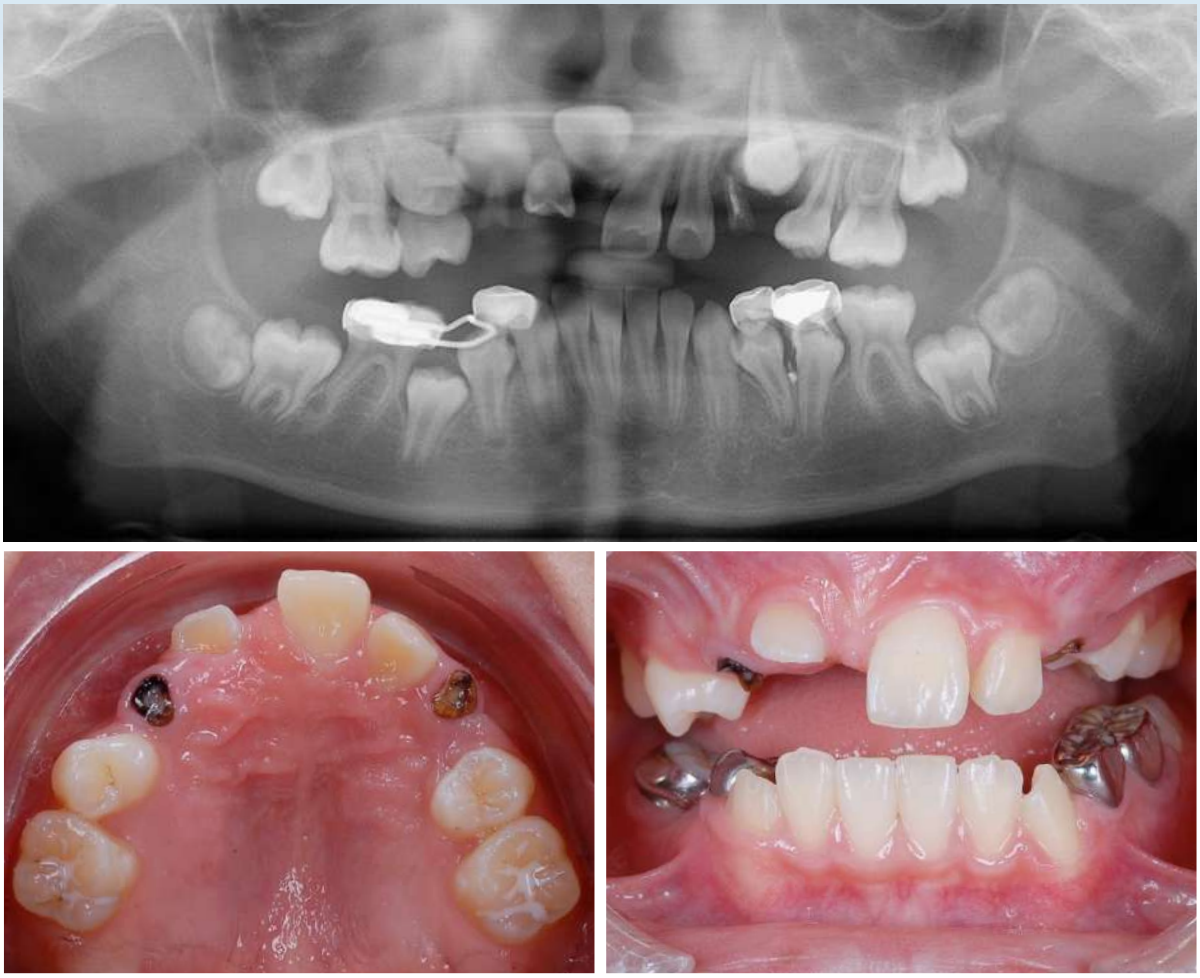


Fig. 18:
Pre-treatment panoramic radiography and intraoral photographs document the oral morphology associated with an impacted upper right central incisor (UR1) compared to an upper left central incisor (UL1) in occlusion. CBCT imaging was indicated.

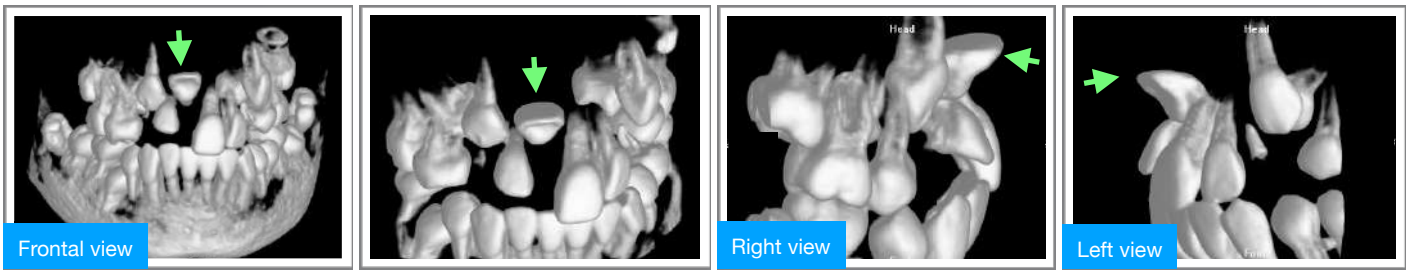


Fig. 19: *Four 3D views of the CBCT scan show the impacted central incisor (green arrows). See text for details.*

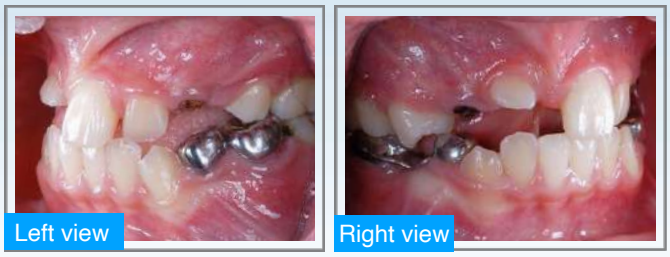


Fig. 20:
Left and right intra-oral views document the low fibrous attachment of the labial frenum between the UR2 and UL1

for esthetics (chief complaint). For the 9-year-old girl and her family, a missing maxillary central incisor is an emotional issue. Furthermore, retaining an impacted tooth may result in pathologic complications such as root resorption of the adjacent teeth, cyst formation, loss of arch length, referred pain, etc.[5] All considered, this treatment option was rejected by both the patient and her parents.

Option 2: Extract the impacted UR1, and restore the tooth with a bridge after UR2 fully erupts and the dentition is mature. The difficult extraction surgical procedure will be referred to an oral surgeon to be performed under general anesthesia in a hospital. The missing UR1 will be temporarily restored until the permanent prosthesis is constructed at about 16-18 years of age. Then the UR2 and UL1 will be prepared as bridge abutments. Replacing a single central incisor with a fixed prosthesis is expected to result in some degree of esthetic compromise. The patient and her patents rejected this option.

Option 3: Surgical approach and orthodontic traction :

1. Regain adequate UR1 space with active orthodontic treatment.
2. Surgically expose the impaction, and bond an attachment for orthodontic traction.
3. Use an APF to reposition the labial frenum more apically and to increase the quantity of keratinized gingiva in the maxillary anterior esthetic zone.

After a thorough discussion of the pros and cons for each treatment approach, the patient and her parents selected Option 3.

Step-by step surgical procedure

Step 1: After space was created between UR2 and UL1 (Fig. 21), the impaction was surgically exposed and a flap was reflected (Fig. 22).

Step 2: The UR1 was surgically luxated with a periosteal elevator to rule out ankylosis. A button

Fig. 21:
After 7 months of active orthodontic treatment, space for the UR1 was created with open coil spring.

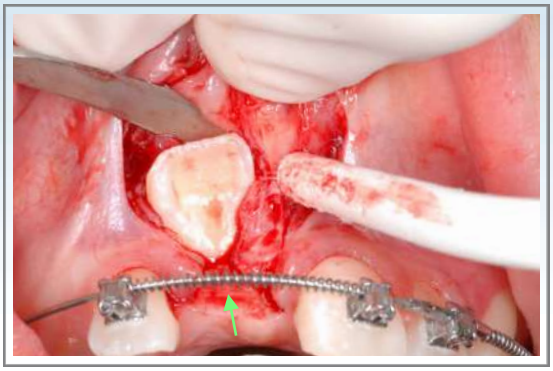


Fig. 22:
A partial-thickness flap reflection technique (green arrow) was used to expose the impacted UR1.

Fig. 23:
A button with a power chain attached was bonded on the labial side of UR1.

Fig. 24:
The apically flap was positioned about 5mm superior to the alveolar crest to provide additional keratinized gingiva as the wound healed.

with a power chain was bonded on the labial surface of the crown (Fig. 23).

Step 3: The flap and the labial frenum were repositioned more apically to increase the attached gingiva as the impaction erupted (Fig. 24).

Sutures were removed 10 days later. The power chain attached to the UR1 was ligated by power thread to the main archwire to redirect traction toward the occlusal plane. At monthly intervals, power thread was replaced to reactivate traction (Fig. 25).

In the 7th month (4 months after surgery), a 0.022-in Damon 3MX® bracket was bonded on the UR1 and a 0.014-in CuNiTi archwire was placed in the upper arch to achieve alignment (Fig. 26). After 30 months of active treatment, all appliances were removed, and the clear overlay retainers were delivered for both arches. The patient was instructed to wear them full time for the first 6 months and nights only thereafter.

Discussion of the Apically Positioned Flap (APF) procedure

When managing a high impaction (Fig. 19), the quantity of keratinized, attached gingiva is an important issue.[4,8] To increase the band of attached gingiva, the flap was apically positioned with the APF technique. To achieve positive longterm outcomes for an APF requires three objectives: increased keratinized gingiva, maintenance of vestibular depth, and apical repositioning the labial frenum.[9] However, the secondary healing process required is relatively painful, may result in scarring,

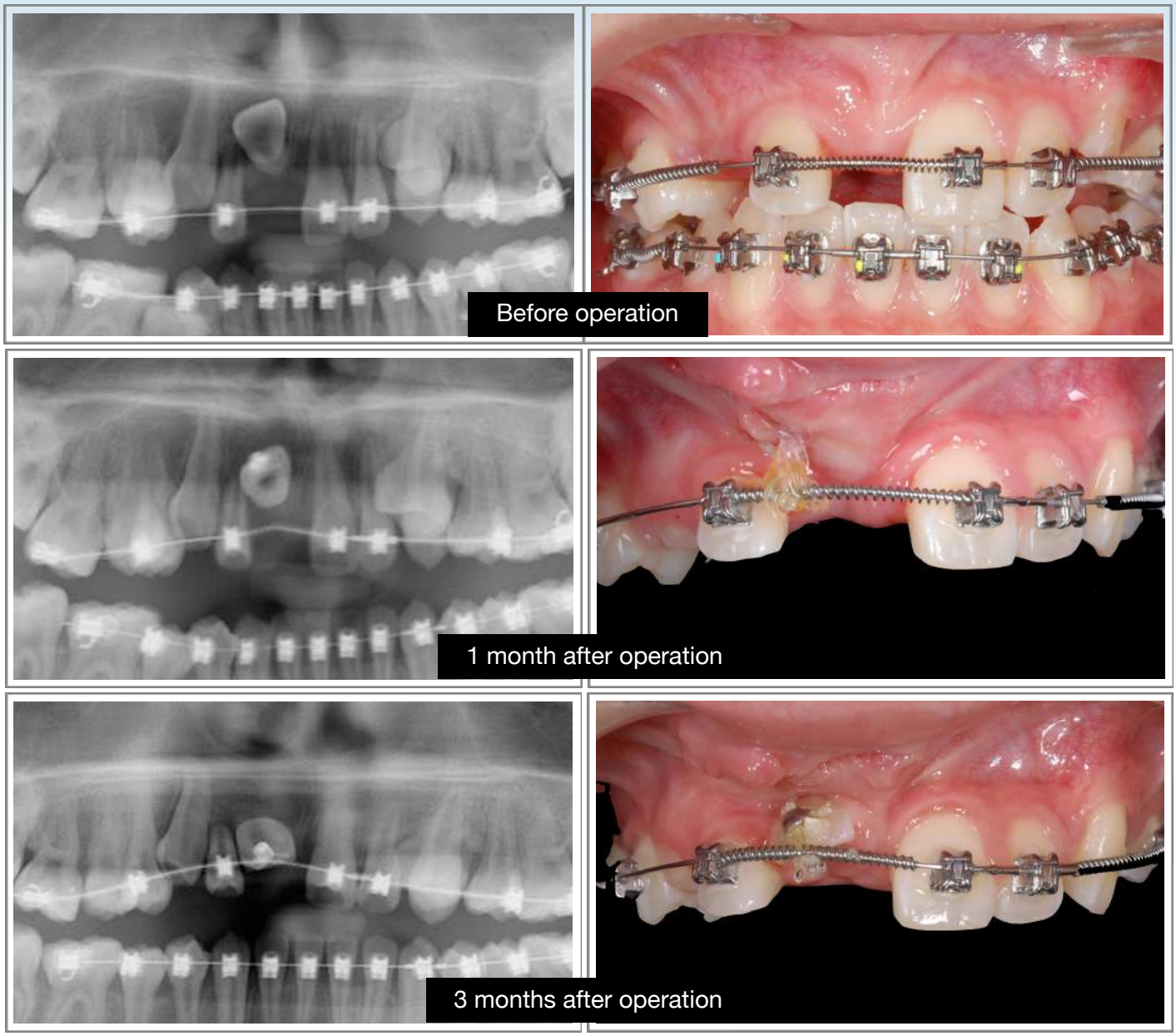


Fig. 25:
A series of panoramic radiographs are matched to intraoral frontal radiographs at three time intervals: Before operation (upper), 1 month after operation (middle), and 3 months after operation (lower).

and has a tendency to relapse, i.e., intrusion of the recovered impaction (Fig. 27). Despite the potential limitations, the patient and her parents desired the APF approach because it offered the potential for the most ideal outcome. At the end of treatment, a connective tissue graft (CTG) was recommended to increase attached gingiva on the UR1, but the family

Fig. 26:
In the 7th month (4 months after surgery), a 0.022-in Damon 3MX® bracket was bonded to UR1 and a 0.014-in CuNiTi archwire was placed in the upper arch.

Fig. 27:
After 30 months of active treatment, the result was near ideal with only a small amount root resorption of the previously impacted UR1. However, visible scar tissue near the surgical area compromised the periodontal result.

declined because they were satisfied with the outcome, particularly with the patient's smile.

Summary of APF

Recovering a deeply impacted canine is a significant orthodontic challenge.[9] Many factors must be considered, such as patient age, esthetics, occlusion, operative procedure, patient comfort, and periodontal support. Conservative correction of the complex problem entails risks that must be carefully controlled with precise appliances and minimally invasive surgery. The APF approach is often preferred because of the potential for a near ideal periodontal outcome. The vertical parallel incisions to elevate the flap allow good surgical access while reducing the potential for scar formation, but a tooth extruded following an APF is subject to relapse (intrusion).

C. Closed Eruption (CE)

The CE technique is preferred for most labially impacted teeth, particularly if they are located apical to the mucogingival junction (MGJ). The APF technique is difficult or impossible to use for most very high impactions.[10-15]

Some clinicians believe that CE with orthodontic traction simulates the natural tooth eruption process to produce the most ideal periodontal results.[13] The CE technique is the most predictable for high impactions particularly on the labial surface.[1]

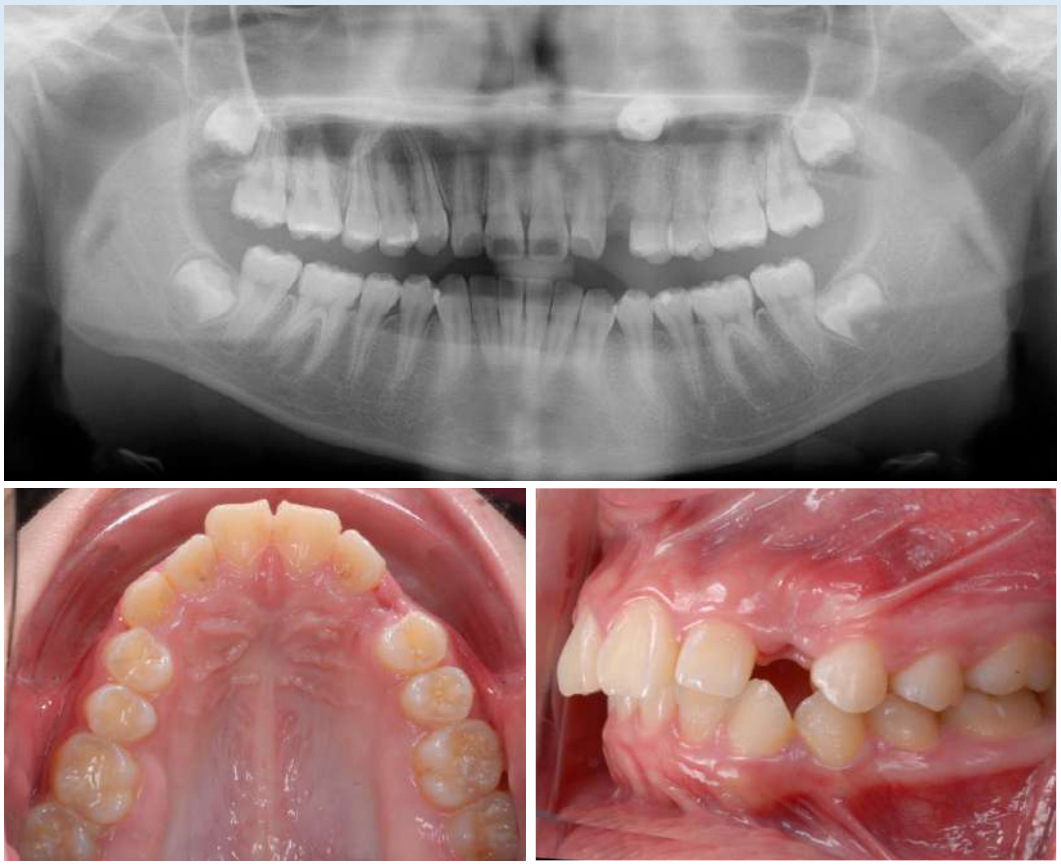


Fig. 28:
Pre-treatment panoramic radiography and intraoral photographs show a deeply impacted upper left canine (UL3) which is apical to adjacent teeth and about 14 mm away from the alveolar crest.

Case Report 3

A 13-year-7-month girl presented with a labially impacted canine that was positioned about 14mm apical to the alveolar ridge (Figs. 28 and 29).

Treatment Plan Options

Option 1: Retain the impacted canine, and provide a removable partial denture to temporarily maintain esthetics, function, and phonetics. An implant is suggested after about the age of 20 to permanently restore esthetics and function.

Option 2: Extract the impacted UL3, and provide a removable partial denture until an implant-supported prosthesis can be constructed after about age 20 years.

Option 3: Surgical uncovering followed by orthodontic traction:

Correct the width of the UL3 space, surgically expose the impaction, and bond an attachment for active orthodontic traction. The CE technique was chosen because the impaction was apical to the MGJ.

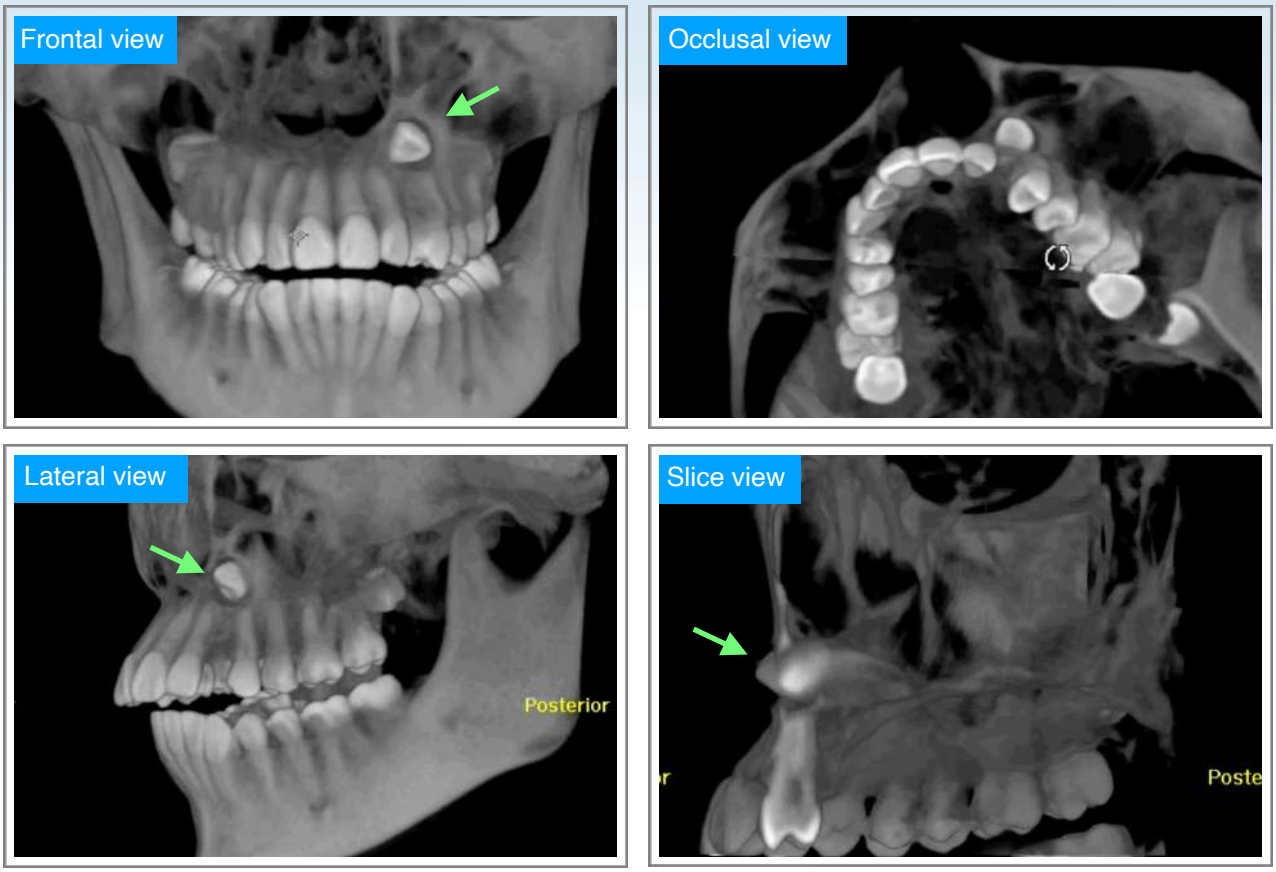


Fig. 29:
Four different images constructed from a CBCT scan show the high labial impaction of an UL3. Green arrows point to the impaction in all images except the occlusal view (upper right).

After a detailed discussion of the pros and cons for each approach, the patient and her parents chose Option 3.

Step-by-Step Surgical Procedure

Step 1: Four months of orthodontic treatment was required to open an adequate space for the impacted UL3 (Fig. 30).

Step 2: The UL3 was surgically exposed and the covering bone was removed with a carbide bur in a high-speed hand-piece (Figs. 31A and B). The impaction was luxated with an elevator to rule out ankylosis, and two buttons were bonded on the buccal and palatal surfaces. Two different-colored power chains were used to differentiate the distinct elements of the force system (Figs. 31C and D).

Step 3: The traction force was anchored with a 2x12-mm OrthoBoneScreww® (OBS, iNewton, Inc., Hsinchu City, Taiwan) that was inserted to the infrazygomatic crest. A 3D lever arm made with 0.019x0.025-in stainless steel (SS) provided traction to move the impacted canine toward the occlusal plane (Fig. 31E). The wound was primarily closed,

Fig. 30:
After 4 months (4M) of active orthodontic treatment, an adequate UL3 space was created with an open coil spring.

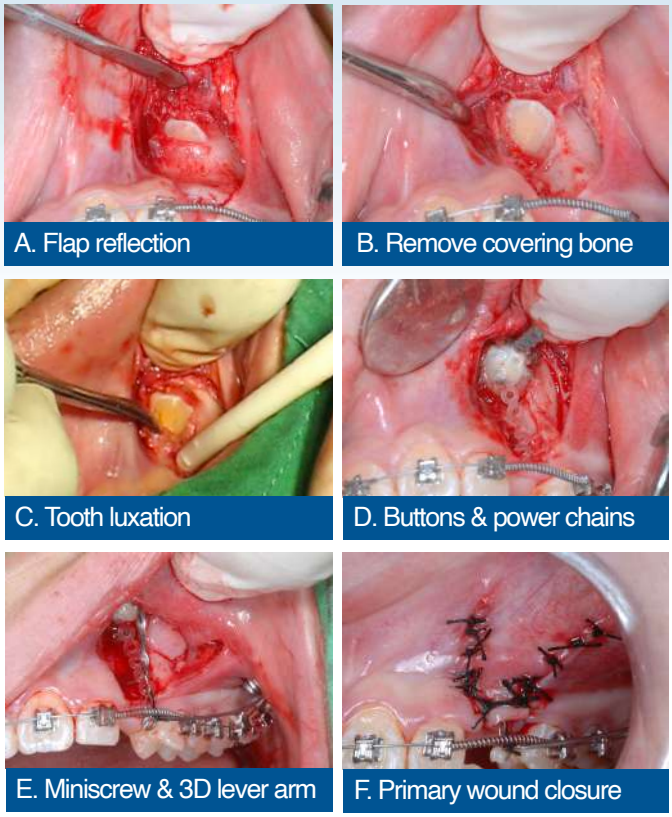


Fig. 31:
Six surgical steps are illustrated for the recovery of a UL3 impaction with the closed eruption technique.

and the traction force was readily activated by adjusting the 3D lever arm (Fig. 31F).

Discussion of CE

The CE technique is usually the most appropriate option to achieve optimal soft tissue healing and esthetics when recovering a labial or transalveolar impaction that is apical to the MGJ. Three stages of soft tissue transition are commonly observed: 1. gingival collar redness, 2. a red patch, and 3. keratinization.[4,16]

Stage 1: *Gingival collar redness*

During the initial period of rapid forced eruption, a collar of redness is often observed around the gingival margin. This is the color of the non-keratinized epithelium tissue inside of the periodontal crevice when it is everted (Fig. 32). This normal gingival response is often misinterpreted as poor healing or gingival inflammation because it is associated with high probing depth in the gingival sulcus. Patients should be instructed to maintain proper oral hygiene at the red soft tissue margins

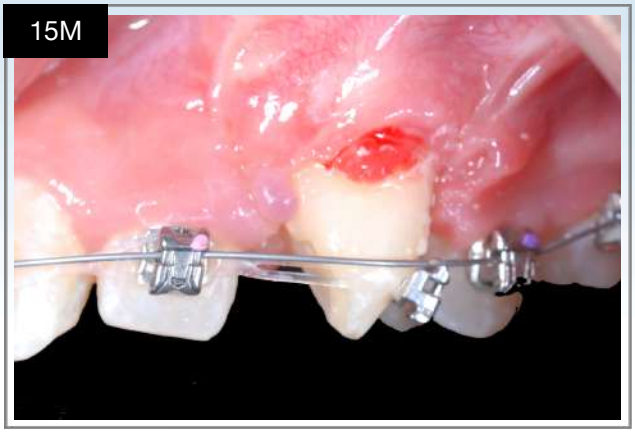


Fig. 32:
Fifteen months in treatment (15M), gingival collar redness with a deep probing depth was noted on the UL3. See text for details.

because gingival collar redness is a normal condition when teeth are rapidly extruded.

Stage 2: *The red patch*

As an impaction is rapidly extruded into the oral cavity, a bright red patch of tissue may appear at the gingival margin. During this stage, probing depth decreases from around 5mm to 3mm, which is within the normal range. However, the color of the gingival margin may be bright red in contrast to the normal pink color of gingiva (Fig. 33).

Stage 3: *Keratinization*

When an impacted tooth is aligned and maintained, the surrounding gingival tissue progressively matures. Completion of the keratinization process for new gingiva requires about 4-6 weeks (Fig. 34).

Soft Tissue Healing: APF vs. CE

Uncovering labial impactions may involve gingival excision (E), apically positioned flap (APF), or closed eruption (CE) techniques.[8,9,12,17] For the present patient (Fig. 29), it was relevant to consider the APF and CE techniques. APF maintains the depth of the vestibule while increasing the width of attached (keratinized) gingiva. However, the surgical method requires secondary healing which may involve considerable pain and scarring. Some reports suggest an intrusive relapse of the impaction may occurs with the APF technique.[11] In contrast, the

Fig. 33: *Nineteen months in treatment (19M)*
The impaction was aligned along the occlusal plane, A "red patch" appeared coronal to the original gingival margin and probing depth was improved to within the normal range (~3 mm).

Fig. 34: *Twenty months in treatment (20M)*
There was maturation of the periodontal support for the UL3. the entire process of keratinization required about 4 to 6 weeks.

closed eruption technique (CE) involves primary healing, which is more comfortable, esthetic and less prone to scar formation. The principal disadvantage for CE is a failure to increase the width of keratinized gingiva supporting the recovered canine.

If a patient is at risk for gingival inflammation due to insufficient keratinized tissue, soft tissue augmentation with connective tissue graft (CTG) may be indicated after CE technique. On the other hand, scarring of the gingiva is a major risk for the APF method in patients with a high smile line.[9]

Vermette et al.[11] compared the APF with CE techniques. They found superior results in terms of gingival, periodontal, and pulp status with the closed eruption (CE) technique. Furthermore, Becker et al.[12] concluded that good long-term esthetic results are routinely achieved by managing impacted maxillary incisors with the CE method.

Summary of CE Technique

Closed eruption (CE) technique is indicated to deeply impacted teeth. A subsequent soft tissue augmentation procedure (CTG) is usually necessary to enhance the keratinized gingiva for recovered impactions.

D. Modified Vestibular Incision Subperiosteal Tunnel Access (VISTA)

Access to the surgical site is obtained by vestibular incision subperiosteal tunnel access (VISTA). Zadeh[18] developed VISTA as a novel, minimally invasive approach for managing isolated recession and multiple contiguous defects in the maxillary anterior region. VISTA offers the opportunity to coronally reposition the margins on teeth with gingival recession and/or osseous defects.[19,20] It is a flapless surgical technique with minimal soft tissue trauma that provides good surgical access and is much more comfortable for the patient. The VISTA technique can be applied with connective tissue and particle bone grafts when managing gingival recession with osseous defects. Since no flap is reflected, tension across the wound is decreased, which facilitates closure with direct loop interrupted sutures.[19,20]

Chang et al.[4] modified the VISTA technique for managing maxillary anterior impactions with or without tooth transposition. The modified VISTA

Fig. 35:
A pre-treatment panoramic radiograph (upper) and intraoral photographs (lower) show a retained upper left primary canine (ULc) associated with a deeply impacted upper left canine (UL3). The latter is is malposed near the apex of UL5 which is about 11mm away from the alveolar ridge.

approach provides a much more comfortable experience for patients with a facilitated wound healing process that is particularly well suited for surgical management of labial impactions in the esthetic zone. This method is a minimally invasive approach for producing optimal dental esthetics.

Case Report 4

A 12-year-old male patient was referred for orthodontics evaluation of a deeply impacted UL3 (Fig. 35). Clinical examination revealed a 5-mm overjet with an asymmetric molar relationship that was Class II on the left and Class I on the right (Figs. 36 and 37). A panoramic radiograph (Fig. 35) showed all permanent teeth were present, the maxillary left primary canine (ULc) was retained, and there was a complete transposition of the deeply impacted UL3 and the adjacent UL4. CBCT (cone-beam computed tomography) imaging was required to precisely locate the impaction relative to the adjacent dentition (Fig. 38).

Treatment plan options

Option A: Extract the retained canine, move the UL4 into the canine position and align the impacted canine to the first premolar position. This conservative approach retains the transposition but still requires surgical exposure and extrusion of the impacted canine. Disadvantages for this option are compromised dental esthetics and function, particularly the ipsilateral loss of canine guidance. Bilateral infrazygomatic crests (IZC) bone screws are needed to correct the asymmetric Class II molar relationship and anchor the extrusion of the impaction.

Option B: Extract the retained ULc and all four first premolars. Uncover the impacted UL3, extrude it into occlusion, and close all extraction

Fig. 36:
Pre-treatment dental models (casts) show a 5mm overjet associated with an end-on Class II molar relationship on the left side, and Class I occlusion on the right side.

Fig. 37:
A pretreatment lateral cephalometric radiograph shows a protrusive upper lip and excessive overjet of ~5 mm.

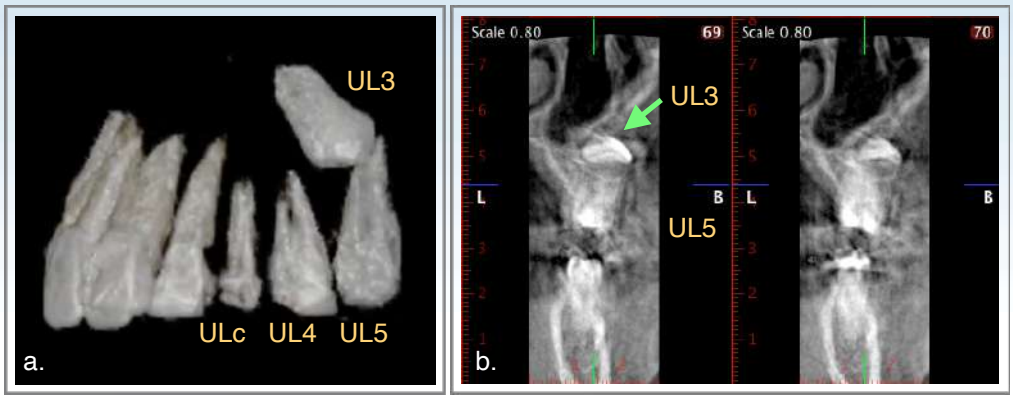


Fig. 38:
a. 3D image of the maxillary dentition documents the relative position of the impacted UL3.
b. Sagittal cuts (slices) through the UL4 to UL5 region of a CBCT image shows a cross-section through the crown of the impacted UL3 (green arrow).

spaces. The disadvantages for this option are the loss of four permanent teeth. However, with IZC bone screw anchorage, ideal canine guidance, symmetry and dental esthetics can be achieved.

Option C: Extract only the retained URc. Correct the transposition with bone screw anchored, submucosal mechanics applied with a modified VISTA approach.[18] Once the impacted canine is sufficiently protracted, extrude and align it in the arch. This treatment plan is clinically challenging, but the potential outcome is near ideal dental esthetics, function, and canine guidance. The disadvantages for this option include increased treatment time and the potential for UL4 root resorption.

After a careful discussion of the pros and cons for each option (Table 1), the patient and his parents preferred option C. However, they preferred to avoid IZC bone screws, but were informed that osseous anchorage was necessary to achieve the optimal outcomes they desired.

	Extraction tooth	Surgical approach	Switch UL3 & UL4 position	Canine guidance	Anterior esthetics	Posterior function	Miniscrew
A	ULc	Yes	No	No	Compromised	Compromised	Yes
B	ULc, All 1st premolars	Yes	No	Yes	Good	Fair	Yes
C	ULc	Yes	Yes	Yes	Good	Good	Yes

Table 1: *Treatment alternatives and their relative pros and cons*

Fig. 39:
All maxillary brackets were bonded from UR6 to UL6 except for the impacted UL3, UL4, and the incompletely erupted second molars. An open coil spring was placed between the UL2 and UL5 to create space for the impacted canine. See text for details.

Treatment Progress and Step-by-Step Surgical Approach

Treatment was initiated in the maxillary arch utilizing a 0.022-in passive self-ligation system (Damon Q®, Ormco, Brea, CA) with standard-torque brackets on the incisors. All maxillary teeth were bonded except for the incompletely erupted second molars (UL7s) and the left first premolar (UL4). No bracket on the UL4 allows it to react as a free body during the space opening to accommodate the permanent canine (Fig. 39). The latter was accomplished with an open-coil spring placed between the left lateral incisor (UL2) and the second premolar (UL5). One month later, surgical approach of the impacted UL3 was carried out using a modified VISTA technique (Fig. 40). Overall, the archwire sequence for maxillary alignment was: 0.014-in CuNiTi, 0.014x0.025-in CuNiTi, 0.017x0.025-in TMA, and 0.016x0.025-in SS.

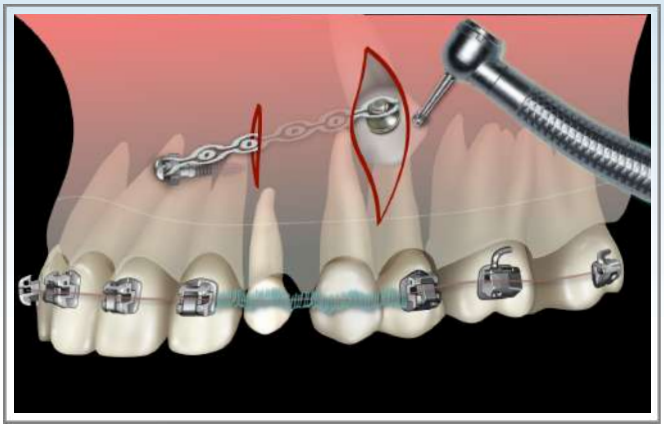


Fig. 40:
A drawing illustrates the modified VISTA technique with OBS anchorage to protract the impacted UL3 to correct the transposition with the UL4. See text for details.

Step 1: After local anesthesia, the first VISTA incision was made to transect the the impacted UL3 (Figs. 41a and 41a'). The VISTA technique provides broad access to the vestibule permitting visualization of the underlying alveolar bone and impacted tooth. Since the crown of the impaction was covered with bone, an explorer was used to penetrate bone to outline it. The enamel surface of the crown is smooth and hard, while adjacent bone is crunchy and irregular.

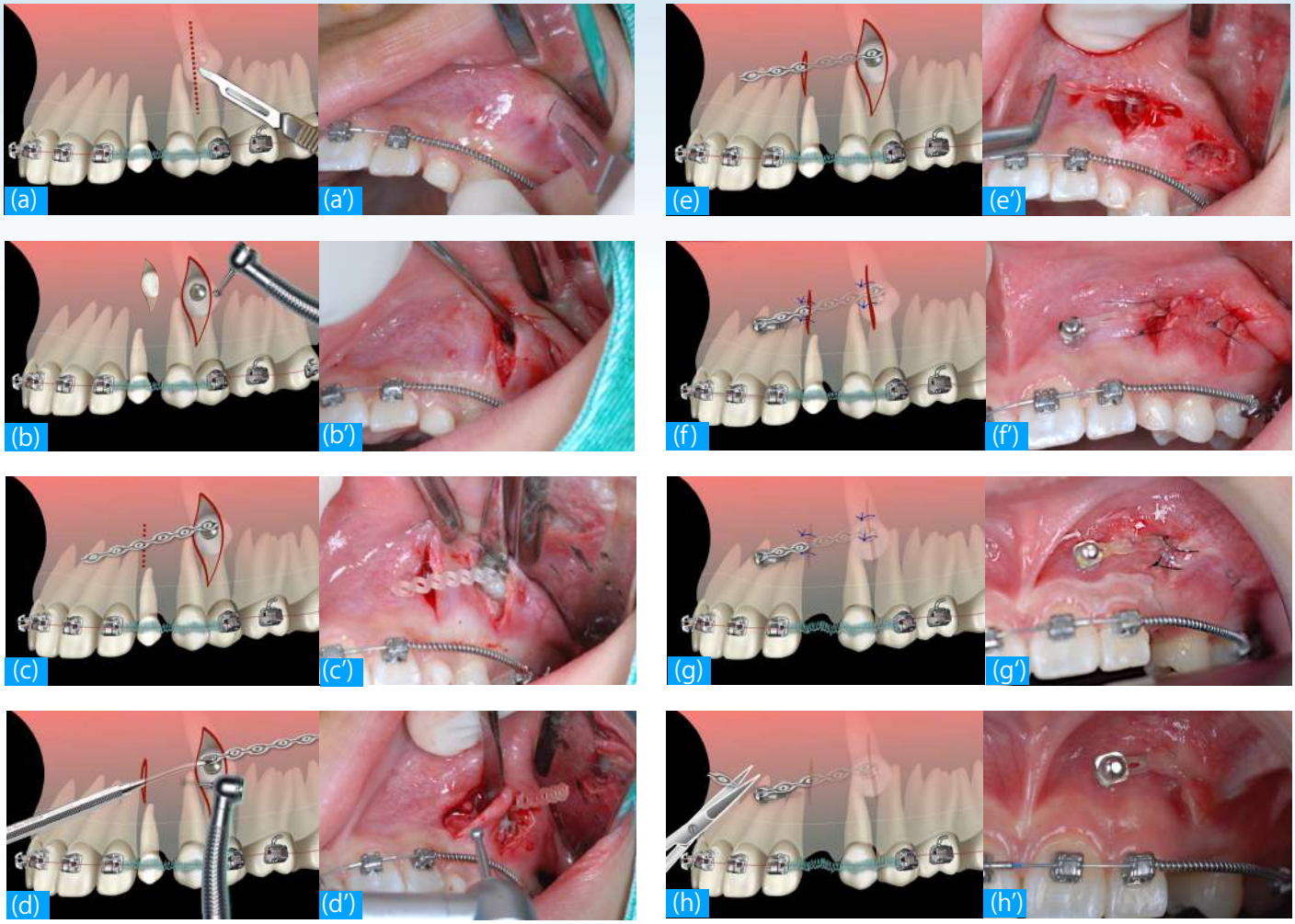


Fig. 41: *A series of illustrations (a-h) are matched to clinical photographs (a'-h') to show the surgical details step by step.*
(a) The first vertical incision was made to expose the impaction area.
(b) The bone covering the UL3 crown was removed down to the CEJ.
(c) A button with an elastic chain attached was bonded to the crown of the impaction. The second incision was made apical and medial to the ULc.
(d) A full-thickness (subperiosteal) tunnel was made with a periosteal elevator and bony contours interfering the planned path of tooth movement were removed with a bur.
(e) The power chain attached to the UL3 was passed through the subperiosteal and exited via the second vertical incision.
(f) A 1.5x8-mm bone screw was inserted interdentally between the roots of UL1 and UL2. The elastic chain was stretched and attached to the bone screw to apply traction to move the impacted UL3 anteriorly. Both vertical incisions were sutured with Nylon 6-0 and the ULc was extracted.
(g) The UL3 impaction is uprighted for about one month.
(h) Reactivation is accomplished by engaging the second loop in the chain and trimming the disengaged loop with surgical scissors.

Bone was removed to totally expose the labial surface of the UL3 crown (Figs. 41b and 41b').

Step 2: Surgical luxation of the UL3 with a periosteal elevator confirmed that is was not ankylosed. A button with a power chain was bonded on the crown (Figs. 41c & 41c').

Step 3: A second vertical incision was made apical to the ULc (Figs. 41c & 41c') and a periosteal elevator reflected a full-thickness tunnel to connect the two vertical incisions (Figs. 41d and 41d'). Bony contours along the line of force for protraction of the canine were removed with a high-speed handpiece. To prevent soft tissue irritation the power chain attached to the canine was passed through the tunnel (Figs. 41e and 41e').

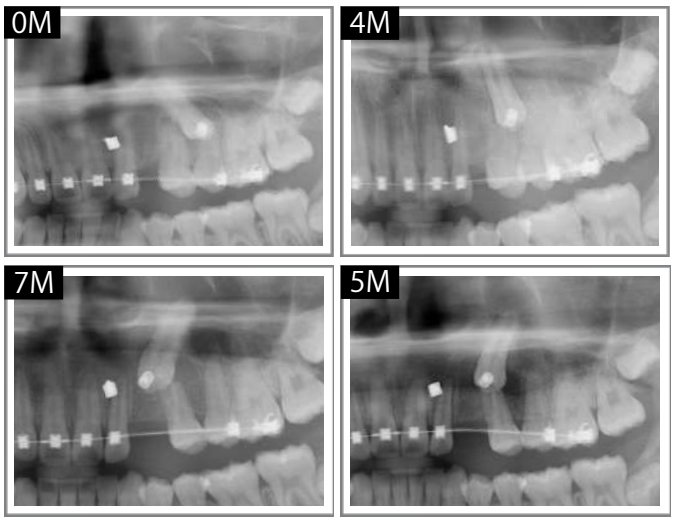


Fig. 42:
Panoramic radiographs in clockwise order document the movement of the UL3:
0M: Immediately post-operative,
4M: after 4 months of anterior traction,
5M: the crown of UL3 is passing the apical area of UL4,
7M: 7 months after surgery, the UL3 crown was moved mesial to the root of UL4 .

Step 4: A bone screw (OBS, 1.5x8-mm, iNewton, Inc., Hsinchu, Taiwan) was inserted interdentally between the roots of maxillary left central and lateral incisors (Figs. 41f and 41f'). The retained ULc was extracted and protraction of the UL3 was activated by stretching power chain and engaging it on the bone screw (Figs. 41g and 41g').

Step 5: To control bleeding and decrease the tendency for scarring, the soft tissue wound was carefully closed with interrupted sutures, which were removed one week later. The power chain was reactivated every month by progressively engaging the next loop on the screw head and the residual loop was trimmed away with scissors (Figs. 41h and 41h'). Follow-up panoramic radiographs were taken every 2 to 3 months to evaluate the movement of the impacted UL3 (Fig. 42).

Step 6: In the 10th month, the crown of the impacted UL3 had been moved to the center of the edentulous position between UL2 and UL4, which was defined as the ideal mesio-distal position for the canine. The UL4 bracket was

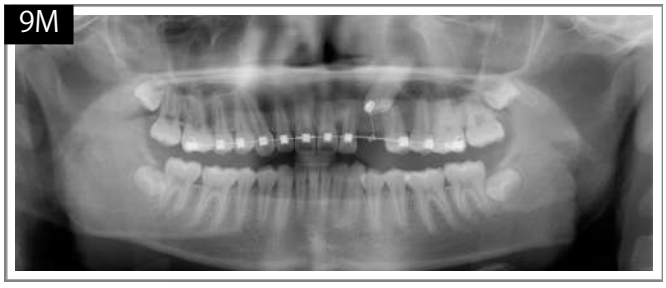


Fig. 43:
Nine months after surgery, the power chain was replaced by a ligature wire that extended into the oral cavity. Power thread tied to the .017x.025-in low friction TMA arch wire applied traction to extrude the UL3. The power thread was replaced monthly to reactivate traction.

Fig. 44:
In the 19th month, the UL3 was adequately extruded to permit the bonding of a bracket.

Fig. 45:
A torque spring was used on the UL3 for palatal root movement.

bonded and a new open-coil spring was placed between UL2 and UL4 on a 0.017×0.025-in low friction TMA arch wire (Fig. 43). Under local anesthesia, the power chain and the miniscrew were removed, but no suture was needed. Power thread was used to extrude the impacted UL3 to the occlusal plane, and it was reactivated at monthly intervals.

Step 7: In the 19th month, a high torque Damon Q® canine bracket was bonded on the UL3 (Fig. 44), and a new .014 CuNiTi main archwire was engaged to level the entire arch. One month later, the upper arch wire was changed to .014x.025-in CuNiTi and a torque spring was inserted on the UL3 for lingual root movement (Fig. 45).

After 30 months of active treatment, all appliances were removed, and clear overlay retainers were delivered for both arches. The patient was instructed to wear it full time for the first 6 months and nights only thereafter (Fig. 46).

Fig. 46: Post-treatment panoramic radiograph and intraoral photographs

Unfortunately there was scar formation, an insufficient band of keratinized gingiva, and recession on the UL3 relative to the contralateral canine. In addition, a soft tissue dehiscence was apparent near the mesial papilla. A CTG was recommended but the family were quite satisfied the orthodontic outcome and the patient's smile. They declined additional surgery but agreed to routine follow-up to monitor the soft tissue problems. The 2-year follow-up records document a very good but not ideal outcome. The gingival margins on the upper canines were improved but were still asymmetric. Overall dental health was stable because the patent was maintaining good oral hygiene (Fig. 47). The patient and her family were very pleased with the longterm result.

Summary of Modified VISTA and Miniscrew (OBS) Anchorage

For the present patient, the VISTA technique was modified with two specific vertical incisions to manage a labially impacted canine that was horizontally oriented in a transverse position.

A 1.5x8-mm OBS (iNewton, Inc., Hsinchu, Taiwan) was inserted between the roots of UL1 and UL2. The power chain was stretched from the button on UL3 to the miniscrew (OBS) between the UL1 and UL2. To control soft tissue irritation, most of the power chain was passed through the subperiosteal tunnel. Wound edges were carefully approximated and sutured. The patient reported mild pain for the first few days post-op but

Fig. 47:
Two-year follow-up records include a panoramic radiograph and intraoral photographs. Overall periodontal heath is stable and oral hygiene is excellent. Periodontal compromises associated with the UL3 were acceptable for the family, and they declined further treatment.

Upper Impaction	E	APF	CE	VISTA
B/P position	P	B	B or T	B or T
Relationship to MGJ	-	Coronal	Apical	Apical
Quantity of KG	-	< 2mm	CTG or not	CTG or not
Transposition	-	No	No	Yes

Table 2:
The decision making table for distinguishing between four surgical techniques: excision (E), apically positioned flap (APF), closed eruption (CE), and vestibular incision subperiosteal tunnel access (VISTA). There are four diagnostic considerations in selecting the surgical method: buccal (B), palatal (P), relationship to the mucogingival junction (MGJ), quality of keratinized gingiva (KG), and transposition (T).

experienced no discomfort during protraction of the impacted UL3 (Fig. 41).

The modified VISTA technique is minimally invasive method for conservative management of a deeply impacted canine. The superior line of force for the power chain minimized the risk of root resorption as the transposition of the UL3 and UL4 was corrected (Figs. 40-46).

Connective tissue grafting for gingival dehiscence

Although the treatment goals were achieved, the final outcomes were not ideal: (1) the facial gingival level was elevated on the UL3 compared to the UR3; (2) a gingival fenestration was found on the distal aspect to the papilla between the UL2 and UL3; (3) scar formation was noted on the apical area of the UL3 gingival margin; and (4) there was only about 1 mm of attached gingiva on the UL3.[21-23]

Scar formation is common for most soft tissue surgery. The vertical incisions of the VISTA technique limit the extent and potential for scar formation. Since there is no sulcular incision, the VISTA technique is less likely to result in gingival recession.[1,18]

The elevated gingival margin and dehiscence may reflect an osseous fenestration on the UL3. A CBCT scan was indicated for a definitive diagnosis. Then the defect could be repaired with connective tissue graft supplemented with bone particles.[18] Despite concerns of the clinician with immediate periodontal outcome and two year follow-up, the family declined further evaluation and treatment. They were pleased that the severe, transposed impaction was corrected and were satisfied with the compromised periodontal outcome (Fig. 47).

Comparison of 4 Surgical Techniques

The first three surgical techniques discussed illustrate the necessity to fit the treatment to the specific problem (Table 2).[1] The open window, excision (E) method is optimal for most palatal impactions because they usually erupt spontaneously into the oral cavity. The closed eruption technique (CE) and apically positioned

flap (APF) are common procedures for labial impactions. The choice depends on the position of the impaction, complexity of the surgery, and the condition of the supporting soft tissue. One of the main problems for CE is the difficulty in releasing tension on the flap. APF shares the same problem when the wound is closed, so it is difficult to precisely control the flap margin. The CE and APF techniques are not indicated for transpositions because they are limited to applying vertical traction on the impaction which may result in severe root resorption on adjacent teeth. The VISTA approach[18] allows for horizontal movement (protraction or retraction) of the impaction high in the alveolar process to position it between the roots of the lateral incisor and first premolar before it is extruded into position. OBSs provide excellent osseous anchorage to support the specialized mechanics required to recover complex canine impactions that are anteriorly positioned and/or transposed with adjacent teeth (Table 2).

Conclusions

At Beethoven Orthodontics Center, palatal impactions continue to be managed by the time-honored open window method: excision (E). An impacted canine is uncovered and the desired path of movement is cleared of soft tissue and bone to allow for spontaneous eruption. Closed eruption (CE) is indicated for deeply impacted canines that are not transposed or horizontally displaced. An apically positioned flap (ARF) is rarely used anymore because of the uncomfortable secondary healing and tendency for scar formation. Opening the space and waiting for auto-eruption is a wiser choice if the the impacted tooth is correctly positioned in the arch. The VISTA technique with OBS anchorage is indicated for complex impactions that are high in the alveolar process, transposed and/or horizontally displaced. Subperiosteal correction of the impaction relative to the rest of the arch is best accomplished before the impaction erupts into the oral cavity.

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2022-2023 第十四年度

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：

2022　5/10、6/7、7/12、8/16、9/6、10/4、11/15、12/6

2023　1/10、2/7、3/7

- **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**

全新的第十四年度 2022-23 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。

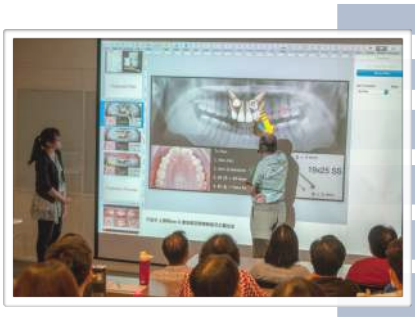
每月一次的課程之中，包含了：

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。

2022-23 貝多芬精修班內容豐富精彩，讓您經由每個月一次的課程，在面對各式的臨床案例時，更能游刃有餘、得心應手。

學習目的：

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



報名專線：03-5735676 #218 陳小姐

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Made in Taiwan

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1.5 | 1.5X8mm

Stainless Steel**

2.0 | 2.0x12mm

2.7 | 2.0x14mm (with holes)

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

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

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Damon Master Program


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全新改版的 2022 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，以及診間臨床見習，讓學員在短時間能快速上手，感染**「熱愛學，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 - 4/14 (A班) | 6/9 (B班)

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

Module 2 - 4/28 (A班) | 6/30 (B班)

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

Practice: Patient photo management

Module 3 - 5/12 (A班) | 7/14 (B班)

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

Practice: Ceph tracing

Module 4 - 6/2 (A班) | 7/28 (B班)

1. Excellent finishing
2. Retention & relapse

Practice: Ceph superimposition & measurement

Module 5 - 6/16 (A班) | 8/4 (B班)

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

Practice: Case report demo

▲ **Computer training (Mac): 1:30-2:30 pm**

Module 6 - 7/21 (A班) | 9/1 (B班)

1. Class III correction
2. Class II correction

Topic: Early orthodontic treatment (曾淑萍醫師)

Module 7 - 8/18 (A班) | 9/22 (B班)

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

Topic: Modfied VISTA (蘇筌瑋醫師)

Module 8 - 9/15 (A班) | 10/20 (B班)

1. ABO DI, CRE workshop
2. Open bite

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

Module 9 - 9/29 (A班) | 11/3 (B班)

1. Implant-ortho combined treatment
2. Asymmetry

Topic: Interdisciplinary approach (邱上珍醫師)

Module 10 - 10/13 (A班) | 12/1 (B班)

1. Minor surgeries in orthodontics
2. Digital orthodontics

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

Module 11 - 11/10 (A班) | 12/15 (B班)

1. Aligner & TADs
2. Keys to aligner learning

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。

報名專線 湧傑 Yong Chieh

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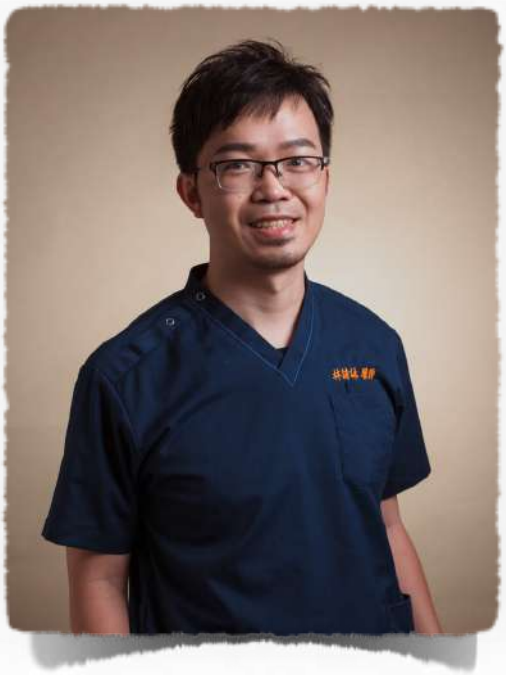
Aspiration of Participation

Beethoven Int'l Orthodontic Specialty Course

Pre-requisite course for the Master program in Specialized Orthodontics
in the International Medical College of the University of Duisburg-Essen, Germany



林詩詠 醫師・貝多芬矯正中心/河堤小鹿牙醫診所
Dr. Joshua Lin *Beethoven Orthodontic Center/Deer Dental Clinic*

「嘿！林詩詠，你真的很幸運耶！能在貝多芬受訓。」

畢業10年了，這句話聽了好多次了；回想10年前被我的好友林修篁醫師拉來上張慧男醫師的 DAMON 矯正基礎班，到現在，我已經在貝多芬受訓進入第8年了；我學到的除了扎實的臨床技術，也在許多國際期刊發表了一些文章；回想起來，我付出的和我學到的這個C/P值絕對可以用幸運來形容了，更不用說畢業至今10年了，成家立業後最昂貴的成本其實是"時間成本"啊！這也是我一直卻步沒有再回學校進修的原因，如今，機會來到門口了，德國的碩士課程竟然讓我有機會一邊執業、一邊陪女兒長大、一邊念碩士，什麼？還是歐盟認証的碩士！「嘿！林詩詠，你真的很幸運耶！」不多說了！我先去報名了！

"Hey Joshua! You are so lucky to be trained at Beethoven!"

10 years after finishing my classes with Beethoven, I could no longer keep count of how many times someone said this to me. 10 years ago, my friend Dr. Hsiou-Huang Lin brought me along to Dr. Chang's Damon Master Program, and now I am in my 8th year training at the Beethoven Orthodontic Center. Not only have I learned solid clinical skills, I've also published several research papers in international refereed journals. Looking back, what I have gained worths so much more than what I have given that the only description truly is *Lucky*! Not even to mention that after having my own family, time becomes even more previous, which is exactly what has held me back from returning to the academia for further studying.

Now, the best opportunity came knocking on my door. The Master's Program allows me to maintain my practice and participate in my daughter's childhood while studying towards the degree. What's more? It is a Master's Degree recognised by the EU!

"Hey Joshua! You are SO lucky!" Without further ado, I am off to signing up!

張倩瑜 醫師・君悅牙醫診所
Dr. Charlene Chang *Jun-Yue Dental Clinic*

大學畢業時對攻讀碩班毫無頭緒，工作幾年後因緣際會參與貝多芬矯正一系列課程，有幸跟著張慧男大師學習，一步一步開啟我專業知識與積極人生的大門，才體悟出學海無涯！現在有個難得的在職進修機會，完成貝多芬先修課程後取得資格攻讀德國矯正碩士學位，當然要好好把握，繼續深造，跟隨大師的腳步！

Back when I was still a college graduate, I had no idea whether or not to pursue a Master's Degree. After a few years of clinical practice, I had the opportunity to learn from Dr. Chris Chang in his Beethoven Orthodontic Courses. Step by step, I came closer and closer, and finally opened the door to professional knowledge and a proactive life attitude. That is when I realized that there truly is no end to learning! The Beethoven Int'l Orthodontic Specialty Course, followed by a Master's program in Specialized Orthodontics in Germany, provides such a great opportunity for practicing doctors like myself to pursue advanced training while maintaining my current practice. Of course I will seize the chance, follow the master's footsteps, and keep sharpening my skills and knowledge!

蘇珮雯 醫師・廈門愛心口腔
Dr. Sophia Shu *Xiamen Ai-Xin Dental Clinic*

我想要參加德國矯正碩士班的課程主要原因來自於我最崇拜的矯正老師張慧男醫師和高老師。他們不僅教我矯正的技術和知識，也是我人生當中最啓發我的老師。他們曾說過：「讀書是投資自己最好的方式。」所以我很希望能像張老師所說的：「We're students for life. Learn ambitiously!」我很感謝高老師的鼓勵讓我再次鼓起勇氣挑戰自己出去學習。很期待能有這個機會加入張老師的團隊一起去德國杜易斯堡-埃森大學進修矯正專科碩士學位。

I was motivated to join the Beethoven International Orthodontic Specialty Course by the respected Dr. Chris Chang and Dr. Shufen Kao. They have not only taught me the knowledge and technique of orthodontics, but also inspired me so much in life. They once said "Studying is the best investment you can ever make for youself." I hope to achieve what Dr. Chang told us "We're students for life. Learn ambitiously!" I am grateful for Dr. Kao's encouragement, which pushed me to pluck up the courage to step out and start learning again. I look forward to studying with Dr. Chang's team towards a Master Degree in Specialized Orthodontics in the University of Duisburg-Essen, Germany.

A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 3

BIOGRAPHICAL CHRONOLOGY, 1855–1930

Date	Event
June 1, 1855	Edward Hartley Angle born to Philip Casebeer Angle (1820–1907) and Isabel Erskine Angle (1824–1908) in District 1 "Ballibay," Herrick Township, Bradford County, Pennsylvania. The fifth of seven children. Demonstrates early talent for using tools and devising and constructing machinery, including a hay rake (at age 11); attends high school in Canton, Pennsylvania.
1874–1876	Apprentices with a local dentist in Herrick.
Fall 1876 – February 1878	Attends the Pennsylvania College of Dental Surgery in Philadelphia, receiving DDS degree on February 28, 1878; begins practicing dentistry in Towanda, the county seat of Bradford County, Pennsylvania. Here he develops an interest in orthodontia.
Spring 1881	Develops a chronic respiratory ailment, called pleural pneumonia, probably tuberculosis.
Autumn 1881	Moves to Minneapolis, Minnesota, for health reasons. Within months, his health recovers and he returns to Pennsylvania briefly to join his older brother Mahlon and friends in planning a sheep-raising venture in Montana.

Reprinted from News & Trends in Orthodontics 2009;16:21-23, originally reprinted with permission from Angle Orthod 2009;79:1034-1036. Copyright 2009). (J Digital Orthod 2022;65:88-93)

Corresponding author: Dr Sheldon Peck, Clinical Professor of Developmental Biology, The Harvard School of Dental Medicine. Boston, MA 02115 (e-mail: peckslam@att.net or speck@hms.harvard.edu)

Accepted: February 2009. Submitted: February 2009.

Sheldon Peck

Secretary, The Edward H. Angle Society of Orthodontists (EHASO) and The E.H. Angle Education and Research Foundation.

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

Private practice, Newton, Mass.

Late 1881	Moves to Montana with associates to enter the sheep-ranching business.
Early 1882	The severe winter of 1882 kills their sheep flock and dooms the venture financially.
1882–1883	Relocates to Minneapolis and resumes the private practice of dentistry; continues his interest in orthodontia.
1886	Accepts position as professor of histology and lecturer on comparative anatomy and orthodontia in the Dental Department of the Minnesota Hospital College in Minneapolis. Two years later, it becomes part of the University of Minnesota, and he is elevated to professor of orthodontia. Maintains his part-time private practice of dentistry.
March 1887	Marries Florence A. Canning (1865–?) of Minneapolis, sister of his machinist John E. Canning.
September 8, 1887	Presents his first major address describing aspects of the Angle System of Regulating Appliances before the 9th International Medical Congress in Washington, DC. Angle's originality is challenged in the heated discussion that ensues. Angle later considers a 14-page extract of this paper, published without discussion in an 1887 textbook by Loomis P. Haskell, as the "first edition" of the seven American editions of his famous book.
December 3, 1887	Daughter Florence Isabel Angle is born in Minneapolis. (She died in 1970 in Morganton, North Carolina.)
1888	Elected president of the Minneapolis City Dental Society.
March 5, 1889	Patents a jack-screw mechanism, the first of 46 patents held by Angle.
1890	'Second edition" of his book is published, as a 30-page appendix to the second edition of a dental laboratory handbook by Loomis P. Haskell.

1892	Resigns from the faculty at the University of Minnesota; limits his practice exclusively to orthodontia, thus becoming ostensibly the world's first specialist in orthodontia.
1892	Hires Anna Hopkins (1872–1957) of Minneapolis as his secretary and office assistant.
1892	Publishes third edition, a 51-page pamphlet entitled, *The Angle System of Regulation and Retention of the Teeth*.
1892–1898	Professor of orthodontia at the American College of Dental Surgery (later merging into Northwestern University School of Dentistry) in Chicago.
1894	Appointed Surgeon to the Great Northern Railroad for the treatment of fractures of the maxillae.
1895	Fourth American edition is published, a 112-page hardcover book now titled, *The Angle System of Regulation and Retention of the Teeth and Treatment of Fractures of the Maxillae*.
1895	Relocates to St Louis, Missouri (with his wife Florence, his daughter Florence Isabel, and his secretary-assistant Anna Hopkins); sets up a private practice there limited to orthodontia.
1896–1899	Professor of orthodontia in the Dental Department of Marion-Sims College of Medicine, St Louis.
1897–1898	Teaches in the Dental Department of Washington University, St Louis.
1897	Fifth American edition is published by SS White, Philadelphia; also, a German translation of his fourth (1895) American edition is published by SS White Co, Berlin.
1897	Is awarded MD degree from Marion-Sims College of Medicine.
1899	*Dental Cosmos* publishes Angle's "Classification of Malocclusion," his most important journal article to date.
1899	Claudius Ash publishes Gustave Darin's French translation of Angle's book under the title *Methode du Professeur Angle Pour la Re´gularisation et le Traitement des Dents et Pour le Traitement des Fractures des Maxillaires*.

June 6, 1899	Patents the E-Arch, his expansion archwire mechanism.
August 1899	Angle's paper on orthodontia prepared for presentation at the National Dental Association meeting at Niagara Falls is bypassed at the last minute by program officials. This personal slight fuels Angle's desire to found a postgraduate school of orthodontia and a professional society devoted to orthodontia.
November 1899	Teaches a postgraduate course on orthodontia in his office in the Olivia Building, St Louis. Attending are Thomas B. Mercer, Henry E. Lindas, Herbert A. Pullen, and Milton T. Watson.
December 8, 1899	Resigns his appointment at Marion-Sims College of Medicine.
1900	Founds the Angle School of Orthodontia; first 5-week course is held from May 1 through early June 1900 in the Odeon Building, St Louis.
July 1900	Separates from wife Florence Canning Angle.
October 1900	Publishes sixth edition, a 315-page work, *Treatment of Malocclusion of the Teeth and Fractures of the Maxillae. Angle's System*.
Early 1901	Founds the Society of Orthodontists (antecedent of the American Association of Orthodontists) and serves as its first president.
Early 1901	Founds the Society of Dental Science of St Louis.
July 1901	First meeting of the Society of Orthodontists (renamed in 1902, the American Society of Orthodontists) is held in St Louis, Missouri.
1902	With Angle's encouragement, Anna Hopkins graduates from the University of Iowa with a DDS degree.
December 1902	Offered the editorship in orthodontia of the *International Dental Journal*; Angle declines the offer.
August 29 – September 3, 1904	Chairman of Section VI (Orthodontia) of the Fourth International Dental Congress, St Louis.
1904	German translation of his fifth (1895) American edition is published by SS White Co, Berlin.

1905	Contributes chapter on orthodontia in Edward C. Kirk's *American Textbook of Operative Dentistry* (also in 1911 edition, revised).
Spring 1906	Resigns membership in American Society of Orthodontists; encourages establishment of The Alumni Society of the Angle School of Orthodontia (earliest forerunner of The Edward H. Angle Society of Orthodontists).
Winter 1906–1907	Retires from practice of orthodontia in St Louis; focuses on writing seventh American edition of *Treatment of Malocclusion of the Teeth, Angle's System* (628 pages).
1907	Father Philip Casebeer Angle dies, age 87.
May 1907	Incorporates the E.H. Angle Regulating Appliance Co, in St Louis, Missouri.
June 1907	Founds *The American Orthodontist*, the first journal in the world devoted exclusively to orthodontics (discontinued in 1912); it is the forerunner of *The Angle Orthodontist*.
1908	Mother Isabel Erskine Angle dies, age 84.
May 1908	Divorces Florence Canning Angle in Minneapolis, Minnesota.
June 27, 1908	Marries Anna Hopkins in St Louis, Missouri.
Summer 1908	Moves from St Louis with wife Anna H. Angle to Larchmont, New York.
September 15 – October 31, 1908	The Angle School of Orthodontia is in session in New York City for a 6-week course, in an office building at the corner of West 72nd Street and Broadway.
Fall 1908	Hermann Muesser publishes Josef Grünberg's German translation of Angle's sixth (1900) American edition under the title *Behandlung der Okklusionsanomalien der Zähne*.
April 1909	Purchases home at 58 Bellevue Place, New London, Connecticut.
July 1909	Wins patent infringement suit against appliance manufacturer Julius Aderer.
October – December 1909	The Angle School of Orthodontia moves to New London, Connecticut; course session lengthened to 9 weeks, given in the Munsey Building.
July – September 1911	Second (final) course session in New London at the Harbor School, after which Angle closes Angle School of Orthodontia due to his declining health.

1913	Revised and expanded German edition of Angle's book (1907 American edition) is published with new chapters by Josef Grünberg and Albin Oppenheim (778 pages).
February 22, 1915	Awarded Honorary ScD degree by the University of Pennsylvania.
Late 1916	Angle moves to southern California for health reasons; purchases home at 1025 North Madison Avenue, Pasadena.
1917	At request of James C. Angle (no relation), he reopens the Angle School of Orthodontia at his home in Pasadena.
1922	Edward H. Angle Society of Orthodontists is started in California by graduates of the Angle School of Orthodontia.
1922–1923	Grateful students fund construction of a building in Pasadena for the Angle School of Orthodontia at 550 Jackson Street, next to Angle's home; it is dedicated on January 8, 1923.
1924	The Angle College of Orthodontia and Infirmary is chartered by California. No tuition is charged for the College's 12-month program (which is followed with periodic faculty supervision during the first year of private practice). All patients are treated free of charge.
September 15, 1925	Patents the edgewise arch mechanism.
Late 1927	The Angle College of Orthodontia closes unofficially due to Angle's deteriorating health.
August 11, 1930	Edward H. Angle dies in Santa Monica, California, at age 75 from heart failure; burial at Mountain View Cemetery, Altadena, California.
November 17, 1930	*The Angle Orthodontist*, a scientific journal devoted exclusively to orthodontics, is founded in Chicago in Dr. Angle's memory by the newly reorganized Edward H. Angle Society of Orthodontia.

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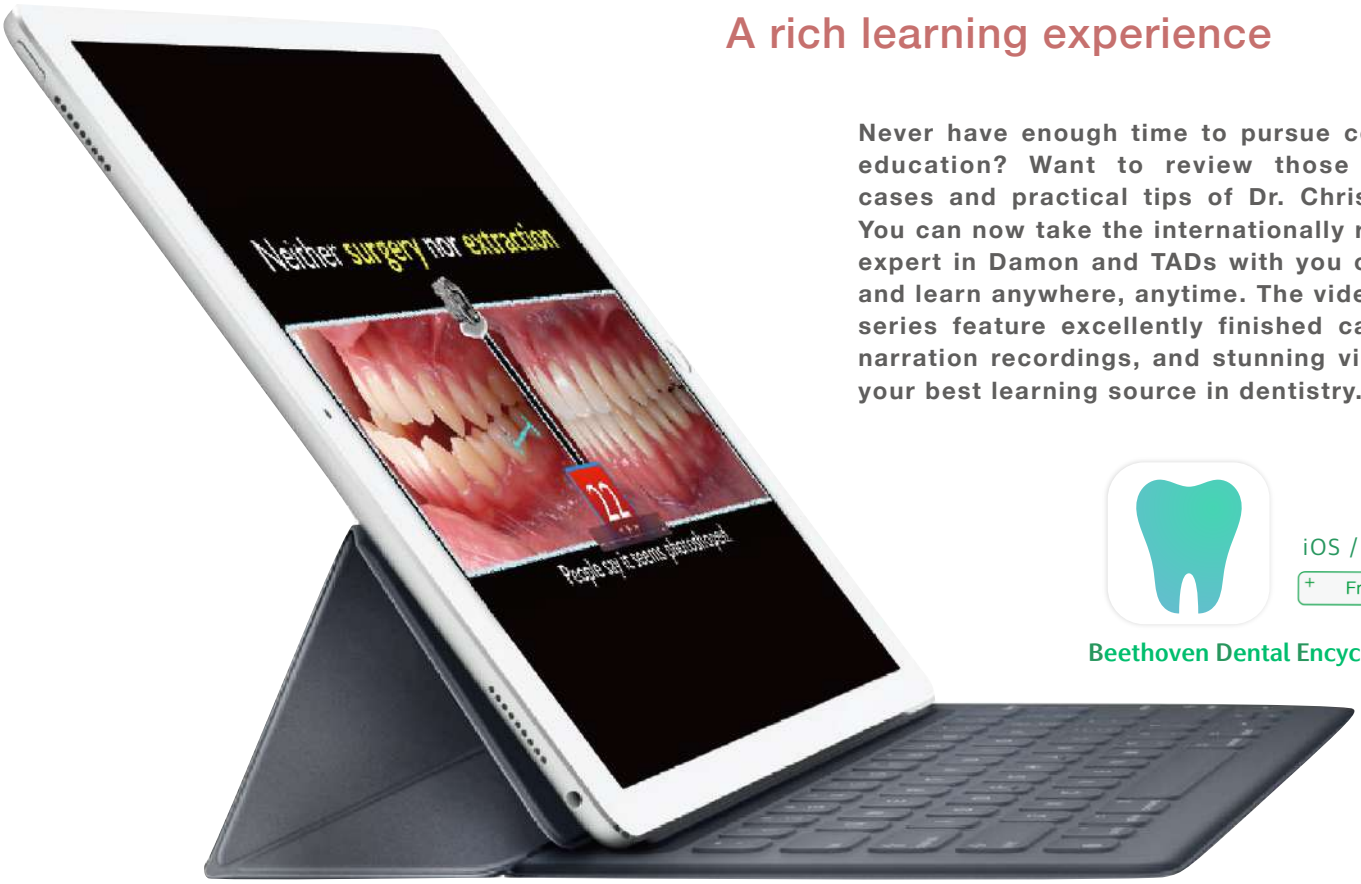

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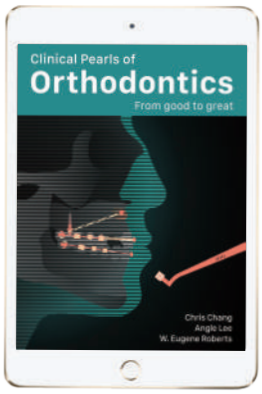

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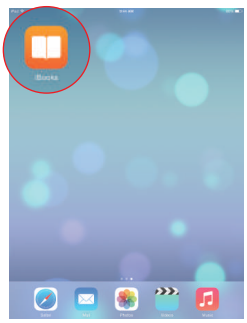

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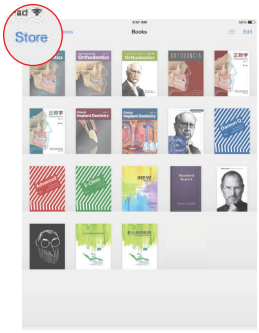
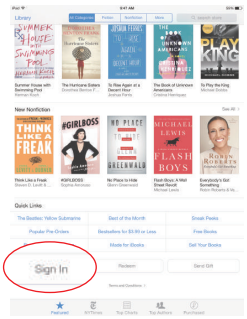
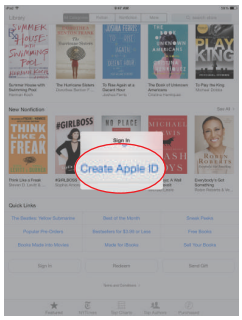


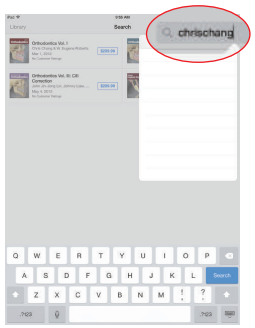
2. Click "Store."



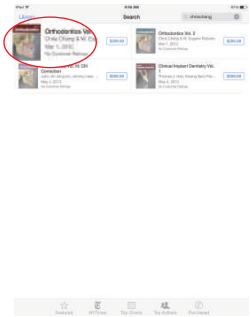
3. "Sign in" with your Apple ID.



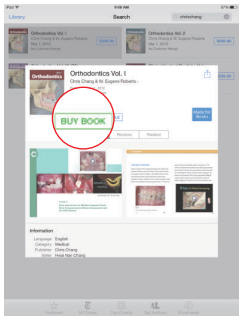
4. "Create Apple ID" if you don't have one.



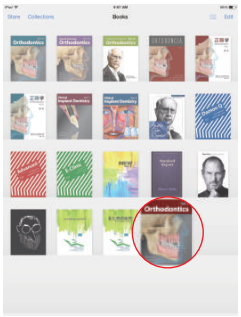
5. Search for "chrischang."



6. Click the book's icon.



7. Check the price and click "BUY BOOK."



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Taiwanese Lifestyle Through the Eyes of CC

Chapter 4. Outdoor Free-Flight Training

A bird in hand is a certainty. But a bird in the bush may sing.

— *Bret Harte*

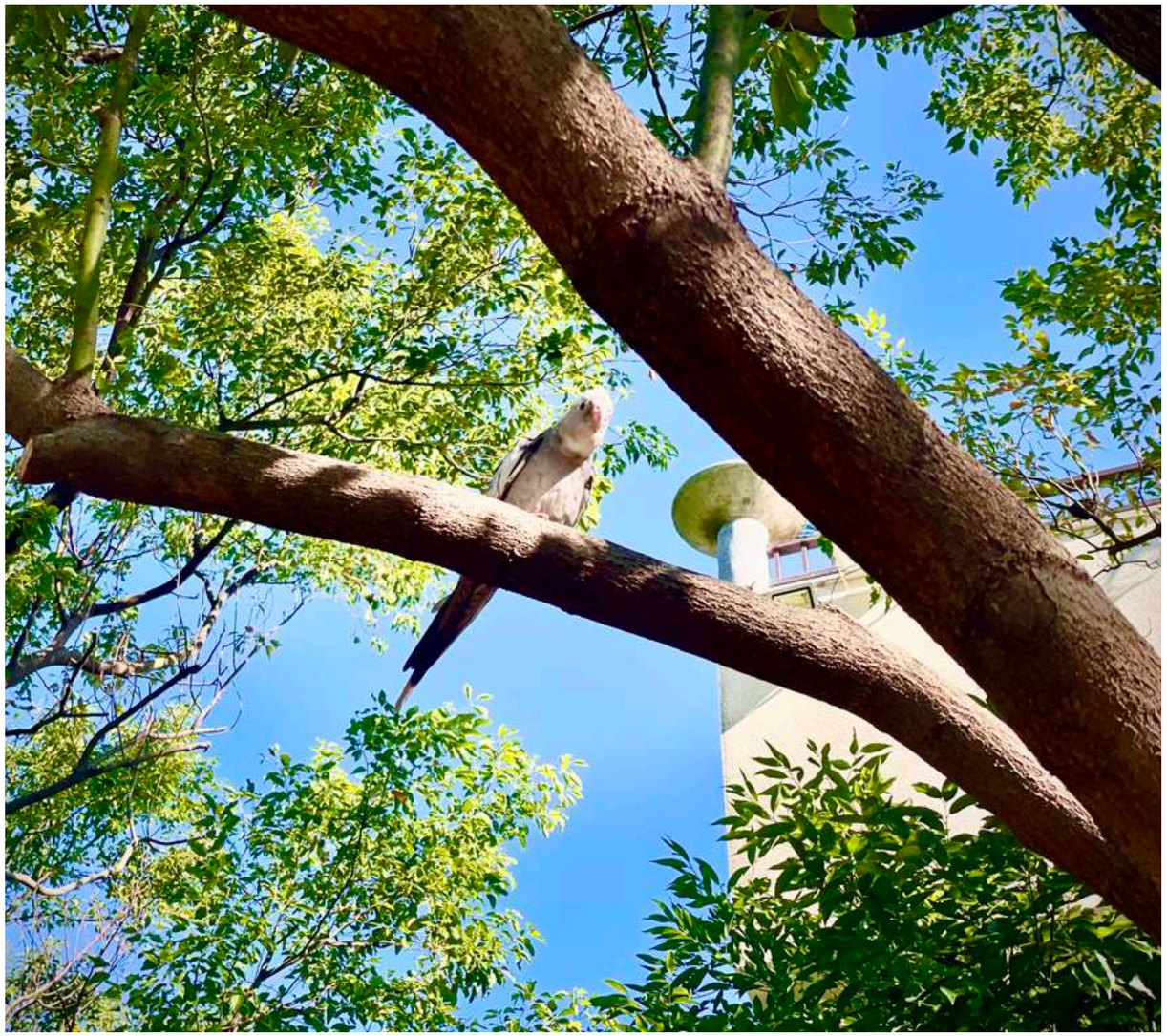


Fig. 1: Dr. Chang with Juno the cockatiel on his hand and Bagel the monk parakeet on his shoulder, enjoying a snack break by the lake in their neighborhood reserve. Visit: https://www.youtube.com/watch?v=LeogP8pU8Tw to learn all about their outdoor training process.

When shown the videos of the Changs' cockatiel Juno and monk parakeet (also known as a Quaker parrot) Bagel in the neighborhood reserve, sometimes flying freely and sometimes leisurely perching on Dr. Chang's shoulders for a stroll, the bird shop owner from where these feathered children were purchased was simply lost for words. During the 40 odd years that he has been running his business, never had he imagined that these birds would be able to develop such a bond with their keeper, especially when taken outdoors.

Free flight outdoors for pet birds is as much of a training course for humans as it is for birds; the safety of the birds must be ensured and potential heartbreak for the owners can be prevented. A crucial ability required of the keepers is to *let go*. However, this does not imply just unleashing the birds from their aviary regardless of the consequences.

The three keys to outdoor free-flight training are *trust*, *safety*, and *technique*. As in any relationship, *trust* is cultivated through love, and a straightforward manifestation of love is quality time spent together. It is important that trust has been established before taking the birds outdoors so that the second key, *safety*, can be maintained at its most fundamental level. As for the trainer and his training skills, they are obviously as essential as the doctor and mechanics are in orthodontics. Without a doctor's careful evaluation and professional execution (*safety*), the *trust* between the doctor and the patient, as well as their mutual dedication (*love*) the mechanics and techniques cannot flourish - restricting the magic to reach its full potential.

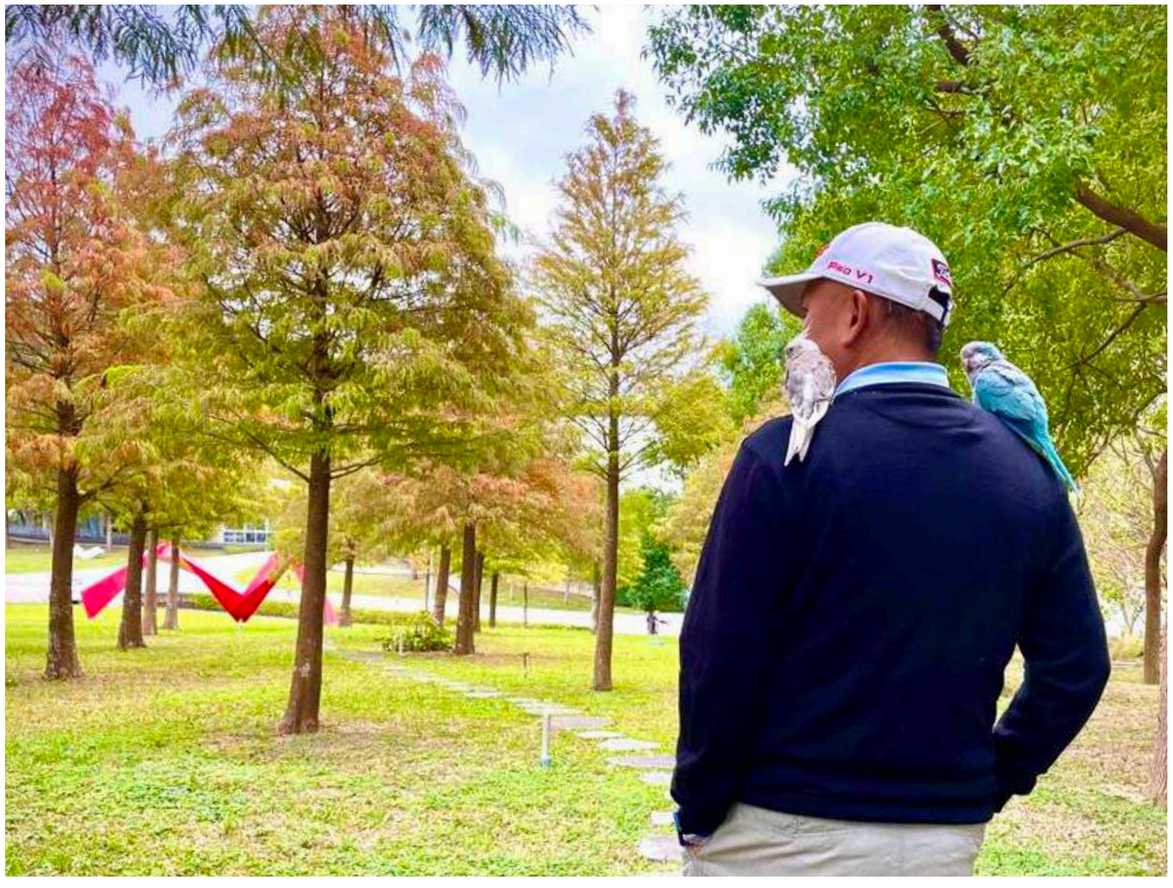
Figs. 2-3: A flip of the hand while your bird is resting on it provides a gestural cue to naturally elicit flight. Keep in mind NOT to force a bird to fly when it does not want to!

The technical part of bird training is best started indoors. Two foundations should be laid down at the beginning of the training: trigger and positive reinforcement. To generate a target action, hand gestures serve as a cue to naturally elicit the birds' reflective behavior - a flip of the palm to send birds flying from the trainer's hand (Figs. 2-3) or raising a hand for birds in flight to perch on (Fig. 4). Props like a whistle can be used to send reoccurring signals - birds associate the signals to the actions - and this is when a trigger is established. After correctly performing a target action following a trigger, positive rewards such as snacks should be immediately presented to reinforce the trigger - this is called positive reinforcement. With repeated practice, reliable recall can be achieved, meaning birds can consistently and correctly respond to the trainer's triggers.

Once reliable recall has been successfully established, the birds are almost ready to be taken outdoors. The last step is to survey the environment the birds will fly around in. It is important to minimize risk factors such as predators and natural obstacles (dense forests, strong winds etc.). Embarking upon their first few flights, pet birds could unexpectedly fly high and far, due to excitement or nervousness, the latter being relatively more hazardous. Therefore, before allowing them to fly freely, it is advisable to choose a tree for them to play and snack in whilst familiarizing themselves with their new infinite surroundings. Upon future farther and higher exploration, this tree and the area around it can provide anchorage, so whenever these feathered children feel lost in a strange part of the woods, they can return to this sanctuary. Reciprocally, with the reassurance that they are safely anchored, hopefully these children can venture into higher branches, knowing that they are guarded, and that they are capable. You, as the trainer, might take on just the same role as the anchoring tree, not only for your birds, but also for those you train.

Fig. 4: Holding out a hand towards a bird in flight is an invitation to perch. Illustration by the talented artist, Jenny Chang.

Fig. 5: Positive rewards such as snacks should be presented immediately after a correct response to the trigger, thereby reinforcing it.



Figs. 6-8: Compared to Juno, Bagel the blue monk parakeet, is more of a home-dweller. However, he still enjoys an occasional stroll in the neighborhood reserve on Dr. Chang's shoulder.

"A bird in hand is a certainty. But a bird in the bush may sing." For the Chang family with their new-found bird-training skills, their reply to Mr. Harte's quote might well be: why not a bird that will perch happily in your hand, but also fly into a tree to sing? Either literally or metaphorically speaking, an outdoor free-flight training course is a crucial step in cultivating independence in your target, not to mention establishing a strong bond between you and the target - regardless of your status - parent, pet owner, or even trainer in a profession. There are times when we all hope to clench everything in our hands. However, lacking air and space might ultimately suffocate the beautiful nature that initially drew us to each other. A caged bird can still sing, but its songs are definitely less intriguing than those of a free one.

Desk editor of JDO & a wildlife enthusiast*

Annie Chen

*Title bestowed by Dr. Chris Chang

*Special thanks to the talented Jenny Chang for the exquisite illustration of Juno in flight.

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Figs. 10-13: Among the birds the Chang family keeps, Juno the cockatiel knows all about free flying fun. Proud facial expressions and body language highlight his self-confidence, as well as his familiarity with the Changs. Visit www.youtube.com/watch?v=9_37LdxlGko to watch Juno happily in flight!

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New Release!

Dr. Chang's monk parakeet (also known as quaker parrot), Bagel, joined the last Damon Master class in Dec, 2021. Read the Taiwanese Lifestyle section in this issue to learn all about the Chang family's new-found fun in free-flight training with their feathered chidlren.