IZC Bone Screw Anchorage for Conservative Treatment of Bimaxillary Crowding in an Asymmetric Class II/I Subdivision 1 Malocclusion

Drs. Ming-Jen Chang, John Jin-Jong Lin & W. Eugene Roberts

Conservative Management of Skeletal Class II Malocclusion with Gummy Smile, Deep Bite, and a Palatally Impacted Maxillary Canine

Drs. Ariel Wong, Chris Chang & W. Eugene Roberts

Bimaxillary Protrusion Treated with Insignia® System Customized Brackets and Archwires

Drs. Charlene Chang, Angle Lee, Chris Chang & W. Eugene Roberts

IJOI

Vol. 48 Oct 1, 2017

Journal of Digital Orthodontics

A Journal for Interdisciplinary Dental Treatment

The Australian Begg Society of Orthodontists 51st annual meeting, Whitsunday Bay, Hamilton Island, Australia, July 18, 2017. Courtesy of Jennifer Chang.

Journal of Digital Orthodontics is a journal for interdisciplinary dental treatment. Download it at http://iaoi.pro.

《僅供牙科專業人士參閱》

2017-19
熱愛學矯正

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

張慧男 博士

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

Damon Master

(Thu) 9:00-5:00 中文授課

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

Year 1 2018

Module 1 - **5/17**/18' Module 4 - **8/2**
Module 2 - **6/21** Module 5 - **9/13**
Module 3 - **7/5** Module 6 - **6/27.29.30**（擇一）

Year 2 2018-19

Module 1 - **10/18** Module 4 - **1/3**/19'
Module 2 - **11/22** Module 5 - **2/14**
Module 3 - **12/20**

Damon + .014 Cu NiTi

Excellent Finishing

(Tue) 9:00-12:00 中文授課

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

Finishing IX

Module 1 - **8/15**/17' Module 6 - **1/9**/18'
Module 2 - **9/26** Module 7 - **3/6**
Module 3 - **10/17** Module 8 - **4/10**
Module 4 - **11/14** Module 9 - **5/15**
Module 5 - **12/19** Module 10 - **6/26**
Module 11 - **7/17**

Damon Clear

Damon, OBS & VISTA International Workshop

English Class

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

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

2018

Class 1 - **5/22-25** Class 2 - **12/04-07**
Additional session - **3/16-19**

2019

Class 1 - **5/21-24** Class 2 - **12/03-06**

Damon + Bite Turbo + Early Light Short Elastic

每次上課請依最新一期 IJOI 公告為主

報名專線
湧傑 Yong Chieh

北區 楊文君 02-27788315 #122
中區 張馨云 04-23058915
南區 蔡淑玲 07-2260030

上課地點：新竹市建中一路25號2樓（金牛頓藝術科技）
2F, No. 25, Jianzhong 1st Rd., Hsinchu City, Taiwan (Newton's A)

Real artists ship on time.

During the summer holidays I had 4 clerks to help (*or hinder*) me in my practice. One of them was the daughter of a classmate of mine from Indiana University, Ariel Wong. She is currently a 3rd year student at IU, wanting to specialise in Orthodontics, and has had some clerk experience at three different practices in Indiana and had been recommended by them to gain more experience at Beethoven.

After the first week I asked her if she wanted to go deeper into studying teeth straightening and suggested that writing a case report would be beneficial. I gave her two cases to choose from, an easy case or a difficult one – she chose the difficult one which contained 5 issues and learning these would help her understand about 80% of Orthodontics. She also had to learn how to use Keynote and Page, ceph tracing, the treatment steps, DI and CRE and the required writing format and all of that in only 3 weeks. Normally this would take a minimum of 3 months, so it was truly a gigantic task. Every evening, between ordering and eating our dinner, she would ask many questions, as well as throughout the day in the practice.

At the end of the month, I had not received a draft and thought that she had bitten off more than she could chew, but, before she left Taiwan, she presented me with her draft. I read through it and immediately sent it to our Editor-in-chief, Dr. Eugene Roberts, who answered that it was the first ever case report that was perfect based on the first revision. High praise indeed! Her case report can be enjoyed in this IJOI edition on page 52.

How can a dental student achieve that? Steve Jobs has supplied us with the answer, *"You did the impossible, because you didn't realise it was impossible."* To add insult to injury, she also joked about being a dumb American, something which this dumb Taiwanese country boy just cannot understand, especially as her mother is from Taiwan and her father from Hong Kong!

And the other clerks? Well, two of them were my daughters and I'm still waiting for their case reports. Their excuse is they had to assist me lecturing in Thailand and at the Begg 51st annual meeting in Australia. Joking aside, this was also time well invested, sharing my profession and being able to enjoy family time in two beautiful countries. Jenny, my youngest daughter, obviously prefers photography to case report writing, as you can see from the cover of this journal; Whitsunday Bay in all its splendour, her first contribution to our journal.

Just before this IJOI edition went to press, Jenny has made me eat my words and her first written IJOI contribution can be read on page 104. Congratulations Jenny!

It has truly been a great summer and I'd like to encourage all students, dumb, smart, and regardless of nationality to make the most of their learning opportunities and join us marching on the path to glory.

Chris Chang DDS, PhD, Publisher of IJOI.

IZC Bone Screw Anchorage for Conservative Treatment of Bimaxillary Crowding in an Asymmetric Class II/I Subdivision 1 Malocclusion

Abstract

***Introduction**: A 23-year-old male presented for orthodontic consultation to evaluate chief complaints of severe crowding and protrusive lips.*

***Diagnosis**: Clinical and radiographic examination revealed a convex facial profile (G-Sn-Pg' 19°), protrusive lips, hypermentalis activity, coincident midlines, mandible deviation to the right, asymmetric Class II/I subdivision-right malocclusion, narrow arches, 7-8mm of crowding in each arch, and a relatively high mandibular plane angle (SN-MP 37°). The Discrepancy Index was 20 points.*

***Treatment**: All permanent teeth were erupted except for horizontally impacted lower third molars. Following extraction of all four third molars, a passive fixed self-ligating appliance was installed. Infrazygomatic crest (IZC) bone screws were inserted buccal to the upper molars to provide posterior skeletal anchorage to retract both arches. Expansion of the constricted maxillary arch was initiated with light buccal force, that was delivered with a circular-formed 0.016-in copper nickel titanium (CuNiTi) archwire. The bite was opened with an anterior bite turbo, and all four buccal segments were differentially retracted, to correct intermaxillary crowding and asymmetric Class II interdigitation, with IZC anchorage and Class III elastics. Third order correction and finishing were accomplished with rectangular archwires and a root torquing auxiliary. Active treatment time was 26 months.*

***Outcomes**: Excellent dental and periodontal results were achieved: Cast-Radiograph Evaluation of 21 and a Pink & White Esthetic Score of 5. Lip protrusion and incompetent lips were corrected to the patient's satisfaction, but there was a 2mm retraction and 2° clockwise rotation of the mandible, that increased both the lower facial height (LFH) and facial convexity (FC).*

***Conclusions**: Retrospective analysis indicated that the mandibular retrusion and clockwise rotation were related to extrusion of the lower molars, and an undiagnosed sagittal slide in occlusion (C_R to C_O discrepancy), as evidenced by wear facets on the initial casts. (Int J Orthod Implantol 2017;48:4-22)*

Key words:
Asymmetric Class II/I, Subdivision 1 malocclusion, passive self-ligating appliance, extra-alveolar (E-A) bone screw anchorage, infrazygomatic (IZC) miniscrew anchorage, anterior bite turbo, sagittal slide in occlusion, centric relation and centric occlusion discrepancy, wear facets

History and Etiology

A 23-year-old male presented for orthodontic evaluation with two chief complaints: severe crowding and protrusive lips. Clinical and radiographic evaluations showed a modest intermaxillary discrepancy (*ANB 4°*) that was due to a slightly protrusive maxilla (*SNA 83°*) and slightly retrusive mandible (*SNA 79°*). The convex facial profile (*G-Sn-Pg' 19°*) was associated with increased lower facial height (*60%*), excessive lip protrusion (*2mm/3.5mm to the E-Line*), and hypermentalis strain when the lips were closed (*Fig. 1*). This morphologic pattern is commonly referred to as an increase in lower facial height (*LFH*) and/or an excessive

Dr. Ming-Jen Chang,
Lecturer, Beethoven Orthodontic Course (Left)
Dr. John Jin-Jong Lin,
Examiner of IJOI. Director of Jing-Jong Lin Orthodontic Clinic (Center)
Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)



vertical dimension of occlusion (*VDO*). An intraoral examination and study casts revealed canine and molar relationships that were Class II on the right side and Class I on the left (*Class II/I subdivision-right malocclusion*). Excessive overjet (*6mm*) was associated with a deep overbite (*4mm*), and there was 7-8mm of crowding in each arch (*Fig. 2*). The dental and facial midlines were coincident, but the chin was deviated to the right (*Fig. 1*).

Fig. 1: Pre-treatment facial and intraoral photographs

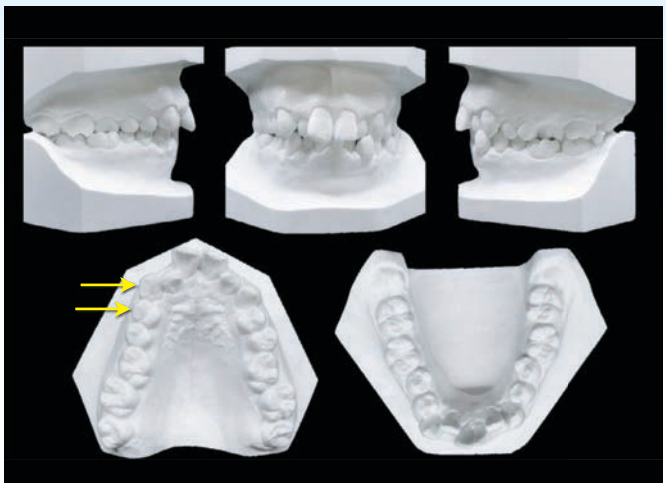


Fig. 2:
Pre-treatment dental models (casts) are marked with yellow arrows to show wear facets.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	83°	83°	0°
SNB° (80°)	79°	77°	2°
ANB° (2°)	4°	6°	2°
SN-MP° (32°)	34°	36°	2°
FMA° (25°)	27°	29°	2°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	6 mm	3 mm	3 mm
U1 To SN° (104°)	106°	99°	7°
L1 To NB mm (4 mm)	10.5 mm	10.5 mm	0 mm
L1 To MP° (90°)	93°	97°	4°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	2 mm	1 mm	1 mm
E-LINE LL (0 mm)	3.5 mm	3.5 mm	0 mm
%FH: Na-ANS-Gn (53%)	60%	62%	2%
Convexity: G-Sn-Pg' (13°)	19°	21°	2°

Table 1: Cephalometric summary

The pre-treatment cephalometric radiograph confirmed a retrusive facial pattern (*G-Sn-Pg' 19°, SNA 83°, SNB 79°, ANB 4°*), with a high mandibular plane angle (*SN-MP 34°*) (*Fig. 3 & Table 1*). The panoramic radiograph (*Fig. 4*) showed bilateral horizontal impaction of the mandibular 3rd molars (*LR8 and LL8*). Three dimensional (*3D*) imaging with cone-beam computed tomography (*CBCT*) revealed the proximity of the lower third molars to the inferior mandibular canal (*Fig. 5*). Skeletal, dental and facial analyses are detailed in the diagnosis section.

The treatment of this asymmetric Class II/I Subdivision malocclusion with an increased VDO was a challenge that was best managed with extra-alveolar (*E-A*) bone screw (*BS*) anchorage.[1-3]

Fig. 3: Pre-treatment lateral cephalometric radiograph

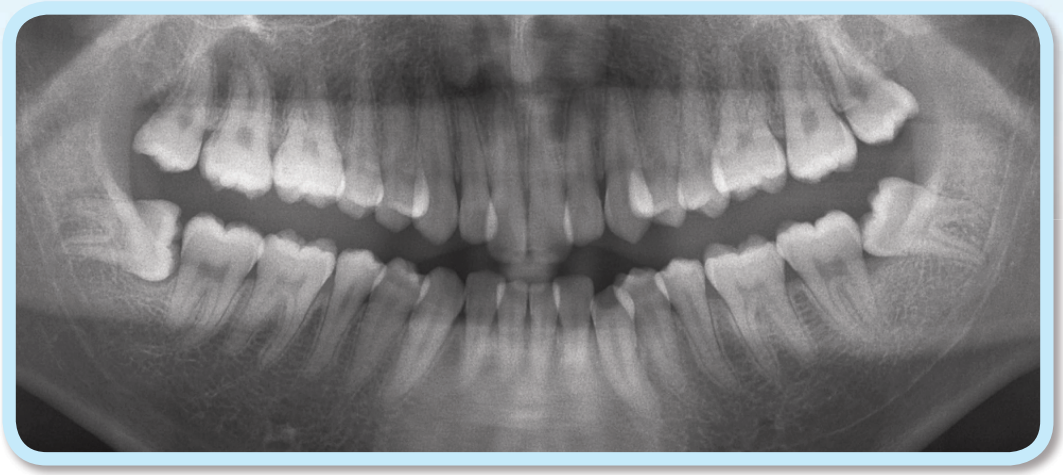


Fig. 4: Pre-treatment panoramic radiograph

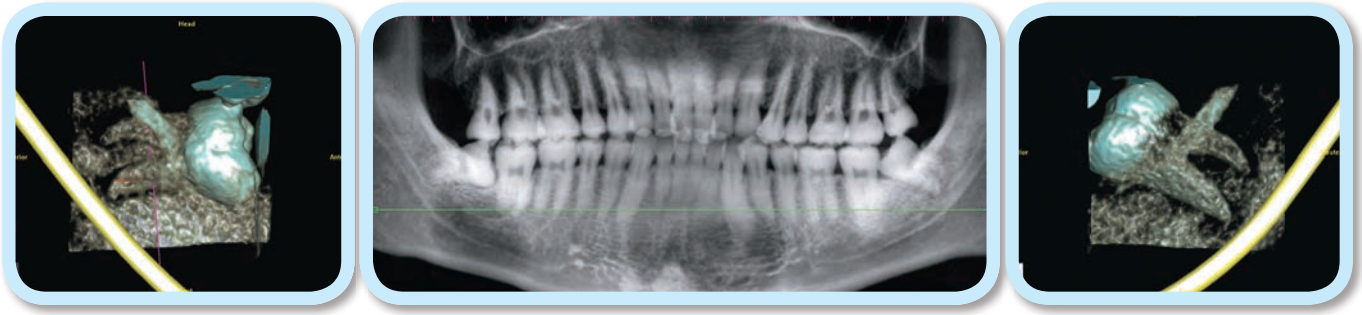


Fig. 5:
CBCT 3D imaging was used to evaluate the relationship between the lower third molar roots and the inferior alveolar canal bilaterally.

The infrazygomatic crest (*IZC*) was an ideal site for temporary anchorage devices (*TADs*) to retract both arches.[1,2]

Diagnosis

Skeletal:

- Lower face is retrusive: *SNA 83°, SNB 79°, and ANB 4°*
- Mandibular plane angle is increased: *SN-MP 34°, FMA 27°*
- Facial asymmetry: *In contrast to coincident facial and dental midlines, the chin point is deviated to the right.*

Dental:

- Buccal (*canine and molar*) relationships: *Class II on the left and Class I on the right.*
- Overjet: *6mm*
- Overbite: *4mm (40%)*
- Crowding: *7mm in the upper arch and 8mm in the lower arch*
- Third molars: *LL8 and LR8 were horizontally impacted*

- Midlines: *Dental and facial midlines were coincident*
- Arch-forms: *Constricted in both arches*

Facial:

- Profile: *Increased convexity (G-Sn-Pg' 19°)*
- Nasolabial Angle: *Increased*
- Anterior-Posterior: *Retrognathic mandible, maxilla was within normal limits (WNL)*
- Protrusive Lips: *2mm/3mm to the E-Line*
- Hypermentalis Strain: *With lips closed*

The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 20 points as shown in the subsequent worksheet 1.[4]

Treatment Objectives

1. Level and align both arches
2. Correct overjet and overbite
3. Retract the lips and control the VDO to relieve mentalis strain
4. Skeletal Relationships: *Maintain the maxilla and mandible in all three planes*
5. Maxillary and mandibular dentition:
   a. Nonextraction alignment of both arches
   b. Optimize the intermaxillary occlusion
   c. Relieve bimaxillary crowding
   d. Obtain an ideal overjet and overbite
   e. Obtain Class I canine and molar relationships
6. Facial esthetics: *Retract the protrusive lips and establish lip competence*

Treatment Alternatives

It is well established that symmetric or asymmetric extraction of premolars is the traditional approach for correction of a severely crowded dentition in an adult. However, the present patient preferred a conservative (*non-extraction*) approach, but understood that arch expansion and TAD anchorage were necessary. Since buccal segment retraction was required in each quadrant, extraction of all four third molars was indicated.

Comprehensive treatment was planned as specified below. Install a full fixed, self-ligating orthodontic appliance to align the dentition, level the arches, and reduce the overjet. Place 2x8mm stainless steel (*SS*) IZC bone screws bilaterally to provide posterior maxillary anchorage for intermaxillary retraction. Use an anterior bite turbo to open the bite for retraction of the maxillary dentition with IZC bone screw anchorage to correct crowding, lip protrusion and interdigitation discrepancies. Class III elastics are indicated for retraction of the lower dentition to correct crowding and the axial inclination of the incisors. Following alignment, detail the occlusion with finishing bends and intermaxillary elastics. Remove fixed appliances and deliver clear overlay retainers for both arches.

Treatment Progress

Following CBCT confirmation that the lower 3rd

Fig. 6:
Upper arch retraction was initiated by applying a chain of elastics from each maxillary TAD to the corresponding upper first premolar. Class III elastics were used, from the lower canines to upper 1st molars bilaterally, to resolve the anterior crowding.

molars were not impinging on the inferior alveolar nerve (*Fig. 5*), all four 3rd molars were extracted prior to commencing orthodontic treatment. A full fixed 0.022-in slot Damon Q® bracket system (*Ormco, Glendora, CA*) was used with archwires and auxiliaries supplied by the same manufacturer. All brackets were standard torque except for the lower anteriors, where low torque brackets were used. Initial archwires were 0.013-in CuNiTi in both arches. A 2x8mm SS IZC miniscrew was installed buccal to the upper first and second molars, bilaterally (*Figs. 6 and 7*). Upper arch retraction was initiated at the start of treatment by applying a chain of elastics from each maxillary TAD to the corresponding upper first premolar (*U4*). Class III elastics (*Quail 3/16-in 2-oz*) applied compressive force from the lower canines to upper 1st molars bilaterally, to resolve the lower anterior crowding (*Fig. 6*). Two months later, the Class III elastics were changed to Fox (*1/4-in 3.5-oz*).

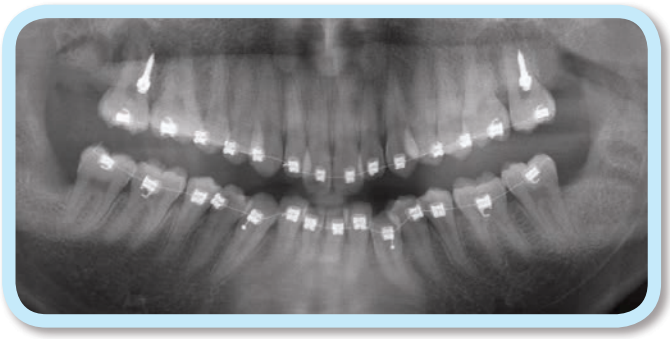


Fig. 7:
2x8mm SS bone screws were installed the IZC bilaterally.

At four months (*4M*) into treatment, alignment of the upper arch was improving, but the maxilla was still quite narrow (*Fig. 8*). The mandibular arch was well aligned (*Fig. 9*) as the lower buccal segments were retracted. A 0.016-in CuNiTi archwire was circled on a small mandrel to distort the arch-form in the form of a circle (*Fig. 8*), and then it was engaged in the maxillary brackets to expand the narrow maxillary arch. Two buttons were bonded on the palatal side of the upper right 2nd premolar (*UR5*) and 1st molar (*UR6*) to attach a criss-cross elastic (*Fox 1/4-in 3.5-oz*) to the lower right 2nd premolar (*LR5*) and 1st molar (*LR6*) (*Fig. 8*). On the left buccal segments, Fox Class III elastics were continued. One month later (*5M*), the Class III elastics were increased to Kangaroo (*3/16-in 4.5-oz*).

Fig. 8: In the 4th month, a circular form 0.016-in CuNiTi archwire was placed to expand the narrow maxillary arch.

Fig. 9:
Four months (4M) into treatment, the crowded lower anteriors were aligned, and Class III elastics were discontinued as documented in the Archwire Sequence Chart (Table 3).

In the 6th month of the treatment (*6M*), the upper archwire was changed to a 0.018x0.025-in CuNiTi. Class III elastics were used on the left side only and changed to Fox. The upper arch retraction mechanics were still engaged from the maxillary TADs to the upper first premolars using power chains (*Fig. 10*).

In the 8th month, the archwires were changed to a 0.016x0.022-in SS in the upper and 0.017x0.025-in titanium-molybdenum alloy (*TMA*) in the lower. Bracket repositioning was performed repeatedly as needed to correct axial inclinations in the buccal segments. Power chains were attached from the upper right central incisor to the first molar bilaterally to close space as the buccal segments were retracted.

In the 15th month of treatment (*15M*), both archwires were replaced with 0.014x0.025-in NiTi archwires. An anterior bite-turbo (*BT*) composed of glass Ionomer cement[5] was bonded on the lingual surfaces of the upper central incisors. The BT(*s*) opened the bite, thereby providing an intrusive force on the upper and lower incisors. They also created a posterior open bite to facilitate full arch retraction. As the arches were leveled and aligned, space was created distal to the upper left lateral incisor (*UL2*) by retracting the left buccal segment (*Fig. 11*).

Fig. 10:
Six months (6M) into treatment, crowding in the maxillary arch was corrected by arch expansion and retraction of the buccal segments with IZC anchorage.

Fig. 11:
In the 15th month of treatment (15M), both arches were fitted with 0.014x0.025-in NiTi archwires. An occlusal bite-turbo (BT) composed of glass ionomer cement was bonded on the lingual surfaces of the upper central incisors to correct anterior deepbite and facilitate maxillary arch retraction.

In the 20th month (*20M*), the IZC bone screw on the left side became loose and was removed because it was no longer needed (*Fig. 12*). Three months later (*23M*), the upper archwire was changed to 0.016x0.025-in SS for expansion of the posterior segments. Upper arch retraction mechanics were continued on the right side with a power chain from the TAD to the upper right first premolar (*Fig. 13*).

Cross elastics were applied from the buttons bonded on the lingual surfaces of the LR4, LR6 and LR7 to the buccal surfaces of the UR4, UR6 and UR7 (*Fig. 14*).

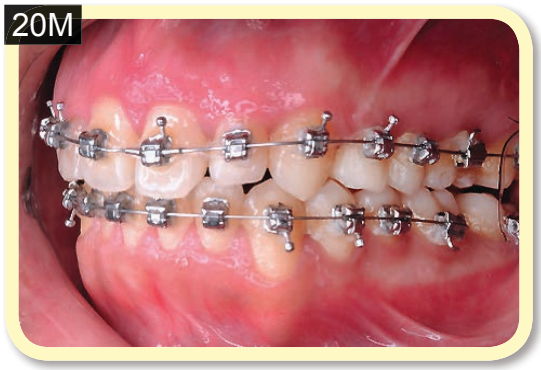
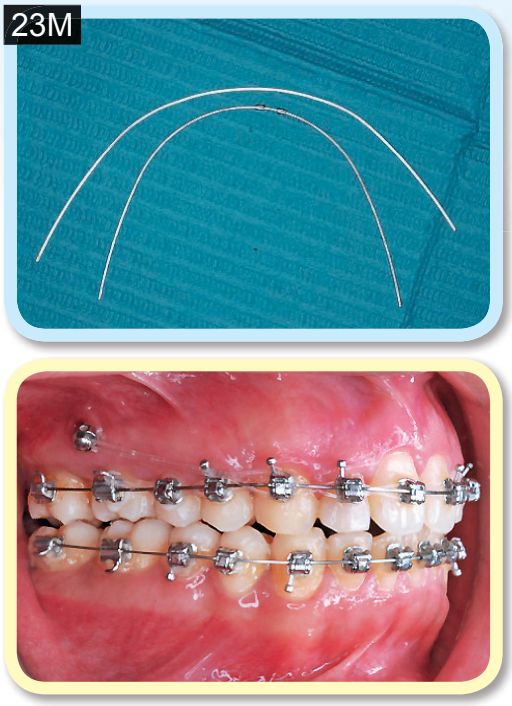


Fig. 12:
In the 20th month (20M), the left IZC miniscrew had been removed.



The unilateral cross elastics on the right side helped correct maxillary arch asymmetry as the buccal segment was retracted. One month later *(25M)* a torquing spring was placed on the upper right lateral incisor to move the UR2 root labially, as the maxillary arch was finished (*Fig. 15*). After 26 months of treatment, all fixed appliances were removed.

■ *Fig. 13:*
In the 23rd month, the upper archwire was changed to 0.016x0.025-in SS to expand of the posterior segments (above). Upper arch retraction of the right maxillary buccal segment was continued.

■ *Fig. 15:*
A torquing spring auxiliary was placed on the upper right lateral incisor to move its root labially.

■ *Fig. 14:*
At twenty-four months (24M) into treatment, frontal and lateral intraoral photographs document progress (upper). Cross elastics were applied from the buttons bonded on the lingual side of the lower teeth (lower right) to the buccal surface of their antagonists (bottom left).

Results achieved

Maxilla (*all three planes*):

- A - P: *Maintained*
- Vertical: *Maintained*
- Transverse: *Expanded with correction of asymmetry*

Mandible (*all three planes*):

- A - P: *Retracted (posterior rotation)*
- Vertical: *Increased (posterior rotation)*
- Transverse: *Maintained*

Maxillary Dentition

- A - P: *Retracted*
- Vertical: *Incisors intruded*
- Inter-molar / Inter-canine Width: *Increased with correction of asymmetry*

Mandibular Dentition

- A - P: *Maintained*
- Vertical: *Increased (molar extrusion)*
- Inter-molar / Inter-canine Width: *Maintained / Increased*

Facial Esthetics:

- Posterior Rotation of the Mandible: *Increased FC (21°) and excessive LFH (62%)*
- Lips: *Retracted to improve facial balance*
- Mentalis Strain: *Relieved by retracting the lips*
- Lip protrusion: *Improved*
- Facial Profile: *More convex (Figs. 16-20)*

Retention

Hawley retainers were delivered for both arches to be worn full time for the first 6 months and nights only thereafter. Plaque control and retainer maintenance instructions were provided.

Final evaluation of treatment

There was a 2% increase in both LFH and FC that was associated with extrusion of the lower molars (*Fig. 20*). The relatively longer, more retrusive facial pattern appeared to be a sequelae of the anterior BT(*s*) used to correct the deepbite and facilitate arch retraction (*Fig. 11*). Despite the increase in FC, there was an overall improvement in lip protrusion, lip competence, dental alignment and functional occlusion (*Figs. 16-19*). The final alignment was assessed at 21 points with ABO Cast-Radiograph Evaluation (*CRE*),[6] as documented in the supplementary worksheet at the end of this report. Major residual discrepancies were noted in three categories: marginal ridges (*6 points*), occlusal contacts (*6 points*) and occlusal relationships on the right side (*5 points*). Overbite was reduced from 4 to 1mm, but the Class II discrepancy was not completely corrected on the right side. In addition, the mandibular second molars were tipped distally because of an inadequate root-distal moment in the archwire. These axial inclination problems (*Fig. 18*) resulted in marginal ridges discrepancies in the posterior segments (*Figs. 16 and 17*). The Pink and White dental esthetic score was 5 points, as subsequently documented in worksheet, which is consistent with the outcomes recommended by Sarver and Yanosky.[7]

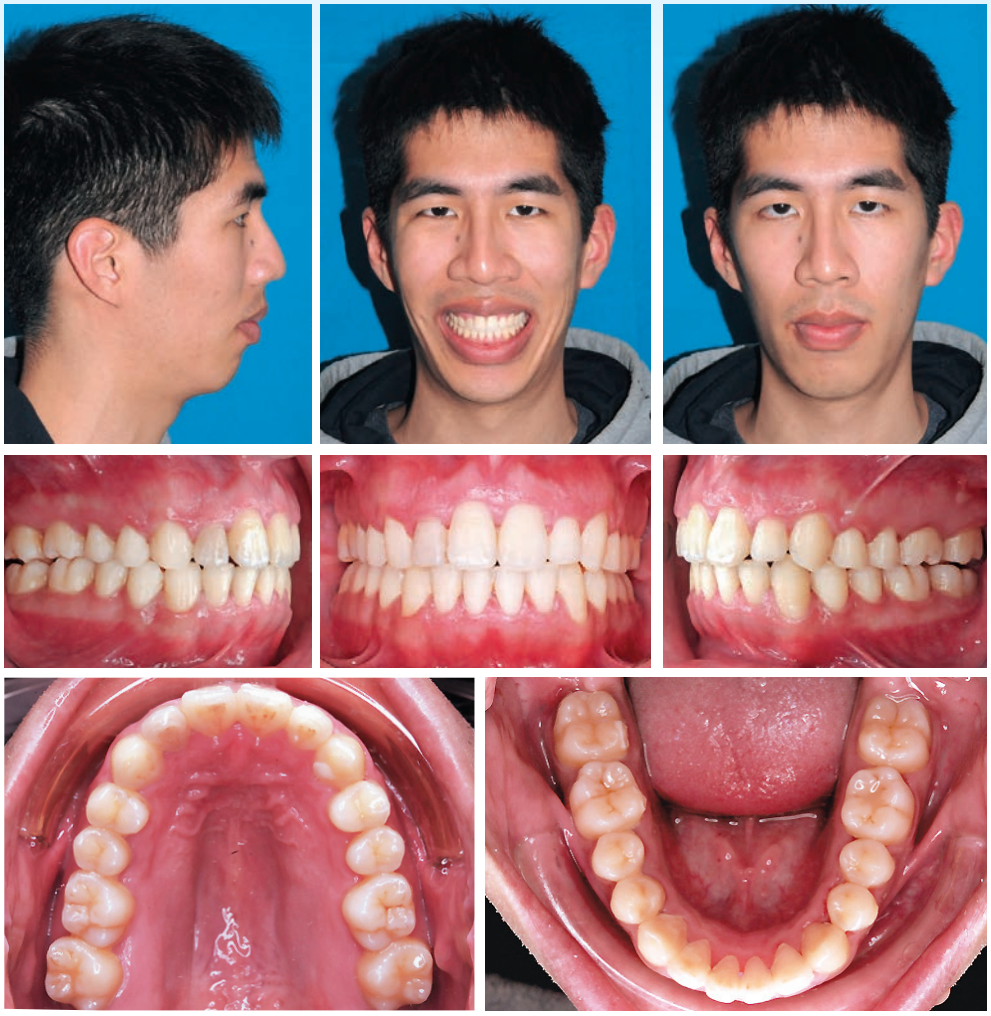


Fig. 16: Post-treatment facial and intraoral photographs

Fig. 17: Post-treatment dental models (casts)

Fig. 18: Post-treatment panoramic radiograph

Fig. 19: Post-treatment lateral cephalometric radiograph

Discussion

Ast et al.[8] examined 1413 high school students aged 15-18 years from upstate New York and found that 23.8% had Class II malocclusions, compared to 69.9% with Class I malocclusions, which was a ratio of ~1:3. The underlying etiology of Class II malocclusions was originally thought to be genetic, based primarily on racial and familial characteristics, but more recent studies suggest that many malocclusions previously thought to be genetic are actually acquired.[9-11] Environment can play an important role in the development of certain types of malocclusions. For example, the early loss of the maxillary second deciduous molars or palatial ectopic eruption of second premolars may result in mesial migration of

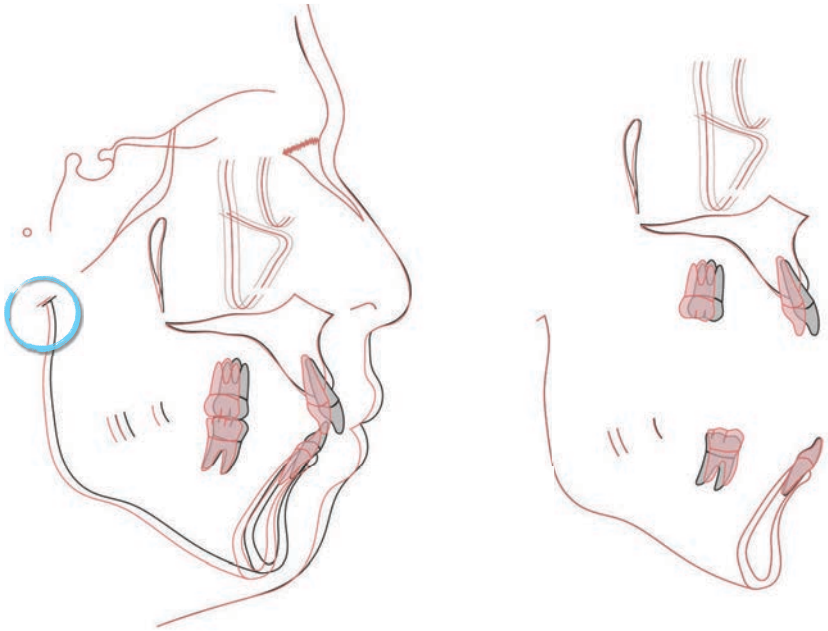
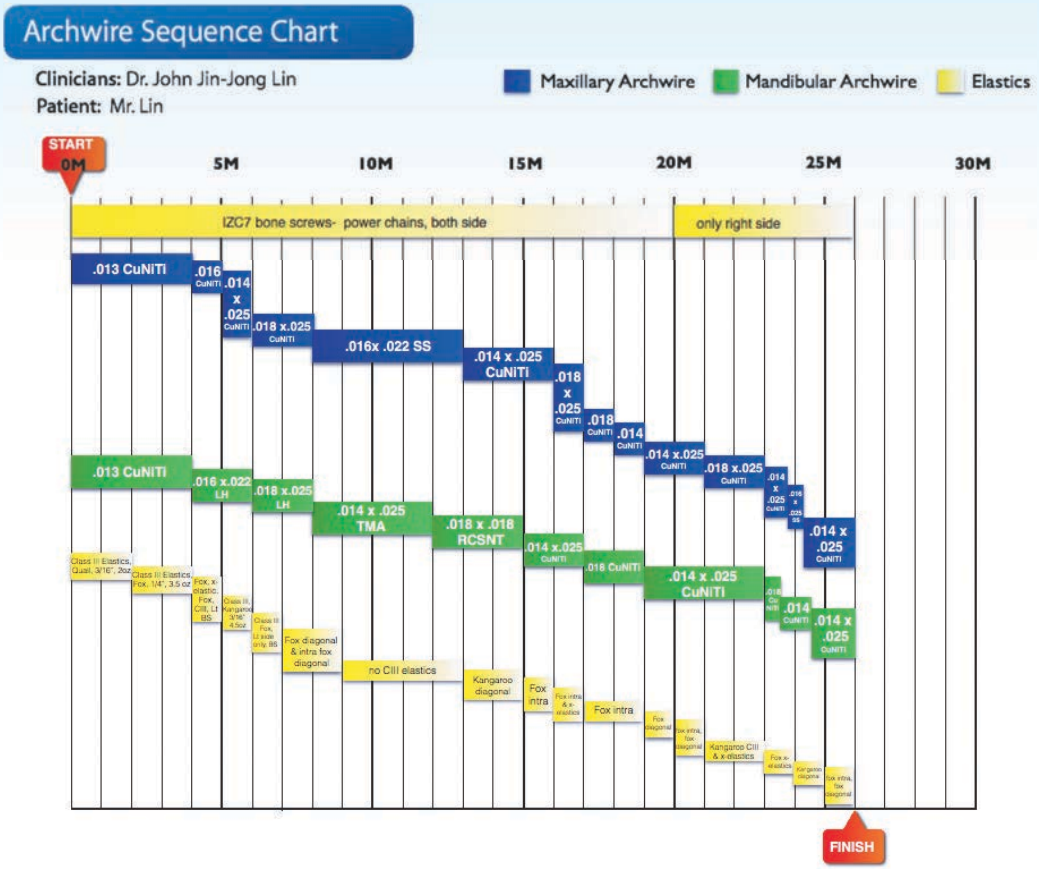


Fig. 20:
Superimposed cephalometric tracings show dentofacial changes over 26 months of treatment (red) compared to the pre-treatment position (black). The anterior cranial base superimposition (left) documents the retraction of the protrusive lips and opening of the VDO as the mandible rotated clockwise. The LFH increased and the mandible assumed a more posterior posture (blue circle). The upper right superimposition on the maxilla shows the retraction of the dentition relative to the apical base of bone. The lower left superimposition on the mandible reveals the extrusion of the mandibular molars. See text for details.



the permanent molars.[12] Furthermore, a persistent finger sucking habit increased overjet, the lower lip may become trapped behind the maxillary incisors, causing abnormal contraction of the mentalis muscle and other perioral muscles leading to uprighting of lower incisors and labial tipping of maxillary incisors.[13] Another proposed etiology for functional types of malocclusion is mouth breathing, which may precipitate a low tongue posture and openbite as a result of nasal or adenoid obstruction.[14,15]

Class II division 2 malocclusion may be associated with mandibular retrusion, maxillary protrusion, increased VDO, posterior positioning of the TMJ fossa, and/or maxillary constriction.[16] For Class II division 1 malocclusion, maxillary incisors tend to be more protrusive when the lower lip is postured in the overjet.[15,17]

Facial esthetics is a critical consideration when considering extractions to alleviate crowding. Four permanent premolars, one in each quadrant, are commonly extracted to treat Class II malocclusion in adults.[16] In general, the skeletal features of a Class II malocclusion are not the primary determinant for extractions. Crowding and differential anchorage requirements are usually the deciding factor(s).

In recent decades, TADs have been increasingly popular for managing difficult malocclusions in adults.[18,19] However, the interradicular position of the miniscrews, a high failure rate, and their

tendency to move when loaded has limited their application for conservative treatment of skeletal malocclusions, particularly when there is crowding.[1-3] Skeletal orthodontic anchorage systems (*TADs*) can provide adequate anchorage for management of severe malocclusions without extensive patient compliance.[1-3]

The present patient felt the convex facial profile was acceptable, but excessive lip protrusion was undesirable (*Fig. 1*). Correcting an Angle Class II/I subdivision malocclusion without extractions requires retraction of a maxillary molar(*s*). The IZC is an ideal maxillary site for the placement of orthodontic bone screws to retract both arches.[1-2]

IZC miniscrews, positioned buccal to the maxillary molars, were an ideal solution for retracting the upper arch and reducing bimaxillary protrusion.[1,2] Failure to completely correct the Class II relationship on the right side was related to a lack of overjet after the axial inclinations of the incisors was corrected. More retraction with IZC anchorage on the right side would have resulted in a midline deviation and end-to-end incisal occlusion. Interproximal reduction (*IPR*) of the enamel on the lower incisors and retraction with a chain of elastics to close IPR space was indicated to produce overjet for Class II correction of the right buccal segment. Once overjet is created, IZC anchorage on the right side was ideal for completing the Class II correction of the right buccal segments. However, retraction of a maxillary segment to correct Class II occlusion requires adequate overjet.

The lower third molars were extracted prior to retraction of the lower molars. Cephalometric superimposition on the mandible (*Fig. 20*) shows extrusion and distal tipping of the lower molars, but no net retraction relative to the apical base of bone. This is an illusion in a 2D cephalometric view (*Fig. 19*). The lower arch was expanded, so the molars were distally tipped as shown in the post-treatment panoramic radiograph (*Fig. 18*). There was no A-P change in the 2D cephalometric views because the arch was expanded, so its A-P length in the sagittal plane was reduced (*Fig. 20*).

Overall, the non-extraction approach using IZC miniscrew anchorage produced good dental alignment and reduced lip protrusion, but there was an increase in the VDO as reflected by ~2° increase in the following: facial convexity, SNB and mandibular plane angle (*FMA*). These undesirable sequelae are consistent with two changes noted in the cephalometric tracings: 1. lower molars are extruded ~2mm in the mandibular superimposition (*Fig. 20 lower right*), and 2. the mandible moved distally ~2mm as it rotated posteriorly ~2° in the anterior cranial base superimposition (*Fig. 20 left*). The molar extrusion problem can be explained by the use of anterior BTs (*Fig. 11*).[5] The posterior displacement of the mandible during treatment suggests a discrepancy between centric relation (C_R) and centric occlusion (C_O). There was no documentation of a $C_R \rightarrow C_O$ shift in the initial examination, but the pretreatment casts (*Fig. 2*) suggest it may have been a long-term problem. Wear facets are noted on the distal inclines of the UR3 cusp and the buccal cusp of UR4 (*Fig. 6*). Apparently, the patient habitually positioned the mandible in a more anterior position, which may have been related to parafunction, and

the path of the anterior excursion of the mandible is evidenced by two wear facets (*yellow arrows in Fig. 6*).

Intermaxillary elastics commonly extrude molars and increase the VDO because of the vertical component of force. This problem can be avoided by using both maxillary and mandibular E-A bone screws for intra-alveolar force in each arch rather than relying on intermaxillary anchorage.[1-3,10-12] For the present patient, there is no documentary evidence that the Class III elastics (*Fig. 10*) contributed to the increase in the VDO. No extrusion of the maxillary molars were noted relative to the apical base of bone in the maxillary superimposition (*Fig. 20 upper right*). Control of the expected upper molar extrusion was apparently controlled by the vertical component of the IZC retracting force (*Fig. 10*).

Conclusions

This challenging malocclusion (*DI=20*), was treated conservatively (*without extractions*) in 26 months to an excellent dental alignment (*CRE=21*) with relatively simple mechanics. IZC bone screw anchorage combined with Class III elastics were effective mechanics for intermaxillary retraction to resolve crowding in both arches and to correct the asymmetric Class II molar relationship. However, mandibular molar extrusion and an apparent $C_O \rightarrow C_R$ discrepancy contributed to increased facial convexity, that was associated with a more posterior position and clockwise rotation of the mandible.

Acknowledgment

Thanks to Mr. Paul Head for proofreading this article.

References

1. Lin JJ. C reative Orthodontics Blending the Damon system & TADs to manage difficult malocclusions. 2nd ed. Taipei: Yong Chieh Co; 2010.
2. Huang TK, Chang CH, Roberts WE. Bimaxillary protrusion treated with miniscrews. Int J Orthod Implantol 2014;34:78-89.
3. Lin JJ. Treatment of severe class III with buccal shelf mini-screws. News & Trends in Orthodontics 2010 Apr;18:4-15.
4. Cangialosi TJ, Riolo ML, Owens SE, Jr, Dykhouse VJ, Moffitt AH, Grubb JE, Greco PM, English JD, James RD. The ABO discrepancy index: a measure of case complexity. Am J Orthod Dentofacial Orthop 2004;125(3):270-8.
5. Mayes JH. Bite Turbos. New levels of bite-opening acceleration. Clinical Impression 1997;6:15-17.
6. Casko JS, Vaden JL, Kokich VG, Damone J, James RD, Cangialosi TJ, Riolo ML, Owens SE, Jr, Bills ED. Objective grading system for dental casts and panoramic radiographs. American Board of Orthodontics. Am J Orthod Dentofacial Orthop 1998;114(5):589-99.
7. Sarver DM, Yanosky M. Principles of cosmetic dentistry in orthodontics: part 2. Soft tissue laser technology and cosmetic gingival contouring. Am J Orthod Dentofacial Orthop 2005;127:85-90.
8. Ast DB, Carlos JP, Cons DC. Prevalence and characteristics of malocclusion among senior high school students in up-state New York. Am J Orthod 1965;51:437-445.
9. Roberts WE, Hartsfield JK Jr. Multidisciplinary management of congenital and acquired compensated malocclusions: diagnosis, etiology and treatment planning. J Indiana Dent Assoc 1997;76(2):42-53.
10. Chang MJ, Chang CH, Roberts. Probable airway etiology for a severe Class III openbite malocclusion: conservative treatment with extra-alveolar bone screws and intermaxillary elastics. Int J Orthod Implantol 2017;45:4-20.
11. Lee A, Chang CH, Roberts WE. MIH-related loss of mandibular first molars resulted in an acquired Class II skeletal malocclusion: conservatively treated with space closure on one side and implant-supported prosthesis on the other. Int J Orthod Implantol 2017;47:26-48.
12. Tseng LYL, Chang CH, Roberts WE. Diagnosis and conservative treatment of skeletal Class III malocclusion with anterior crossbite and asymmetric maxillary crowding. Am J Orthod Dentofac Orthop 2016;149:555-66.
13. Lear CSC, Flanagan JB, Moorrees CFA. The frequency of deglutination in man. Arch Oral Biol 1965;10:83-99.

14. Neto ACB, Saga AY, Pacheco AAR, Tanaka O. Therapeutic approach to Class II, Division 1 malocclusion with maxillary functional orthopedics. Dental Press J Orthod 2015;20(4):99-125.
15. Rijpstra C, Lisson JA. Etiology of anterior open bite: a review. J Orofac Orthop 2016 Jul;77(4):281-6.
16. Cleall JF, Begole EA. Diagnosis and treatment of class II division 2 malocclusion. Angle Orthod 1982;52:38-60.
17. Weinstein S, Haack DC, Morris LY, Snyder BB, Attaway HE. On the equilibrium theory of tooth position. Angle Orthod 1963;33(1):1-26.
18. Park HS, Lee SK, Kwon OW. Group distal movement of teeth using microscrew implant anchorage. Angle Orthod 2005;75:602-9.
19. Park HS, Kwon TG, Sung JH. Nonextraction treatment with microscrew implants. Angle Orthod 2004;74:539-49.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 20

OVERJET

0 mm. (edge-to-edge)	=	
1 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts. 6mm
7.1 – 9 mm.	=	4 pts.
> 9 mm.	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. per tooth = 2 pt

Total = 5

OVERBITE

0 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts. 4mm
5.1 – 7 mm.	=	3 pts.
Impinging (100%)	=	5 pts.

Total = 2

ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth
then 1 pt. per additional full mm. per tooth

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 7

8mm (lower)

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

Total = 4

Full Class II (right)

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 2

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° _____ 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 = 0

OTHER (See Instructions)

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

Identify:

Total = 0

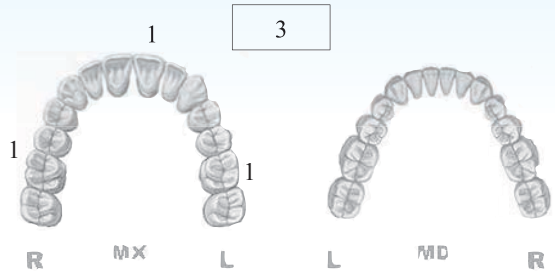
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 21

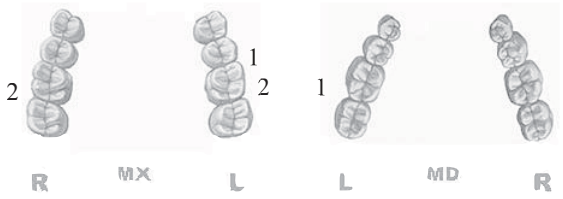
Alignment/Rotations

3



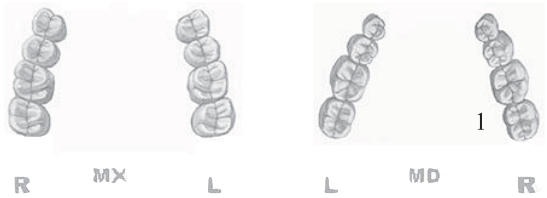
Marginal Ridges

6



Buccolingual Inclination

1

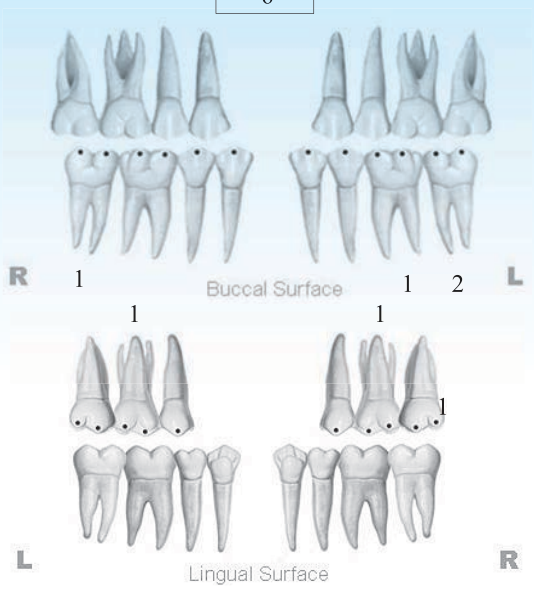


Overjet

0

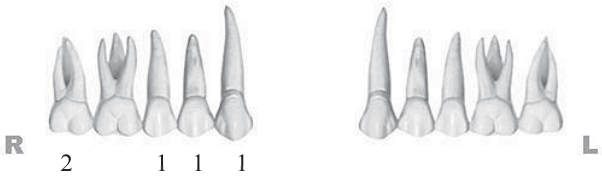
Occlusal Contacts

6



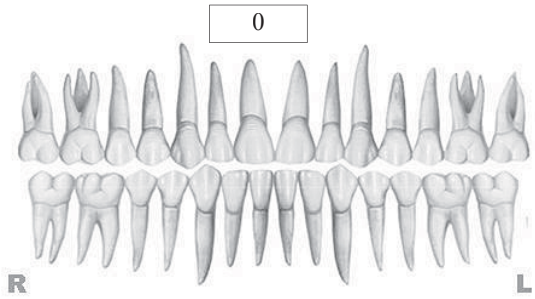
Occlusal Relationships

5



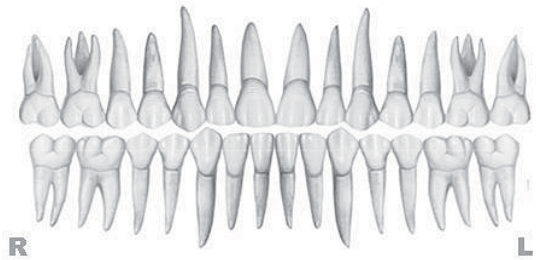
Interproximal Contacts

0



Root Angulation

0



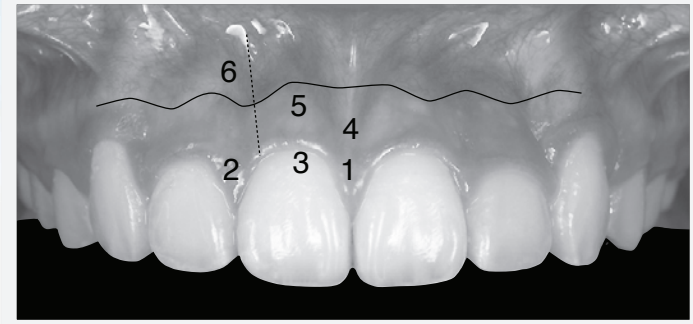
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 5

1. Pink Esthetic Score

Total = 2

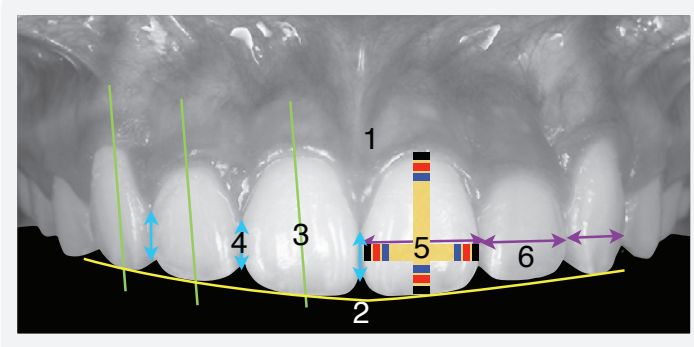


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

2. White Esthetic Score (for Micro-esthetics)

Total = 3



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

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

Dr. Diego Peydro

12 / 07 (Thu)

Location: Newton's A

(2F, No. 25, Jianzhong 1st Rd., East Dist., Hsinchu City, Taiwan)

Modern Orthodontics with Clear Aligners Therapy

Successful Strategies to Solve the Most Difficult Cases with Invisalign Technique

Dr. Peydro Diego received his degree in Dentistry from the University of Valencia, Spain in 2000. He was qualified as an Orthodontists from the Southern Mississippi University Institution, Madrid, Spain in 2004. He has been an Associate Professor of the Master in Orthodontics course at the European University of Madrid and Master Collaborator Professor of Orthodontics at the University of Valencia, Spain. Dr. Peydro is the co-director of two continuing training programs focusing on the Invisalign system and teaches globally on Invisalign. He maintains a private practice in Valencia, Spain and is considered one of the leading Invisalign specialists in Europe.

- **Successful treatment protocols for sagital, transversal and vertical problems with TADs and aligners.**
- **Distalization protocols: miniscrews and elastics.**
- **Increasing predictability through digital tools**
- **Strategies to encourage patient enrollment in Invisalign**

Registration

By 2017/11/01 USD 250 After 11/01 USD 300

Payment: wire transfer (no credit card)

Beneficiary Bank	JIH SUN INTERNATIONAL BANK (SWIFT CODE : JSIBTWTP)
Beneficiary Bank Address	NO.10, SEC. 1, CHONGQING S. RD., TAIPEI CITY, TAIWAN R.O.C.
Beneficiary Name	International Association of Orthodontists and Implantologists
Beneficiary A/C NO.	326-2737621-00

Cancellation policy:

Cancellation before November 7 is subject to 10% of cancellation fees or 30% after November 7.

+886-3-573-5676 http://iaoi.pro contact@iaoi.pro

Conservative Management of Skeletal Class II Malocclusion with Gummy Smile, Deep Bite, and a Palatally Impacted Maxillary Canine

Abstract

***Introduction**: A 21-year-old female presented with chief complaints of crooked teeth, canine impaction, deepbite, and "gummy smile" (excessive maxillary gingival exposure when smiling).*

***Diagnosis**: Increased facial convexity (15.5°), increased lower facial height (56%), and incompetent protrusive lips (E-line to UL 2mm, E-line to LL 2mm) were associated with a severe Class II malocclusion (nearly a full cusp bilaterally). There was 7.5mm of overjet, 100% anterior deepbite, and a left posterior buccal crossbite. Cephalometrics revealed a skeletal discrepancy due to a protrusive maxilla and a retrusive mandible (SNA 85°, SNB 78°, ANB 7°). Cone-beam computer tomography (CBCT) imaging revealed a palatally impacted right maxillary canine (UR3) in close proximity to the adjacent lateral incisor (UR2).*

***Treatment**: The retained right primary canine (URc) was extracted. A simplified open window technique was utilized to surgically expose its impacted successor. A maxillary anterior miniscrew provided anchorage to align the UR3 in its correct anatomical position. Non-extraction treatment with a passive self-ligating fixed appliance was indicated to align and level both arches. Anchorage provided by infrazygomatic crest (IZC) bone screws and maxillary anterior miniscrews was used for correction of Class II malocclusion and gummy smile. To achieve more esthetic crown lengths in the maxillary anterior segment, gingivectomy was performed with a diode laser 2 months after fixed appliances were removed.*

***Outcomes**: This challenging skeletal Class II malocclusion with a Discrepancy Index (DI) of 38, was treated in 32 months to excellent outcomes: Cast-Radiograph Evaluation (CRE) score of 25, and an Pink & White dental esthetic score of 2. All facial and dental corrections were stable at the six month follow-up evaluation. (Int J Orthod Implantol 2017;48:24-46)*

***Key words**:*
Gummy smile, deepbite, Class II malocclusion, palatal canine impaction, self-ligating brackets, bite-turbos, temporary anchorage devices, arch retraction, laser gingivectomy, infrazygomatic crest, extra-alveolar, bone screws

History and Etiology

A 21-year-old female patient presented for orthodontic consultation (*Fig. 1*). Her chief complaints were crooked teeth, canine impaction, deep bite, and gummy smile. Facial evaluation showed a convex profile, protrusive lips, increased lower facial height (*LFH*), hyperactive mentalis muscle (*"golf ball chin" on lip closure*), and a retrusive mandible (*Fig. 1*). A full smile revealed an asymmetric, excessive gingival display (*"gummy smile"*) (*Fig. 2*). The casts showed a full-cusp Class II malocclusion of the right first molars and almost a full cusp Class II on the left (*Fig. 3*). Overall the buccal segments were severe Class II (*6mm*) bilaterally. Intra-oral

Ms. Ariel Wong,
Class of 2018 DDS Candidate, Indiana University School of Dentistry (Left)
Dr. Chris Chang,
Founder, Beethoven Orthodontic Center
Publisher, International Journal of Orthodontics & Implantology (Center)
Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)

examination revealed a retained right maxillary deciduous canine (*URc*), ~4mm of interdental spaces in the maxillary anterior segment, buccal crossbite of the left premolars (*Fig. 3*), deepbite, and 7.5mm of overjet (*Fig. 4*). The upper dental midline was coincident with the facial midline, but the lower dental midline was shifted 1mm to the right of the other two midlines.

Fig. 1: Pre-treatment facial and intraoral photographs

Fig. 2:
Gummy smile, asymmetrical gingival display, and occlusal canting are documented in a frontal photograph.

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

Fig. 4:
Inferior (left) and lateral (right) intraoral views show Impinging (100%) anterior deepbite and large overjet (7.5mm).

Radiographic documentions are lateral cephalometric (*Fig. 5*) and panoramic radiographs (*Fig. 6*). Both panoramic (*Fig. 6*) and CBCT imaging (*Fig. 7*) revealed a palatally impacted right permanent canine (*UR3*) and three developing third molars (*UL8, LL8 and LR8*); the UR8 was missing. There was no additional contributing medical or dental history. Cephalometric measurements are presented in Table 1 and diagnostic details are outlined below.

Diagnosis

Skeletal:

- Class II relationship due to maxillary protrusion and relative mandibular retrusion (*SNA 85º, SNB 78º, ANB 7º*)
- High mandibular plane angle (*SN-MP 39º, FMA 32º*)

Fig. 5: Pre-treatment lateral cephalometric radiograph

Fig. 6: Pre-treatment panoramic radiograph shows both condylar heads outlined in yellow.

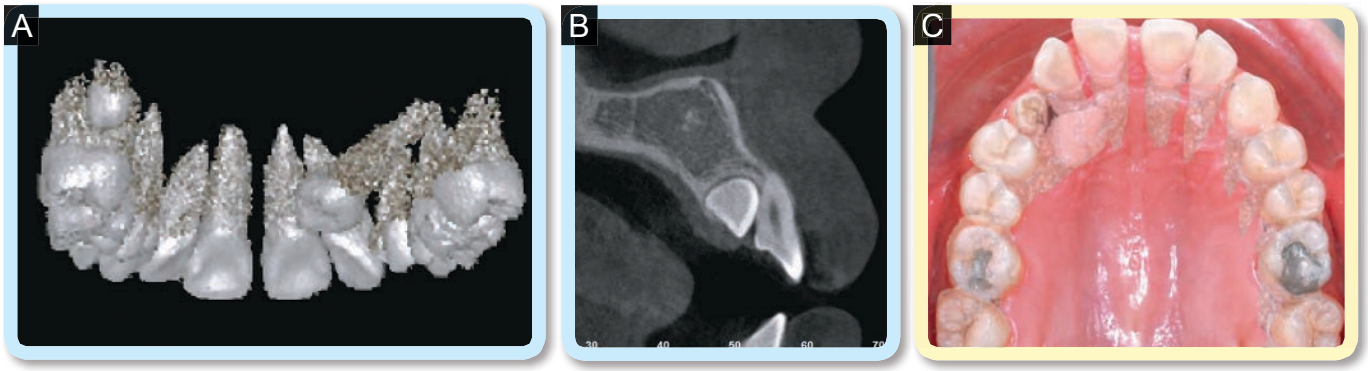


Fig. 7:

A. 3D image of the maxillary dentition documents the relative position of the impacted canine.

B. A sagittal cut through the UR2 region of a CBCT image shows a cross-section through the cervical region of the impacted UR3.

C. A CBCT image of the maxillary arch is superimposed on an occlusal intraoral photograph to reveal the position of the impacted canine.

Dental:

- Class II molar relationships: *near full cusp bilaterally (6mm)*
- Overjet of 7.5mm
- 100% impinging deepbite
- Retrusive upper incisors (*U1 to NA 1mm*) with decreased axial inclination (*U1 to SN 96º*)
- Increased axial inclination the lower incisors (*L1 to MP 102º*)

Facial:

- Convex profile (*15.5º*)
- Protrusive lips (*2mm/2mm to the E-line*)
- Hyperactive mentalis with the lips closed

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	85°	84°	1°
SNB° (80°)	78°	77°	1°
ANB° (2°)	7°	7°	0°
SN-MP° (32°)	39°	41°	2°
FMA° (25°)	32°	34°	2°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	1 mm	4 mm	3 mm
U1 TO SN° (104°)	96°	90°	6°
L1 To NB mm (4 mm)	6 mm	6 mm	0 mm
L1 TO MP° (90°)	102°	97°	5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	2 mm	2 mm	0 mm
E-LINE LL (0 mm)	2 mm	1 mm	1 mm
%FH: Na-ANS-Gn (53%)	56%	57%	1%
Convexity: G-Sn-Pg' (13°)	15.5°	15.5°	0°

■ Table 1: Cephalometric summary

The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*)[1] was 38 points as shown in the subsequent worksheet at the end of this report.

Treatment Objectives

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

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

Maxillary dentition

- A - P: *Retract the maxillary anterior segment*
- Vertical: *Intrude the maxillary anterior segment*
- Inter-molar / Inter-canine Width: *Expand to properly occlude with the lower dentition*

Mandibular dentition

- A - P: *Maintain*
- Vertical: *Maintain*
- Inter-molar / Inter-canine Width: *Upright molars to increase inter-molar width*

Facial Esthetics: Retract protrusive upper and lower lips

Treatment Alternatives

First Option: Extract three teeth (*retained URc, impacted UR3, and UL4*). Move the UR4 into the UR3 position. Disadvantages for this treatment option include compromised dental esthetics and ipsilateral loss of canine guidance.

Second Option: Extract two teeth (*retained URc and impacted UR3*), followed by prosthetic restoration with a fixed partial denture or an implant-supported prosthesis. The disadvantages for this approach include cost, loss of tooth structure for conventional prosthesis, implant failure if bone fixtures are used, and a potential compromise in both esthetics and function with either prosthetic option.

Third Option: Extract the retained URc and align the dentition with a fixed passive self-ligating (*PSL*) appliance. Expose the impacted UR3 with an open-window technique, allow it to erupt spontaneously,[2]

and align the entire arch orthodontically. Place maxillary anterior miniscrews to intrude the upper incisors for correction of the deep bite. Install maxillary posterior bone screws bilaterally in the infrazygomatic crests (*IZC*) to provide anchorage for retraction of the entire maxillary dentition. The perceived disadvantages for this option include increased treatment time and potential root resorption of UR2. After weighing the pros and cons, the patient preferred the least invasive, most conservative approach (*Option 3*) despite the treatment risks. Upon completion of active treatment, a gingivectomy is indicated on the labial surface of the maxillary anterior segment. Assuming there is adequate biologic width of the gingival attachment, as defined later in this report, a gingivectomy with a diode laser is indicated to increase the crown length of the dentition in the maxillary anterior segment (*the esthetic zone*).

Treatment Progress

Following extraction of the URc, a full fixed appliance with 0.022-in slot Damon Q® PSL brackets (*Ormco, Glendora, CA*) was installed on the maxillary arch. The upper archwire sequence was: 0.014-in CuNiTi, 0.018-in CuNiTi, 0.014x0.025-in CuNiTi, 0.017x0.025-in TMA, and 0.016x0.025-in SS.

In the 2nd month of treatment, surgical exposure of the impacted UR3 was completed using a simplified open window technique (*Fig. 8*). CBCT imaging was

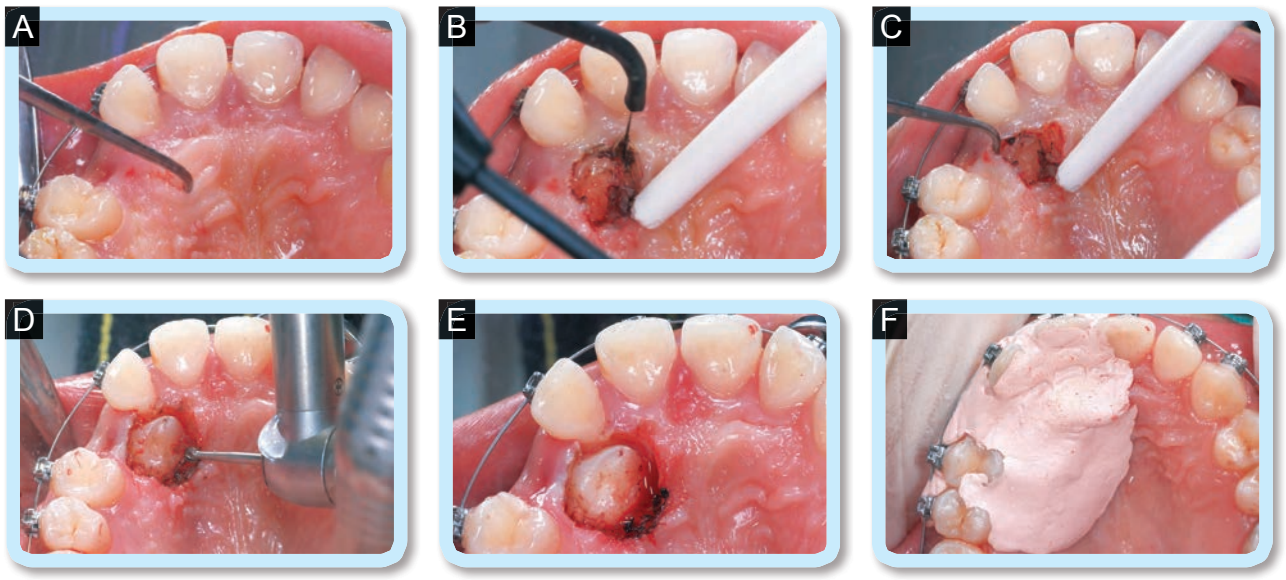


Fig. 8:

A. The simplified open-window technique begins with precise location of the crown of the impaction by sounding through the soft tissue to detect enamel.

B. The palatal soft tissue covering the crown is removed with electrosurgery.

C. An explorer is used to penetrate the overlying cervical bone to estimate the location of the CEJ.

D. Bone covering the crown is carefully removed with a round bur in a high speed hand piece down to the level of the CEJ.

E. Canine crown is exposed without severing the greater palatine artery or damaging the tooth.

F. COE-PAK® periodontal dressing is placed for patient comfort and to prevent soft tissue from recovering the exposed crown.

required for precise localization of the impaction relative to adjacent teeth (*Fig. 7*). Local anesthesia was administered at the surgical site and the location of the crown was marked with a sharp surgical explorer (*Fig. 8*). A dental electrosurgical unit was used to remove the soft tissue covering the crown of the UR3, while carefully avoiding the greater palatine artery. Uncovering a palatally impacted UR3 in the maxillary anterior area has the potential for severe bleeding if the adjacent artery is severed. The use of an electrosurgical unit for the uncovering procedure provides the surgeon with the means to rapidly coagulate the bleeding artery if it is accidentally severed.

An explorer was used to determine the position of the UR3 crown. Since spontaneous tooth eruption is facilitated by removing bone apical to the height of contour of the crown,[2] a high speed handpiece with a carbide round bur and irrigation was used to remove the overlying bone down to the level of the CEJ. To insure patient comfort and control hyperplastic soft tissue, COE-PAK®periodontal dressing was placed over the wound.

In the third month, an open coil spring was installed to create space for the impacted canine (*Fig. 9*). Approximately two months after the surgical procedure, a button was bonded on the UR3. At the same appointment, a 2x12mm bone screw (*OrthoBoneScrew®, Newton's A Ltd, Hsinchu City, Taiwan*) was inserted on the labial aspect of the alveolar ridge position. The latter anchored an elastic power chain that was attached to the button bonded on the UR3 to apply traction for guiding the canine laterally (*Fig. 10*). Additional 2x12mm bone screws were placed in each IZC for bilateral extra-alveolar (*E-A*) anchorage (*Fig. 10*). Furthermore, glass ionomer bite turbos (*GIBTs*) were bonded on the lower first molars to open the bite for correction of the left posterior crossbite tendency (*Fig. 11*).

Eleven months into treatment the miniscrew providing anchorage for labial movement of the UR3 was removed, and one month later (*12 mo into treatment*) brackets were bonded to the UR3 and the entire lower dentition (*Fig. 11*). The lower archwire sequence for was 0.014-in CuNiTi, 0.014x0.025-in CuNiTi, 0.017x0.025-in TMA, and 0.016x0.025-in SS.

■ *Fig. 9:*
In the third month (3M) of treatment, an open coil spring was placed between the right maxillary lateral incisor and first premolar to create space to align the impacted canine.

Fig. 10:

A. In the fourth month, a miniscrew is placed between the 1st premolar and canine position and loaded with 150gm-force (cN) of traction to move the impacted canine into its correct anatomical position.

B. A right lateral intraoral radiograph shows the mechanism for retraction of the right buccal segment as the palatally displaced canine is moved into the arch.

C. A left lateral view reveals symmetric mechanics to retract the left buccal segments with 280gm-force (cN) per side.

Fig. 11:

In the 12th month of treatment brackets are bonded to the maxillary right canine (left) and also on the entire lower arch (center). BTs are noted on the occlusal surfaces of the mandibular first molars (right).

In the 16th month, two anterior bite turbos (*BTs*) were bonded on the maxillary central incisors to aid in correction of the 100% deepbite. Class II elastics (*Fox 1/4-in, 3.5-oz*) were applied bilaterally to correct the Class II molar and canine relationships.

In the 17th month, two 1.5x8mm miniscrews (*Newton's A Ltd, Hsinchu City, Taiwan*) were placed between the roots of the upper central and lateral incisors for anchorage to prevent extrusion of the maxillary anterior segment when Class II elastics were applied (*Fig. 12*). In the 26th month, the anterior miniscrews were removed. In the 30th month, interproximal reduction (*IPR*) was performed to address the black triangles noted between the maxillary anterior teeth.

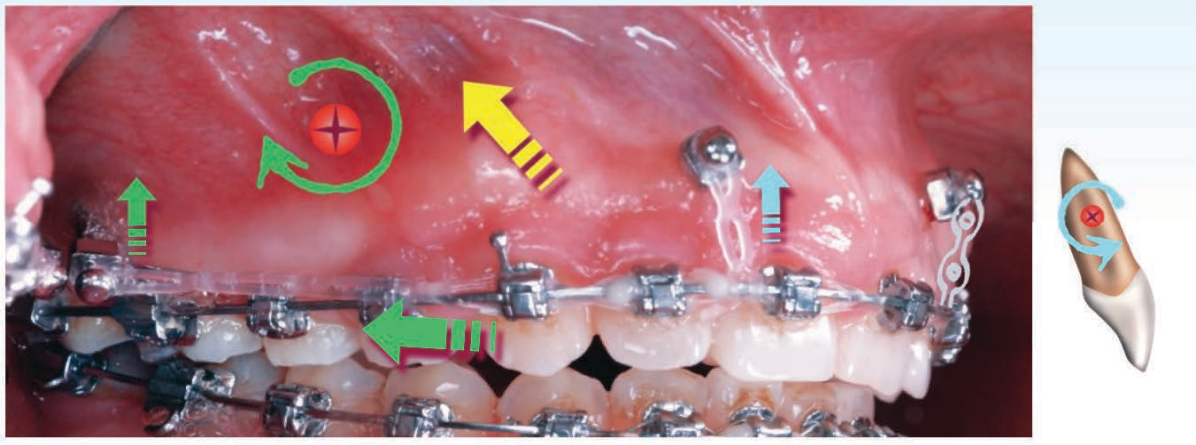


Fig. 12:
Based on a presumed center of resistance (C_R) for the maxillary arch (red circle with a cross), the chain of elastics from the IZC bone screw to the cuspid bracket has distal and vertical components (straight green arrows) that produce a clockwise moment around the C_R. The maxillary anterior miniscrew anchors an intrusive force (blue arrow) that creates a counterclockwise moment (blue curved arrow) tending to flare the maxillary incisors. The presumed resultant for all the applied loads is the yellow arrow.

Fig. 13:
A. Pre-operative photograph shows the irregular gingival margins and clinical crown lengths in the maxillary anterior esthetic zone. There is also a low attachment of the maxillary midline frenum.
B. Image taken immediately after diode laser gingivectomy and frenectomy which was performed 2 months into active treatment.
C. Follow-up one month later shows esthetically pleasing tooth proportions and gingival contours, as well as an apical migration of the revised frenum attachment.

After 32 months of active treatment, all fixed appliances were removed. Upper 2-2 fixed retainers and upper and lower clear removable retainers were delivered. The patient was instructed to wear the retainers full time for the first 6 months and nights only thereafter. Home care and retainer maintenance instructions were provided. Two months into retention a diode laser was used for a maxillary midline labial frenectomy, as well as for esthetic crown lengthening of the teeth in the maxillary anterior segment (*Fig. 13*).

Fig. 14: Post-treatment facial and intraoral photographs

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

Fig. 16: Post-treatment panoramic radiograph

Treatment Results

Optimal results were obtained through interdisciplinary treatment with surgical exposure of the UR3 and the use of a passive self ligating bracket system for alignment (*Fig. 14*). The ABO Cast-Radiograph Evaluation (*CRE*)[3] score was 25, which documents an excellent result for a severe malocclusion with a DI of 38 points. The major residual discrepancies scored for the CRE included marginal ridges (*4 points*), buccolingual inclinations (*7 points*), and occlusal relationships (*10 points*). Comparison of the before (*Figs. 1-7*) and after (*Figs. 14-18*) treatment records revealed a dramatic improvement in facial form and dental alignment. Post-treatment radiographic results are documented in the cephalometric and panoramic radiographs

Fig. 17: Post-treatment lateral cephalometric radiograph

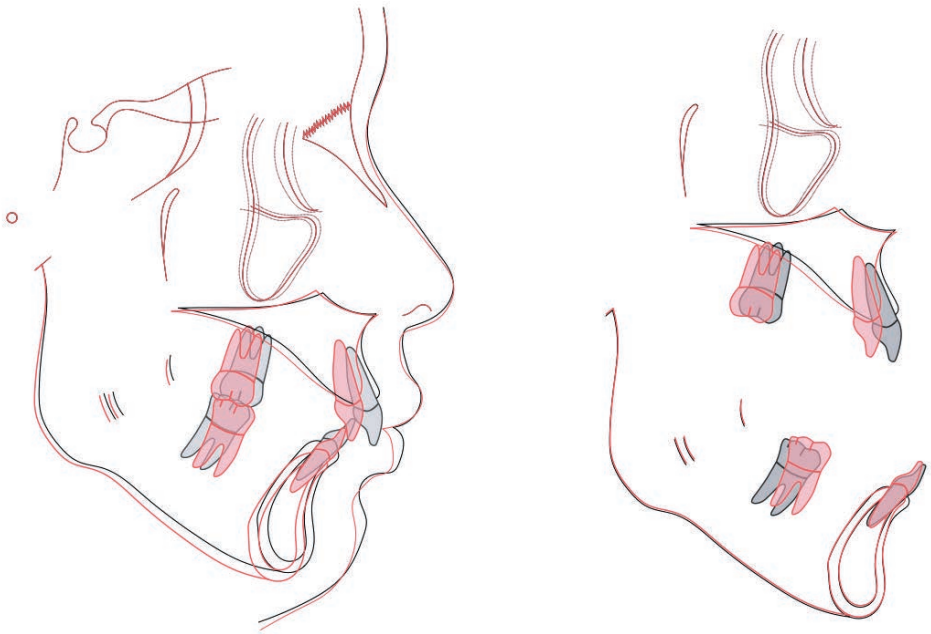


Fig. 18:
Superimposed cephalometric tracings showing dentofacial changes resulting from 32 months of active treatment (red) compared to the pre-treatment (black). Note that the maxilla and particularly the maxillary incisors did not move as expected in the presumed loading diagram (Fig.12). See text for details.

Fig. 19:
Post-treatment TMJ radiographs show that mandibular contours and articular relationships are within normal limits for both on the right and left sides. The open and closed positions for the right TMJ are shown in the two images on the left side, and the same relationships for the left TMJ are shown on the right side of the illustration.

(*Figs. 16 and 17*). Dentoalveolar changes are shown in the superimposition of cephalometric tracings before and after treatment (*Fig. 18*). Post-treatment TMJ radiographs in the opened and closed positions show symmetrical and well-positioned condylar heads of the mandible (*Fig. 19*). Lip strain was improved dramatically, but the soft tissue profile of the upper lip did not follow the hard tissue in a 1:1 manner as the maxilla was retracted, so the patient's protrusive lip profile was not completely corrected. Overall, the post-treatment photographs show optimal correction of the palatally impacted canine, deep bite, posterior buccal crossbite, gummy smile, and lip strain. The patient was well satisfied with the result.

Discussion

Palatally impacted maxillary canines

After third molars, maxillary canines are the second most commonly impacted teeth, affecting approximately 2% of the population.[4] Two-thirds of maxillary canine impactions are palatal, and the remaining third are transalveolar or labial to the roots of the adjacent teeth.[5,6] The etiology for the location of palatally impacted maxillary canines is unknown,[7] but both guidance and genetic theories have been proposed.[8,9] The guidance theory holds that the lateral incisor root serves as a guide for canine eruption, so a missing lateral incisor or deformed root interferes with the normal path of eruption. The genetic theory proposes an inherent predisposition to palatally impacted maxillary canines.[10] There are multiple sequelae associated with canine impactions including: 1. migration of adjacent teeth, 2. internal or external root resorption of the impaction and/or adjacent teeth, 3. cyst formation, 4. infection, and 5. referred pain.[11]

The maxillary canines are important keystones for optimal dental esthetics and function,[12] so their proper eruption and alignment is a high priority. Proper diagnosis is critical for efficient surgical and orthodontic management of eruption anomalies. Cone Beam Computed Tomography (*CBCT*) is a precise method for three dimensional (*3D*) localization of an unerupted canine.[13] Without 3D imaging, it is difficult to plan an efficient and relatively atraumatic uncovering of an impaction. CBCT imaging is also useful for planning the orthodontic mechanics to recover the canine and align it in the arch.

There are two methods for managing palatal impactions: preventative and surgical.[5,14] Prevention with interceptive treatment is preferable if the problem is diagnosed at an early age. This approach for an unerupted maxillary canine involves extracting the deciduous canine, and then orthodontically opening the space between the maxillary permanent lateral incisor and the primary first molar or permanent first premolar. Ericson and Kurol[5]

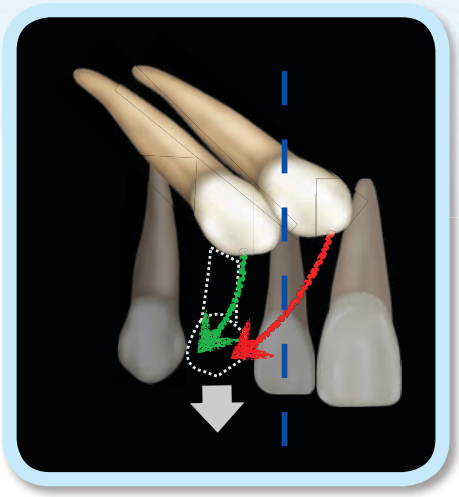


Fig. 20:
Illustration of the concept proposed by Ericsson and Kurol (1988) for prevention of maxillary permanent canine impaction by the timely extraction of the retained deciduous canine (outline dotted in white) and space opening if needed to accommodate the erupting canine. The probable success of the procedure depends on the sagittal position of the unerupted canine relative to the midline of the maxillary canine in a 2D radiograph. See text for details and references.

reported that removing the maxillary deciduous canine before 11 years of age has a differential effect on the normal eruption of the succedaneous canine. If the radiographic image of the canine crown is located distal to the midline of the lateral incisor root, 91% of the potentially impacted canines erupt normally (*Fig. 20*). However, the success rate decreases to 64% if the canine crown is located mesial to the midline of the lateral incisor root. Timely extraction of the deciduous canine is very effective for enhancing the eruptive potential of a canine, with a deviated path of eruption, but the space opening must be carefully managed to avoid root resorption if the unerupted canine is near the roots of the adjacent lateral incisors and/or premolars.[15]

If prevention is not feasible, or the procedure fails to prevent the impaction, the most desirable approach is surgical exposure of the canine in combination with orthodontic treatment.[14] This type of interdisciplinary treatment requires careful communication between the orthodontist, surgeon, and patient. Kokich[2] described several advantages of pre-orthodontic uncovering and spontaneous eruption of the palatally impacted canine, when compared to the closed eruption technique. Removing the relatively thick palatal mucosa and bone covering the impacted canine allows for more predictable spontaneous eruption. However, in young adult patients, the passive pre-orthodontic eruption process requires almost a year, and the procedure is less predictable in adolescent patients.[14]

For the present patient, miniscrew guided eruption of the impacted canine was performed in conjunction with surgical uncovering and orthodontic treatment (*Fig. 21*). After exposing the impacted canine using a simplified open-window technique, the previously impacted tooth extruded 2-3mm in two months. A miniscrew was placed on the labial surface for anchorage to guide the movement of the canine into the arch-form. As palatal impactions are moved facially, gingival accumulation on the labial surface is common, and may result in an unesthetic short clinical crown. The excess gingival tissue is easily removed with a diode laser prior to bracket placement.[16]

Efficient management of impacted maxillary canines requires a proper diagnosis and thorough

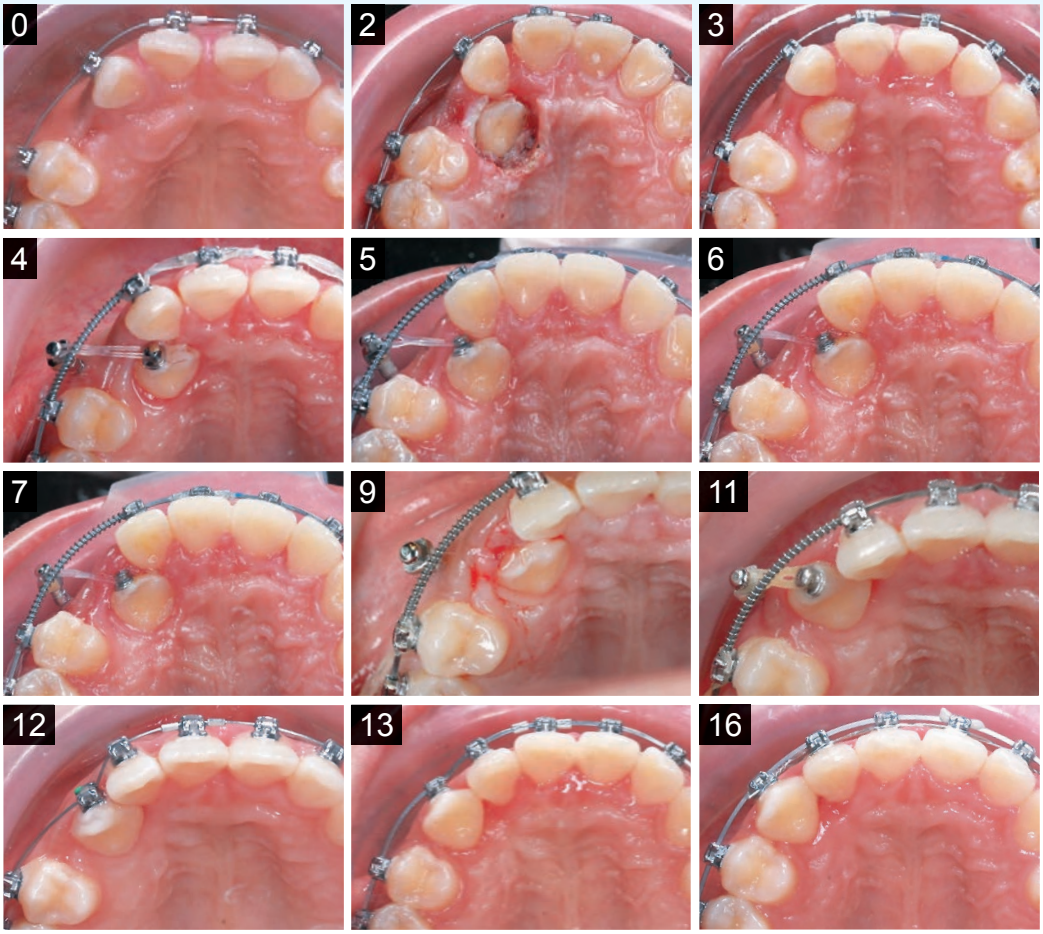


Fig. 21:
The progression for the recovery and alignment of the palatally impacted right maxillary canine is shown in a series of occlusal photographs taken at monthly intervals from the start of treatment at zero months (0) to completion of the initial alignment at sixteen months (16).

understanding of anchorage demands for proper alignment. Becker et al.[17] analyzed a sample of 37 impacted maxillary canines and found that the most common reasons for failure to recover an impaction were related to two diagnostic deficiencies: 1. inaccurate assessment of the location and orientation of the impaction, and 2. failure to understand to anchorage demands for proper alignment.[17] For the present patient, the CBCT image was used to plan the surgical uncovering and miniscrew anchorage. This approach resulted in ideal functional and esthetic alignment without periodontal or esthetic compromise.

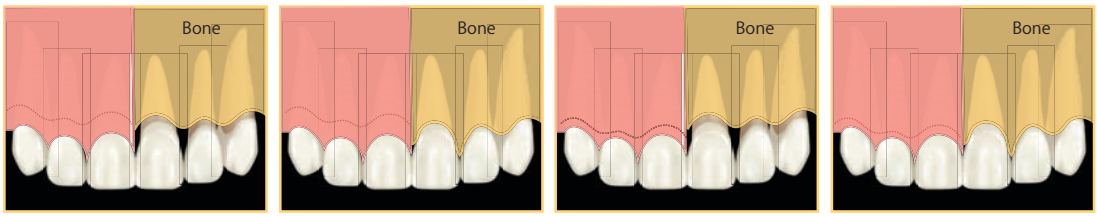
Gummy Smile

The ideal amount of gingival display when smiling is around 1-2mm.[18] Excessive maxillary gingival

exposure is commonly referred to as "*gummy smile.*" The problem may be generalized or localized, and has multiple etiologies.[19,20] Extra-oral factors include: 1. short and/or hypermobile upper lip, 2. maxillary anterior dentoalveolar extrusion, and 3. vertical maxillary excess. Intra-oral manifestations include gingival hypertrophy and altered passive eruption.

Altered passive eruption (*APE*) occurs when the gums do not physiologically recede following active tooth eruption. Coslet's[21] classification of APE is based on the width of attached keratinized gingiva and the location of the osseous crest in relation to the CEJ. There are four classifications of APE: Type I Subgroup A, Type I Subgroup B, Type II Subgroup A, and Type II Subgroup B. In all four groups, the free gingival margin is located occlusal to the CEJ. Classification of APE is helpful in determining subsequent treatment,[22] and a summary can be found in Table 2.

APE-related, short clinical crowns were diagnosed as the etiology of the current patient's gummy smile. Measuring gingival sulcus depth and bone sounding under local anesthesia to determine the level of crestal bone are important diagnostic tools for determining if a gingivectomy is indicated to correct gummy smile.[23] The present patient exhibited an adequate zone of attached gingiva and the bone sounding depth was found to be 5mm. Based on Coslet's[21] classification (*Table 2*) of altered passive eruption, the patient was classified as Type I-A (*excessive gingival width*), and a diode laser gingivectomy was deemed an appropriate



	Type I-A	Type I-B	Type II-A	Type II-B
Zone of attached keratinized gingiva	Adequate	Adequate	Inadequate	Inadequate
Osseous crest in relation to the CEJ	Osseous crest is 2-3 mm apical to the CEJ	Osseous crest is at the CEJ	Osseous crest is 2-3 mm apical to the CEJ	Osseous crest is at the CEJ
Treatment	Gingivectomy	Gingivectomy + Osseous surgery	Apically Positioned Flap	Apically Positioned Flap + Osseous surgery

■ Table 2:
Coslet's classification for Altered Passive Eruption relates to the zone of keratinized gingiva, osseous crest relative to the cementoenamel junction (CEJ). The mucogingival junction (MGJ) is marked by the black dotted line. The MGJ is noted by a dotted line. Types I and II reflect the width of attached gingiva, and subtypes A and B is defined by the CEJ to crestal bone height dimension. See text for details and references.

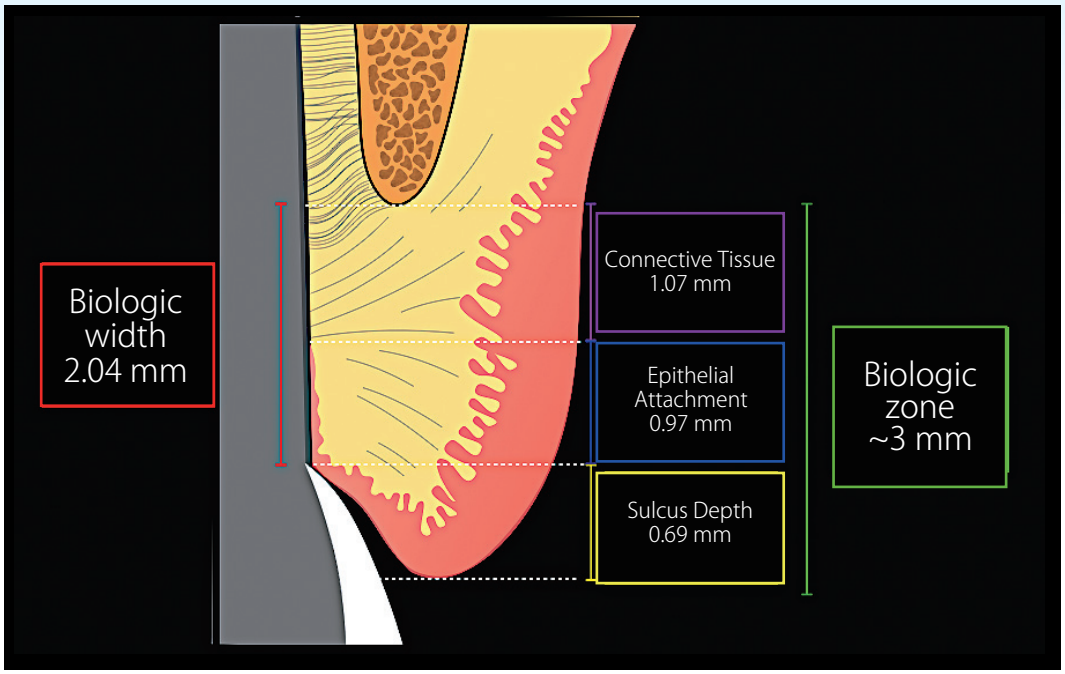


Fig. 22:
A diagram of the periodontal attachment to a tooth illustrates the concept of biologic width: sulcus depth+width of the epithelial attachment+connective tissue attachment of collagen fibers directly into cementum occlusal to the alveolar bone crest. The total width of the biologic zone is ~3mm. See text for details and references.

treatment to enhance dental esthetics by increasing crown lengths in the anterior segment.

Diode Laser: Gingivectomy and Labial Frenectomy

It is important to have a good understanding of biologic width prior to a gingivectomy procedure.[24,25] Some symptoms of biologic width violation include persistent gingival inflammation, recurrent pocket depths, and tissue recession.[24] Biologic width is a term that was coined by Cohen,[23] and is defined as the combined heights of the connective tissue attachment and epithelial attachment. In 1961, Garguilo et al.[26] reported the average connective tissue height was 1.07mm and the average epithelial attachment was 0.97mm, leading to an average biologic width of 2.04mm. The average depth of the facial gingival sulcus was 0.69mm, thus the average total gingival height above the bone was found to be approximately 2.73mm (*Fig. 22*). Kois[27] rounded this value up to 3mm and called it the biologic zone (*Fig. 22*). Maintaining a biologic zone of 3mm is an important factor in maintaining a healthy dentogingival complex.

For the present patient, the 3mm reserved for maintaining the biologic zone was subtracted from the 5mm bone sounding depth, revealing 2mm of gingival width could be safely removed with laser

Fig. 23:
Pre-treatment (left) and post-treatment (right) lower facial photographs. The upper two views are a comparison of full smile before and after treatment. The lower two photos area similar comparison with the lips closed. See text for details.

gingivectomy.[28] As an additional procedure, the area of attachment for an impinging maxillary midline frenum was also removed with the diode laser, and the wound healed by secondary intention.

The word "*LASER*" is an acronym which stands for Light Amplification of Stimulated Radiation Emission. Dental devices are generally classified as superficial and deep penetrating lasers.[29] Diode lasers deeply penetrate the tissue and are well absorbed by hemoglobin, thereby producing a layer of coagulation within the soft tissues (*hemostasis*) that controls bleeding. Diode lasers are usually preferred for dental soft tissue revision because of their precise cutting and coagulation ability. For orthodontic gingival hypertrophy, diode laser gingivectomy is reported to provide earlier healing and greater improvement in gingival health compared to scalpel surgery.[30,31] Pre-treatment and post-treatment comparison of gingival exposure when smiling is documented in Fig. 23.

Posterior and Anterior Bite Turbos

For the present patient, the use of posterior bite turbos opened the bite to permit correction of buccal crossbite for the upper left premolars. The subsequent anterior bite turbos (*BTs*) were installed on the lingual surfaces on the maxillary central incisors for correction of her deep bite. Because of the large overjet, anterior BTs were bonded more gingivally. BTs should not be used on endodontically treated teeth because the latter are more susceptible to fracture. Upright or lingually-tipped maxillary incisors may require a correction in the axial inclination before installing BTs. Anterior BTs serve as vertical stops in occlusion at the desired vertical dimension of occlusion (*VDO*). Spontaneous eruption of the posterior dentition to the desired occlusal plane, consistent with the treatment VDO, was the primary mechanism for overbite correction. However, the vertical load associated with anterior BTs may result in intrusion of the upper and lower incisors.[32-34]

Class II Elastics

Class II elastics tend to retract the maxillary arch and extrude the maxillary anterior segment while rotating the plane of occlusion posteriorly (*clockwise*). The lower dentition compensates by posterior rotation of the mandible, opening of the VDO, extrusion of the posterior teeth, and increased axial

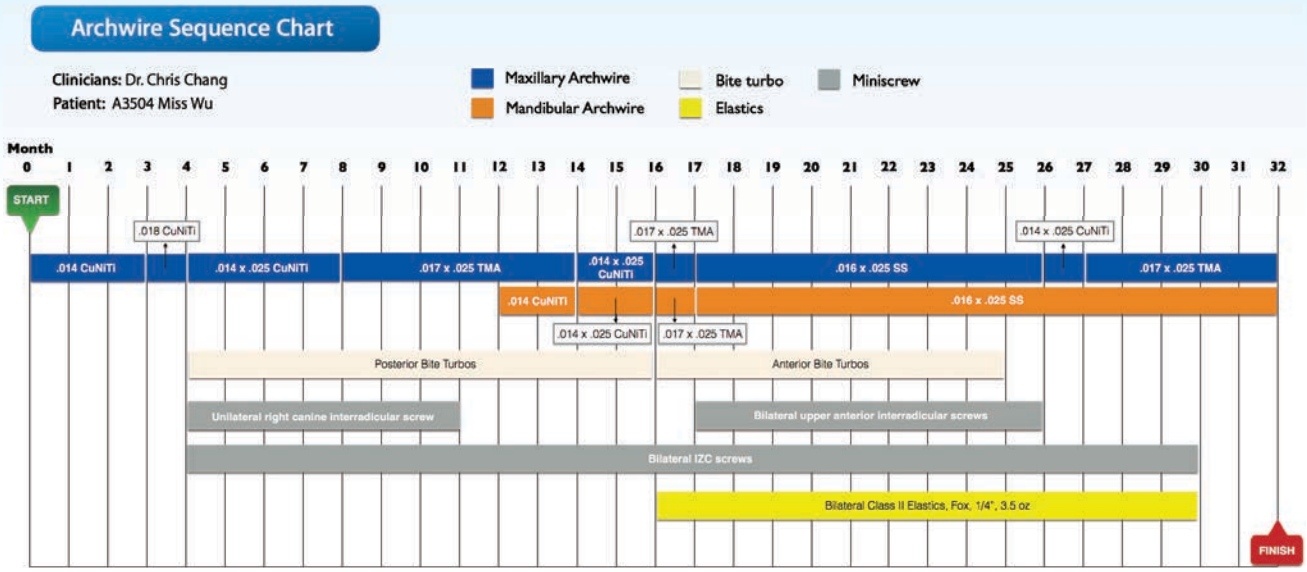


Table 3: Archwire sequence chart summarizes the sequential mechanics over the course of active treatment. See text for details.

inclination of the incisors. With respect to anterior dental segments, Class II elastics produce two predictable side effects: uprighting of the maxillary incisors and flaring of the mandibular incisors.[35]

To resist the incisal tipping effects of Class II elastics, higher torque brackets are indicated in the maxillary anterior and lower torque brackets are prescribed for the mandibular anterior.[36,37] However, for the present patient, standard torque brackets were placed in both arches. This approach worked well for the lower arch because L1 to SN° improved from 102° to 97°. Unfortunately, the expected flaring effect of the intrusive force, anchored by the maxillary anterior miniscrews (*Fig. 12*), was inadequate to counteract the side effects of the Class II elastics, so the axial inclination the upper incisors decreased (*U1 to SN° from 96° to 90°*). In retrospect, this problem was preventable as follows: 1. use higher torque brackets on the maxillary incisors, 2. progress to larger rectangular archwires to more completely express torque (*Table 3*), and/or 3. place palatal root torque in the anterior segment of the maxillary rectangular archwire.

Inadequate torque control of the maxillary incisors prevented the complete correction of the Class II posterior segments (*Fig. 15*). This problem resulted in deduction of 10 additional points on the CRE score. The patient was adequately treated to ABO standards as evidenced by an overall CRE score of 25, but if there was adequate overjet for a complete Class II correction, the score would have been a truly outstanding 15.

Conclusions

When treating complex malocclusions, bone screws provide effective anchorage in the maxillary anterior as well as the posterior regions of both arches.

Recovery and alignment of an impacted maxillary canine is best accomplished with a simplified open window technique, in combination with miniscrew anchorage, to successfully guide the impacted canine into its correct anatomical position. A Class II malocclusion with gummy smile was efficiently corrected with bilateral IZC bone screws and maxillary anterior miniscrews, but decreased axial inclination of the maxillary incisors prevented complete correction of the Class II buccal segments.

Acknowledgment

Thanks to Dr. Rungsi Thavarungkul for the beautiful illustrations. Thanks to Doctors Chris Chang, Angle Lee, Charlene Chang, Ashley Huang, and Lomia Lee for their mentorship and assistance with data collection.

References

1. Cangialosi TJ, Riolo ML, Owens SE Jr, Dykhouse VJ, Moffitt AH, Grubb JE, Greco PM, English JD, James RD. The ABO discrepancy index: a measure of case complexity. Am J Orthod Dentofacial Orthop 2004;125(3):270-8.
2. Kokich VG. Preorthodontic uncovering and autonomous eruption of palatally impacted maxillary canines. Semin Orthod 2010;16:205-211.
3. Casko JS, Vaden JL, Kokich VG, Damone J, James RD, Cangialosi TJ, Riolo ML, Owens SE Jr, Bills ED. Objective grading system for dental casts and panoramic radiographs. American Board of Orthodontics. Am J Orthod Dentofacial Orthop 1998;114(5):589-99.
4. Litsas G, Acar A. A review of early displaced maxillary canines: Etiology, diagnosis and interceptive treatment. Open Dent J 2011;5:39–47.
5. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. Eur J Orthod 1988;10:283–95.
6. Mitchell L, editor. An Introduction to Orthodontics. 3rd ed. New York: Oxford University Press; 2007. pp. 147–56.
7. Jacoby H. The etiology of maxillary canine impactions. Am J Orthod 1983;84:125–32.
8. Richardson G. A review of impacted permanent maxillary cuspids-diagnosis and prevention. J Can Dent Assoc 2000;66:497–501.
9. Becker A, editor. The orthodontic treatment of impacted teeth. 2nd ed. Abingdon, Oxon, England: Informa Healthcare; 2007. pp. 1–228.
10. Peck S, Peck L, Kataja M. The palatally displaced canine as a dental anomaly of genetic origin. Angle Orthod 1994;64:249–56.
11. Shafer WG, Hine MK, Levy BM, editors. A textbook of oral pathology. 2nd ed. Philadelphia: WB Saunders; 1963. pp. 2–75.
12. Bedoya MM, Park JH. A review of the diagnosis and management of impacted maxillary canines. J Am Dent Assoc 2009;140:1485–93.
13. Alqerban A, Jacobs R, Fieuws S, Willems G. Comparison of two c one beam tomographic systems versus panoramic imaging for localization of impacted maxillary canines and detection of root resorption. Eur J Orthod 2011;33:93–102.
14. Ericson S, Kurol J. Radiographic assessment of maxillary canine eruption in children with clinical signs of eruption disturbance. Eur J Orthod 1986;8:133-140.
15. Hsu YL, Chang CH, Roberts WE. Canine-lateral incisor transposition: controlling root resorption with a bone-anchored t-loop retraction. Am J Orthod Dentofacial Orthop 2016;150:1039-50.
16. Chang CH, Su CW, Hsu YL, Roberts WE. Soft tissue considerations for the management of impactions. Int J Ortho Implantol 2011;24:50-9.
17. Becker A, Chaushu G, Chaushu S. Analysis of failure in the treatment of impacted maxillary canines. Am J of Orthod Dentofacial Orthop 2010;137(6):743-754.
18. Hulsey CM. An esthetic evaluation of lip-teeth relationships present in the smile. Am J Orthod Dentofacial Orthop 1970;57:132-144.
19. Yeh HY, Chang CH, Roberts WE. Implant-orthodontic combined treatment for gummy smile with multiple missing teeth. Int J Orthod Implantol 2013;32:16-32.
20. Wu H, Lin J, Zhou L, Bai D. Classification and craniofacia features of gummy smile in adolescents. J Craniofac Surg 2010;21:1474-1479.

21. Coslet JG, Vanarsdall R, Weisgold A. Diagnosis and classification of delayed passive eruption of the dentogingival junction in the adult. Alpha Omegan 1977 Dec;7(37):24-8.
22. Ezquerra F, Berrazueta MJ, Ruiz-Capillas A, Arregui JS. New approach to the gummy smile. Plast Reconstr Surg 1999;104:1143-1150, discussion 51-2.
23. Cohen E. Atlas of cosmetic and reconstructive periodontal surgery. 3rd ed. Decker BC; 2007. p. 259.
24. Jorgic-Srdjak K, Plancak D, Maricevic T, Dragoo MR, Bosnjak A. Periodontal and prosthetic aspect of biological width part I: Violation of biologic width. Acta Stomatol Croat 2000;34:195–7.
25. Ingber JS, Rose LF, Coslet JG. The "biologic width"—a concept in periodontics and restorative dentistry. Alpha Omegan 1977;70:62–5.
26. Gargiulo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. J Periodontol 1961;32:261-7.
27. Kois JC. New paradigms for anterior tooth preparation. Rationale and technique. Oral health 1998;88(4):19-22, 25-17, 29-30.
28. Sarver DM, Yanosky M. Principles of cosmetic dentistry in orthodontics: part 2. Soft tissue laser technology and cosmetic gingival contouring. Am J Orthod Dentofac Orthop 2005;127:85-90.
29. Verma SK, Maheshwari S, Singh RK, Chaudhari PK. Laser in dentistry: An innovative tool in modern dental practice. National Journal of Maxillofacial Surgery 2012;3(2):124-132.
30. To A, Rabie AB, Wong RW, McGrath CP. The adjunct effectiveness of diode laser gingivectomy in maintaining periodontal health during orthodontic treatment. The Angle Orthod 2013 Jan;83(1):43-47.
31. Ize-Iyamu IN, Saheeb BD, Edetanlen BE. Comparing the 810nm diode laser with conventional surgery in orthodontic soft tissue procedures. Ghana Medical Journal 2013;47(3):107-111.
32. Thavarungkul R. Correcting deep-bite with fixed bite ramps. News & Trends in Orthodontics 2009;16:68-71.
33. Lin SL, Chang CH, Roberts WE. Mutilated class II division 2 malocclusion: implant-orthodontic treatment utilizing flapless implant surgery and platelet-rich fibrin. Int J Orthod Implantol 2014;33:22-45.
34. Liu CW, Chang CH, Roberts WE. Class II deep bite malocclusion with posteriorly-inclined incisors. Int J Orthod Implantol 2012;25:32-42.
35. Janson G, Sathler R, Fernandes TMF, Branco NCC, de Freitas MR. Correction of Class II malocclusion with Class II elastics: A systematic review. American J of Orthod and Dentofacial Orthop 2013;143(3):383-392.
36. Kozlowski J. Honing Damon system mechanics for the ultimate in efficiency and excellence. Clin Impressions 2008;16:23-28.
37. Pitts T. Begin with the end in mind: bracket placement and early elastics protocols for smile arc protection. Clin Impressions 2009;17:4-13.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 38

OVERJET

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

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

Total = 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	2 pts.
Full Class II or III	=	4 pts. per side	4 pts.
Beyond Class II or III	=	1 pt. per mm. additional	____ pts.

Total = 6

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 4

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts

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

Each degree > 6° 1 x 1 pt. = 1

SN-MP

≥ 38° = 2 pts.

Each degree > 38° 1 x 2 pts. = 2

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

Each degree > 99° 3 x 1 pt. = 3

Total = 13

OTHER (See Instructions)

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

Identify:

Total = 6

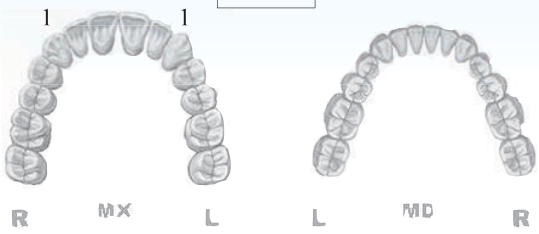
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 25

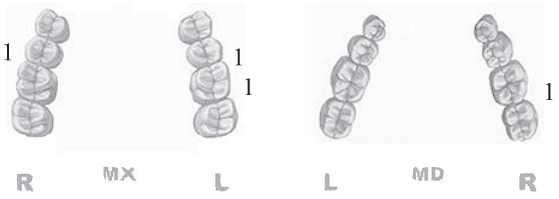
Alignment/Rotations

2



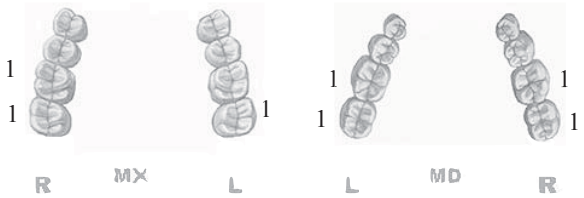
Marginal Ridges

4



Buccolingual Inclination

7

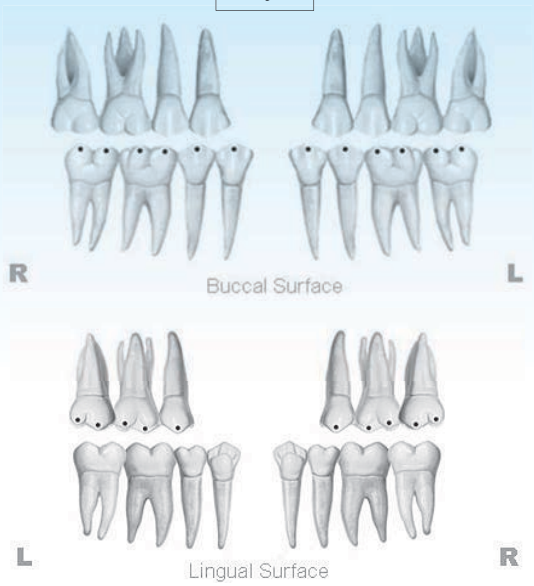


Overjet

2

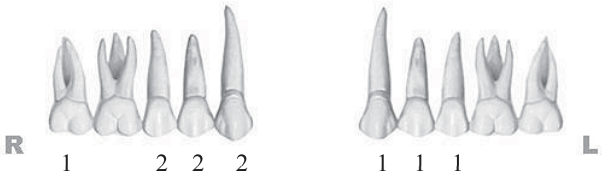
Occlusal Contacts

0



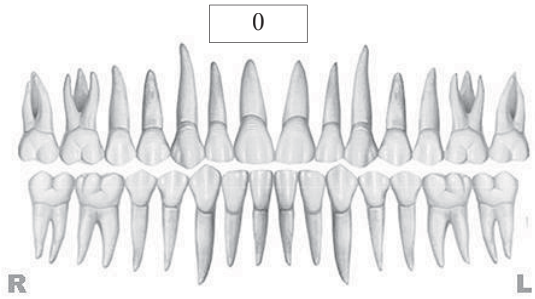
Occlusal Relationships

10



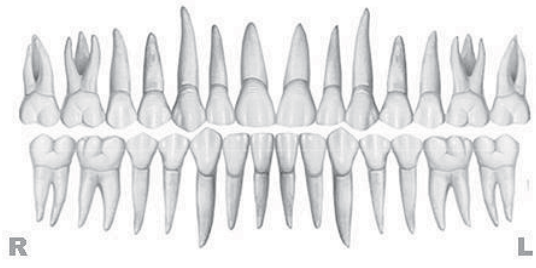
Interproximal Contacts

0



Root Angulation

0



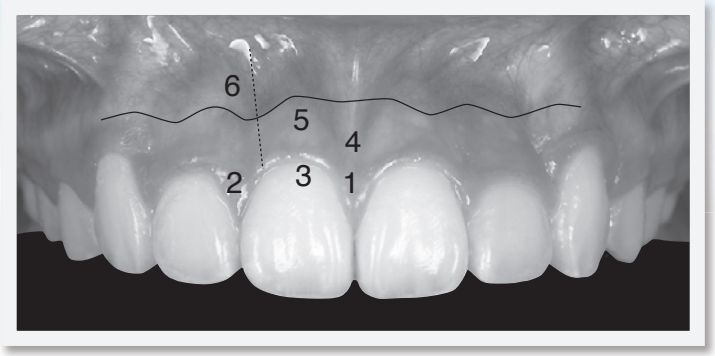
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 2

1. Pink Esthetic Score

Total = 2

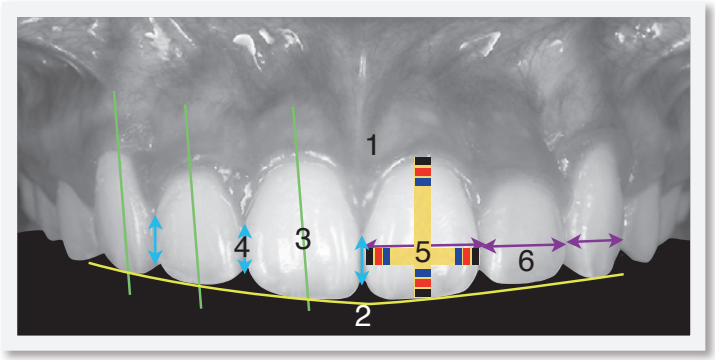


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

2. White Esthetic Score (for Micro-esthetics)

Total = 0



1. Midline	0	1	2
2. Incisor Curve	0	1	2
3. Axial Inclination (5°, 8°, 10°)	0	1	2
4. Contact Area (50%, 40%, 30%)	0	1	2
5. Tooth Proportion (1:0.8)	0	1	2
6. Tooth to Tooth Proportion	0	1	2

1. Midline	(0)	1	2
2. Incisor Curve	(0)	1	2
3. Axial Inclination (5°, 8°, 10°)	(0)	1	2
4. Contact Area (50%, 40%, 30%)	(0)	1	2
5. Tooth Proportion (1:0.8)	(0)	1	2
6. Tooth to Tooth Proportion	(0)	1	2

International Beethoven Workshop

Dental Clinic Established 1996

2017 Session B: 11/28-12/1 (Full)
2018 Session A: 05/22-25 (Full) Session B: 12/04-07

@Taiwan

Since 2009, Beethoven International Damon, OBS & VISTA Workshop has received over 350 participants from more than 30 countries. This three-day advanced hands-on course combines practical lectures and in-office clinical learning and has attracted orthodontic practitioners worldwide to strengthen their skills and knowledge in the Damon System, TADs and minimally invasive surgeries. In addition to clinical development, participants will be exposed to clinic management and staff training of a world-class orthodontic centre. The optional Keynote workshop will help improve your ability to master professional digital communication. Come join us and be part of a community of excellence.

Course Schedule

VISTA

This 4-hour hands-on surgical workshop features minimally invasive procedures for impactions and soft tissue enhancement.

Topics include:

1. VISTA for Screw Placement
2. VISTA for Connective Tissue Graft
3. Suture Techniques

Day 1	Chair-side observation
Day 2	Lecture, Model workshop, Chair-side observation
Day 3	VISTA Lecture, Lecture by Dr. John Lin, VISTA workshop
Day 4	Keynote workshop

KEYNOTE

Dr. Rungsi Thavarungkul, Thailand
Lecturer, Advanced Keynote Workshop

"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."

THE LECTURERS

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 ***International Journal of Orthodontics & Implantology,*** he has been actively involved in the design and application of orthodontic bone screws.

Dr. John Lin

President of the Jin-Jong Lin Orthodontic Clinic. Dr. Lin received his MS. from Marquette University and is an internationally renowned lecturer. He's also the author of Creative Orthodontics and consultant to ***International Journal of Orthodontics & Implantology.***

FEES

Day 123 USD 2,700 Early bird rate: $200 off by 2018/10/04 (B)
Day 4 USD 600 Early bird rate: $100 off by 2018/10/04 (B)

For more information and registration, visit
http://iworkshop.beethoven.tw

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

International Association for Orthodontists & Implantologists

Join the *iAOI* the future of dentistry!

About our association-iAOI

International Association of Orthodontists and Implantologists (iAOI) is the world's first professional association dedicated specifically for orthodontists and implantologists. The Association aims to promote the collaboration between these two specialties and encourage the combined treatment of orthodontic and implant therapy in order to provide better care for our patients.

How to join iAOI?

Certified members of the Association are expected to complete the following three stages of requirements.

1. Member

Doctors can go to http://iaoi.pro to apply for membership to join iAOI. Registered members will have the right to purchase a workbook in preparation for the entry exam.

2. Board eligible

All registered members can take the entry exam. Members will have an exclusive right to purchase a copy of iAOI workbook containing preparation materials for the certification exam. The examinees are expected to answer 100 randomly selected questions out of the 400 ones from the iAOI workbook. Those who score 70 points or above can become board eligible.

3. Diplomate

Board eligible members are required to present three written case reports, one of which has to be deliberated verbally. Members successfully passing both written and verbal examination will then be certified as Diplomate of iAOI.

4. Ambassador

Diplomates will have the opportunity to be invited to present six ortho-implant combined cases in the iAOI annual meeting. Afterwards, they become Ambassador of iAOI and will be awarded with a special golden plaque as the highest level of recognition in appreciation for their special contribution.

For more information on benefits and requirements of iAOI members, please visit our official website: http://iaoi.pro.

iAOI Diplomate

國際矯正植牙院士

Dr. 張銘珍* Ming-Jen Chang

18 pts

Dr. 葉信吟 Hsin-Yin Yeh

18 pts

Dr. 徐玉玲▲ Lynn Hsu

16 pts

Dr. 李雙安▲ Angle Lee

14 pts

Dr. 蘇筌瑋 Bill Su

14 pts

Dr. 曾淑萍 Shu-Ping Tseng

12 pts

Dr. 林詩詠 Joshua Lin

10 pts

Dr. 黃祈 Richie Huang

10 pts

Dr. 黃瓊嫥 Sabrina Huang

8 pts

Dr. 黃育新 Yu-Hsin Huang

8 pts

Dr. 曾令怡▲ Linda Tseng

7 pts

Dr. 林曉鈴 Sheau-Ling Lin

7 pts

Dr. 邱上珍▲ Grace Chiu

6 pts

Dr. 黃登楷 Kevin Huang

6 pts

Dr. 張馨文 Sara Chang

6 pts

Dr. 李名振 Major Lee

6 pts

Dr. 陳惠華 Judy Chen

6 pts

Dr. 魏明偉 Ming-Wei Wei

6 pts

Dr. 林森田 Chris Lin

6 pts

Dr. 張銘津 Ariel Chang

5 pts

Dr. 呂詩薇 Julie Lu

4 pts

Dr. 彭緯綸 Wei-Lun Peng

4 pts

* *Ambassador（大使）: One who has published 9+ case reports in IJOI.*

▲ *Case report(s) published at least once in AJODO.*

● *AJODO/Research paper - 3 points*
ABO case report - 2 points
Clinical tip - 1 point

Bimaxillary Protrusion Treated with Insignia® System Customized Brackets and Archwires

Abstract

Introduction: *Correction of bimaxillary protrusion is challenging, particularly without orthognathic surgery and/or temporary anchorage devices. A viable option is bimaxillary space closure following extraction of premolars in all four quadrants. This time consuming and technically challenging approach is facilitated with a digital custom appliance.*

Diagnosis: *A 12yr 6mo old boy presented with a chief complaint of lip protrusion. The diagnostic evaluation revealed a convex profile (15°), slight skeletal protrusion (ANB 83°, SNB 80°, ANB 3°), steep mandibular plane angle (FMA 33°), bimaxillary lip protrusion (3mm/5mm to the E-Line), flared incisors (18°/92°), excessive overbite (5mm), deep curve of Spee (4mm), and a Discrepancy Index (DI) of 20.*

Treatment: *All four first premolars were extracted and a customized appliance (Insignia® system), with self-ligating brackets and progressive archwires, was constructed by reverse engineering from a digital set-up. Extraction spaces were successfully closed in all four quadrants. There were two minor molar alignment problems and inadequate lingual torque expression on the UL1. All of these discrepancies were attributed to undetected errors in the digital set-up. Active orthodontic treatment was accomplished in 13 appointments over 19 months.*

Outcomes: *Excellent dental alignment and esthetics were documented with a Cast-Radiograph Evaluation (CRE) of 21, and a Pink & White Esthetic Score of 5. Compared to about 36 months for conventional extraction treatment of bimaxillary protrusion, the Insignia® appliance provided an almost 50% decrease in treatment time (19 months). The patient and his parents were pleased with the dental alignment, facial esthetics and relatively short treatment time.*

Conclusion: *The Insignia® digital appliance is very accurate, and precisely aligns the dentition according to the digital set-up, but torque compensations are required for mechanics that significantly move the roots of teeth. With correct treatment planning, the outcomes are enhanced by minimal treatment adjustments, thereby producing fewer therapeutic lag phases due to PDL necrosis. Thus decreased treatment time is due to continuous low force mechanics with few adjustments. (Int J Orthod Implantol 2017;48:50-70)*

Key words:
Insignia® system, customized passive self-ligating bracket, digital set-up, bimaxillary protrusion, extraction of premolars, incisor retraction, bite turbos, early light short elastics, decreased treatment time, lag phase due to PDL necrosis

Introduction

Bimaxillary dentoalveolar protrusion is a common Asian dentofacial anomaly that results in both functional and esthetic problems. Patients with a moderate to severe protrusion are candidates for orthodontics, extractions and orthognathic surgery, to improve the facial profile.[1] Extraction of all four first premolars followed by retraction of the anterior segments with maximal anchorage mechanics is a common treatment

Dr. Charlene Chang,
Lecturer, Beethoven Orthodontic Course (Left)
Dr. Angle Lee,
Director, Beethoven Orthodontic Center
Editor, International Journal of Orthodontics & Implantology (Center left)
Dr. Chris Chang,
Founder, Beethoven Orthodontic Center
Publisher, International Journal of Orthodontics & Implantology (Center right)
Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)

for the correction of bimaxillary protrusion.[2-4] However, the differential anchorage value of posterior segments,[4-5] and variable growth potential of adolescents contribute to the unpredictability of many orthodontic and surgical approaches for correcting protrusion.[6-12]

One-size-fits-all straight wire appliances rarely produce a precisely finished final result without substantial finishing effort: bracket repositioning and detail bends in archwires. Standard pretorqued and preangulated brackets are designed for average teeth and minimal root movement. Thus, substantial clinical compensation

Fig. 1: Pre-treatment facial and intraoral photographs

via bracket repositioning and detailing bends is required for a precise final alignment despite variations in tooth-surface morphology, manual errors in the direct bonding process, and root movement mechanics.[6-12] Using advanced digital technology, the Insignia® System (*Ormco, Glendora, CA*), introduced in 1987 by Dr. Craig Andreiko, involves two components: (*1*) Insignia Approver® a three-dimensional (*3D*) real-time software for virtual treatment planning with torque compensations, and (*2*) a Custom Fixed Appliance consisting of brackets, placement jigs, and archwires. The customized design of the appliance for the specific correction planned greatly decreases detail bends and bracket rebonding, which results in less traumatic mechanics and improved treatment efficiency.[13]

Closing extraction spaces, without producing undesirable side effects, continues to be a challenging process in orthodontics, even with an advanced digital set-up.[14-18] Details in biomechanics must be carefully anticipated to provide appropriate torque compensations. This case report presents an adolescent patient with a bimaxillary protrusion treated with premolar extraction and space closure utilizing a digital Insignia® system appliance. No temporary anchorage devices (*TADs*)[7] were used.

Etiology and Diagnosis

A 12 years 6 month male presented to Beethoven Orthodontic Center in Hsinchu City, Taiwan, with a chief complaint of lip protrusion (*Figs. 1-4, Table 1*). He had a very convex profile (*15°*) and protrusive lips (*3mm/5mm to the E-Line*). There was no contributory medical or dental history. Sagittal skeletal

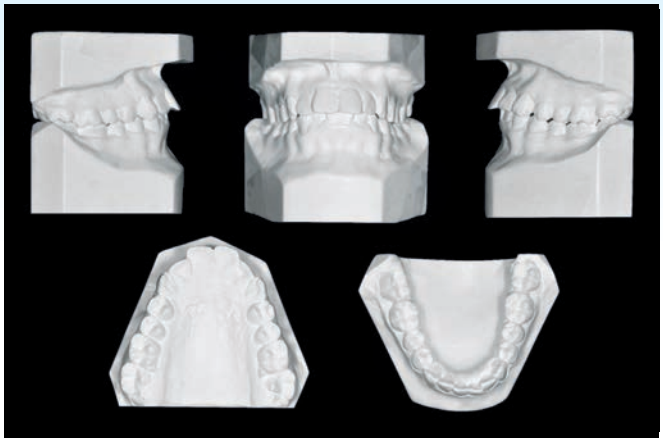


Fig. 2: Pre-treatment study models (casts)

Fig. 3:
Pre-treatment panoramic radiograph shows both condylar heads outlined in red.

Fig. 4: Pre-treatment cephalometric radiograph

relationships (*SNA 83°, SNB 80°, ANB 3°*) were within normal limits (*WNL*), but the mandibular plane was steep (*SN-MP 40°, FMA 33°*). Lower facial height (*%FH 53.6%*) was WNL. There was no significant skeletal asymmetry, nor signs or symptoms of temporomandibular disorder (*TMD*).

An intraoral examination showed that the maxillary dental midline was coincident with the facial midline, but the mandibular midline was 0.5mm to the left. In the absence of a significant skeletal discrepancy, bimaxillary dental protrusion was consistent with the cephalometric analysis of the lips to the E-Line (*3mm/5mm*). The upper incisors were tipped labially (*U1 to NA 7mm, U1 to SN 118°*), as were the mandibular incisors (*L1 to NB 8mm, L1 to MP 92°*). The American Board of Orthodontics (*ABO*) discrepancy index (*DI*) was 20 points, as shown in the supplementary Discrepancy Index (*Worksheet 1*).

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	83°	84°	1°
SNB° (80°)	80°	80°	0°
ANB° (2°)	3°	4°	1°
SN-MP° (32°)	40°	39.5°	0.5°
FMA° (25°)	33°	32.5°	0.5°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	7 mm	0 mm	7 mm
U1 To SN° (104°)	118°	103°	15°
L1 To NB mm (4 mm)	8 mm	3.5 mm	4.5 mm
L1 To MP° (90°)	92°	82°	10°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	3 mm	0 mm	3 mm
E-LINE LL (0 mm)	5 mm	1 mm	4 mm
%FH: Na-ANS-Gn (53%)	53.6%	53.7%	0.1%
Convexity: G-Sn-Pg' (13°)	15°	13°	2°

■ Table 1: Cephalometric summary

Treatment Objectives

The following treatment objectives were determined:

1. Correct lip protrusion.
2. Decrease the inclination of the incisors to the apical base of bone.
3. Establish ideal overjet and overbite.
4. Correct the slight mandibular midline discrepancy.
5. Resolve the crowding in both arches.
6. Establish Class I molar and canine relationships.

Treatment Plan

Extract all first premolars and install the digitally designed (*Insignia*) fixed appliance utilizing Damon Q® passive self-ligating (*PSL*) brackets (*Ormco, Glendora, CA*). All archwires, auxiliaries and elastics were produced by the same company, unless otherwise specified.

Maximally retract the anterior segments to resolve dental protrusion. Correct the curve of Spee as well as the axial inclination of the incisors. If further retraction is required, install bilateral infrazygomatic crest (*IZC*) bone screws to serve as anchorage to further retract both arches. Detail and seat the final occlusion with vertical elastics as needed.

Digital Set-Up

(1) Vertical:

- Upper: *Extrude incisors 1mm*
- Lower: *Intrude incisors 2mm, and correct the curve of Spee*
- Anterior overbite: *Set to 1.5mm (interlabial surface dimension)*

(2) Extract upper and lower first premolars.

(3) A/P movement and space closure:

- UR6, LR6, UL6: *Move 3mm mesially*
- LL6: *Move 4mm mesially*
- Close Extraction Spaces: *Equal and opposite (50%-50%) movement of the anteriors and posteriors (Fig. 5)*

(4) Incisor Crown Torque:

- Upper: *Decrease 9 degrees*
- Lower: *Increase 3 degrees*

* **Note**: Closing extraction spaces decreases the axial inclination of the anterior teeth, so both upper and lower incisors require ~5° more positive torque. Upper incisor crown torque was reduced from 118° (*pre-treatment*) to 109° (*standard 104°+over-correction 5°*). The lower incisor torque was increased from 92° (*pre-treatment*) to 95° (*standard 90°+over-correction 5°*).

(5) Midline correction:

- Move the lower midline 0.5mm to the right to coincide with the upper midline (*Fig. 5*).

(6) Archwire Plane:

- Set to the center of the upper and lower central incisors.

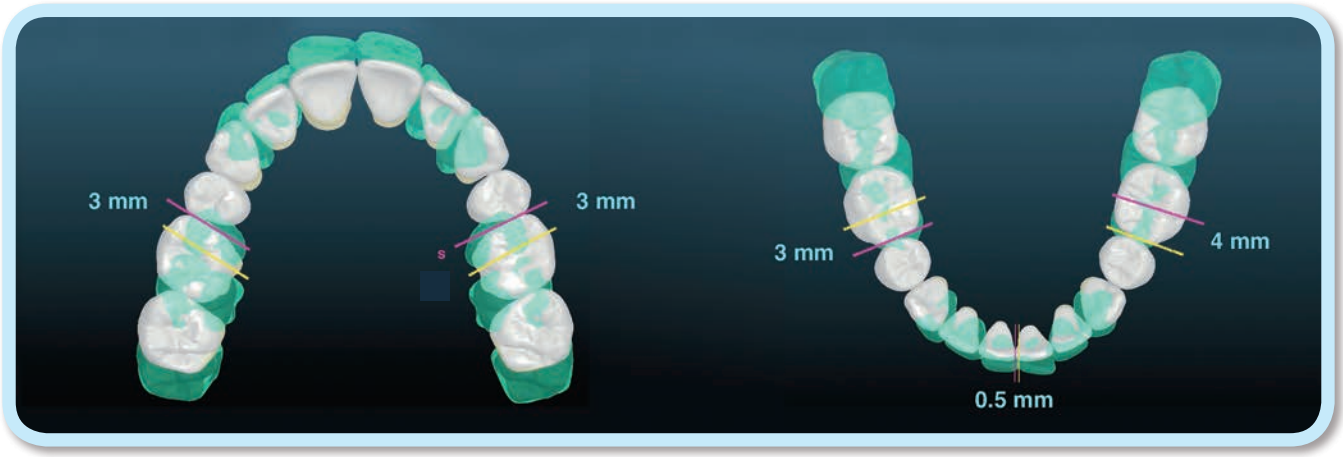


Fig. 5:
Digital set-up prescribes the relative movement in the occlusal plane, including incisal retraction and space closure. White teeth are the desired post-treatment alignment. Green teeth are the pre-treatment dentition. The yellow lines mark the pre-treatment mesial surfaces of the first molars and lower midline. Pink lines are the post-treatment mesial surfaces of the first molars and lower midline.

Right buccal segment: Move tooth UR6 and LR6 3mm mesially.

Left buccal segment: Move teeth UL6 3mm mesially, and LL6 4mm mesially. Close all spaces using 50%-50% movement of anteriors and posteriors. Move the lower midline 0.5mm to the right.

Treatment Progress

Two months following extraction of all four first premolars, all teeth were bonded with an Insignia® digitally-designed 0.022-in custom fixed appliance with Damon Q® self-ligating brackets on all permanent teeth. All treatment and sequencing details are shown in Table 2 and Figs. 6-10. All fixed appliances were removed after 19 months of active treatment.

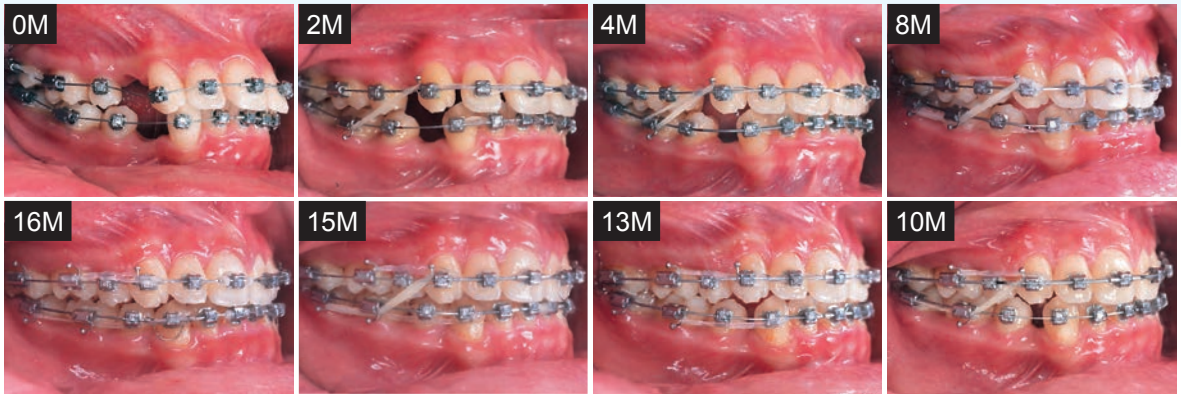


Fig. 6:
A series of right buccal view photographs shows progress from the start of treatment at zero months (0M) to sixteen months (16M) in clockwise order.

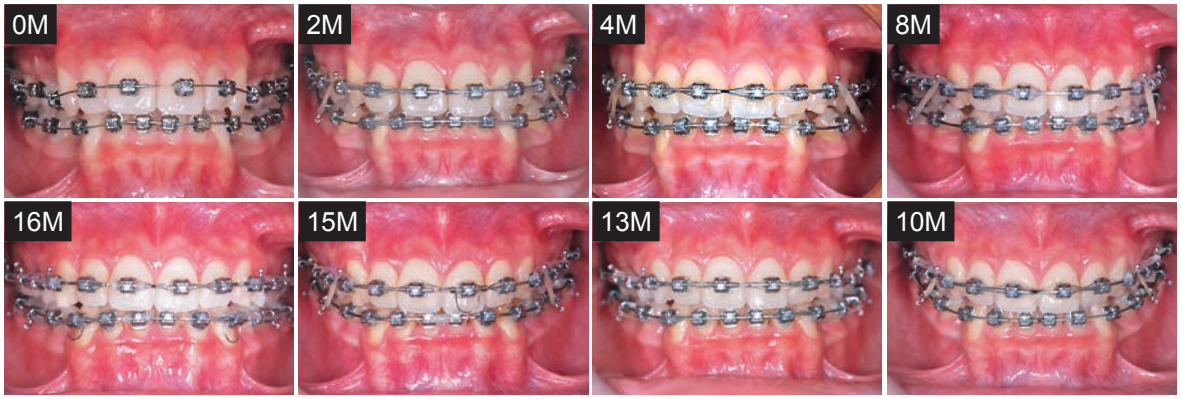


Fig. 7:
A series of frontal view photographs shows progress from the start of treatment at zero months (0M) to sixteen months (16M) in clockwise order.

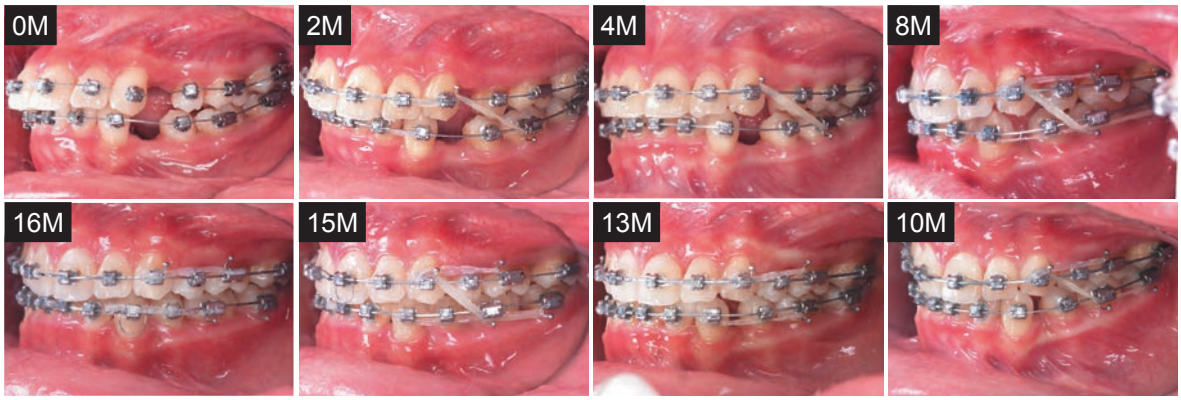


Fig. 8:
A series of left buccal view photographs shows progress from the start of treatment at zero months (0M) to sixteen months (16M) in clockwise order.

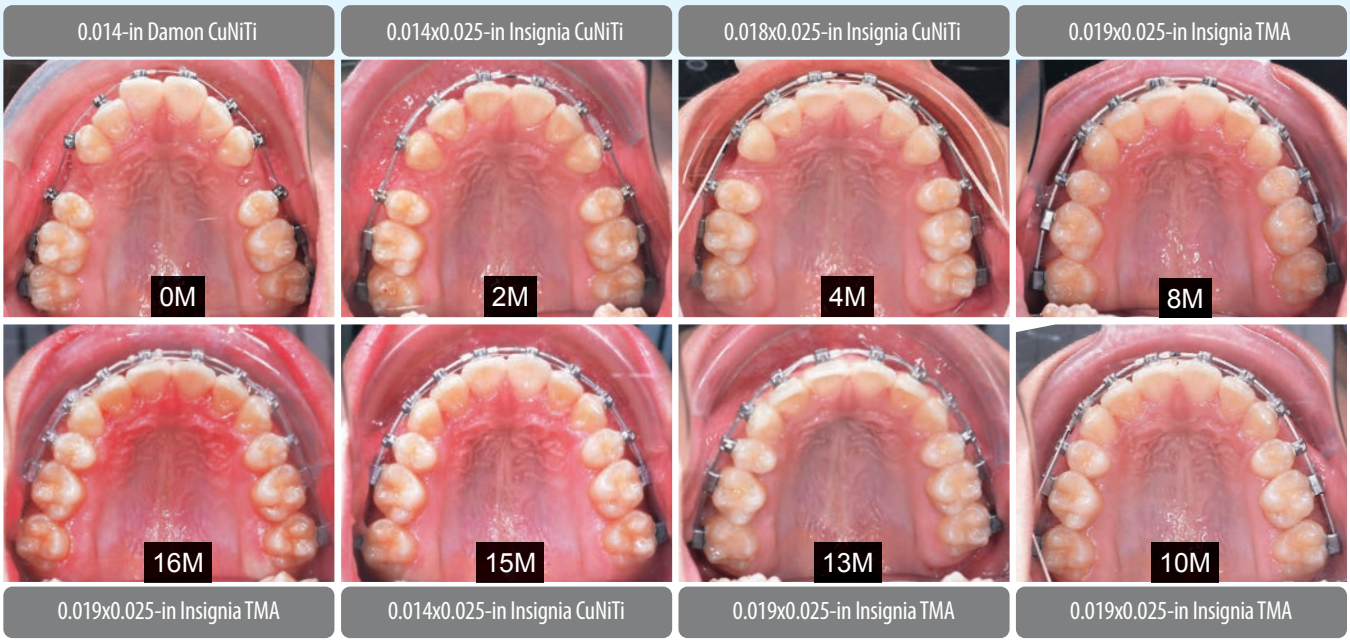


Fig. 9:
A series of upper occlusal view photographs shows progress from the start of treatment at zero months (0M) to sixteen months (16M) in clockwise order.

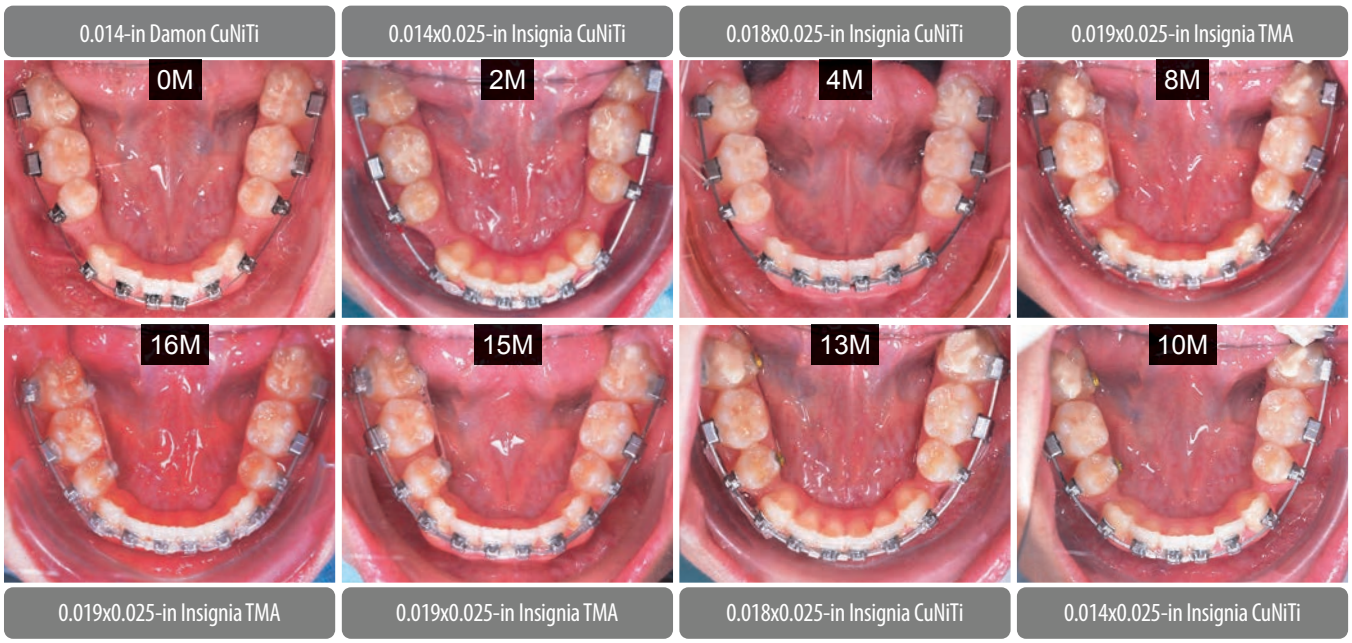


Fig. 10:
A series of lower occlusal view photographs shows progress from the start of treatment at zero months (0M) to sixteen months (16M) in clockwise order.

Appointment	Archwire	Notes
1 (*0 mo*)	U/L: 0.014-in Damon CuNiTi	• Disarticulation with posterior bite-turbos constructed with Fuji II® Type II Glass Ionomer cement (*GC America, Alsip IL*) on the occlusal surfaces of the L7s.
2 (*1 mo*)	U/L: 0.018-in Damon CuNiTi	
3 (*2 mo*)	U/L: 0.014x0.025-in Insignia CuNiTi	• Start early light short Class II elastics (*Quail, 3/16-in, 2-oz*) from U3s to L6s to retract maxillary anteriors (*Figs. 6-8, 2M*).
4 (*4 mo*)	U/L: 0.018x0.025-in Insignia CuNiTi	• Maxillary anterior teeth were tied together with an 0.010-in stainless steel ligature wire (*Figs. 7-4M, 9-4M*), and retracted with Class II elastics (*Fox, 1/4-in, 3.5-oz*) from U3s to L6s.
5 (*6 mo*)		• Rebonded the UR2 bracket to a more mesial position for mesial-in correction.
6 (*8 mo*)	U/L: 0.019x0.025-in Insignia TMA	• All the extraction spaces were closed with pre-stretched power chains. • Class II elastics (*Fox, 1/4-in, 3.5-oz*) were used from U3s to L6s and L7s to add a more horizontal vector to retract the upper anteriors and to protract the lower posteriors. • Lingual buttons were applied on LR5 and LR7. Power chains protracted the LR7 (*Fig. 10-8M*).
7 (*10 mo*)	U/L: 0.019x0.025-in Insignia TMA	• Rebonded the LL2 bracket to a more mesial position for mesial-in correction (*Fig. 10-10M*).
8 (*13 mo*)	U/L: 0.019x0.025-in Insignia TMA	
9 (*14 mo*)	U/L: 0.014x0.025-in Insignia TMA	• Rebonded the UR6 bracket to a more mesial position for mesial-in correction.
10 (*15 mo*)		• The incisal edges of UL1 were not well aligned with the UR1 because of insufficient lingual crown torque. A torquing spring (*auxiliary*) was used to correct the problem (*Fig. 7-15M*). • First order in-and-out bends were also applied to the LL2 and LR2 to correct the mesial-in rotations (*Fig. 10-15M*).
11 (*16 mo*)	U: 0.019x0.025-in Insignia TMA L: 0.019x0.025-in Insignia TMA	• First order in-and-out bends were applied to the UR2 and all 3s to correct the mesial-in rotations. • Third order bend (*twist bend: -10°*) was also applied on UL1 to enhance the lingual crown torque. • Two torquing springs were used at LR3 and LL3 to decrease buccal root torque (*Fig. 7-16M*).
12 (*18 mo*)		• The Class II elastics (*Fox, 1/4-in, 3.5-oz*) were changed to triangle intermaxillay elastic (*Chipmunk, 1/8-in, 3.5-oz*) from UR5 to LR5 and LR6 to settle the right occlusion.
13 (*19 mo*)		• All appliances were removed. Anterior fixed retainers were bonded on all mandibular canines and incisors (*3-3*). Removable clear overlay retainers were delivered for both arches, and the patient was instructed to wear them full time for the first 6 months and nights only thereafter. Instructions were provided for home hygiene and maintenance of the retainers.

■ Table. 2: Treatment Sequence.

Treatment Results

The patient was treated to the desired result and the post-treatment records show remarkably improved facial esthetics due to the harmonious relationship of the upper and lower lips. Overjet was corrected to 0mm and the overbite was reduced from 5 to 1.5mm. Bilateral Class I canine and molar relationships were achieved (*Figs. 11 and 12*). The post-treatment panoramic radiograph shows complete space closure with acceptable root parallelism and no significant periodontal bone loss or root resorption (*Fig. 13*).

The cephalometric analysis of tracings superimposed on the anterior cranial base (*ACB*) revealed substantial vertical and anterior growth. Substantial anterior growth of the maxilla produced a 1° increase in the SNA

Fig. 11: Post-treatment facial and intraoral photographs

Fig. 12: Post-treatment study models (casts)

Fig. 13:
Post-treatment panoramic radiograph shows both condylar heads outlined in red.

Fig. 14: Post-treatment cephalometric radiograph

and ANB angles to 84° and 4°, respectively. Extensive incisor retraction (*7.0mm/4.5mm*), resulting in a 2° decrease in facial convexity to an ideal 13° (*Figs. 14-15 and Table 1*).

Clockwise rotation of the occlusal plane was related to correction of the deep curve of Spee. Despite substantial retraction of the upper and lower incisors (*7.0mm/4.5mm respectively*), torque control of the maxillary incisors was near ideal (*U1-SN 103*°), but the lower incisors were tipped distally about 8° (*L1 to MP 82*°). A portion of this problem reflected an error in the initial digital set-up (*Fig. 16*), but the major aspect of the discrepancy was compensation associated with space closure mechanics. Additional incisor retraction was required to offset protrusive maxillary growth (*Fig. 15*). Torque compensations were required to optimize overbite and overjet. Despite the protrusive growth pattern, space closure and dental compensations produced excellent facial esthetics (*Fig. 11*), which was the patient's chief complaint.

The ABO Cast Radiograph Evaluation (*CRE*) score was 21 points (*Worksheet 2*). Significant CRE discrepancies occurred relative to the UR6, which is thought to be due to rotations that were not detected prior to approving the digital set-up (*Fig. 16*). The dental esthetics were excellent as documented by the Pink and White dental esthetic index of 5 (*Worksheet 3*). Post-treatment clinical evaluation revealed no significant signs or symptoms of TMD, tooth mobility, loss of vitality, generalized root resorption, or periodontal compromise.

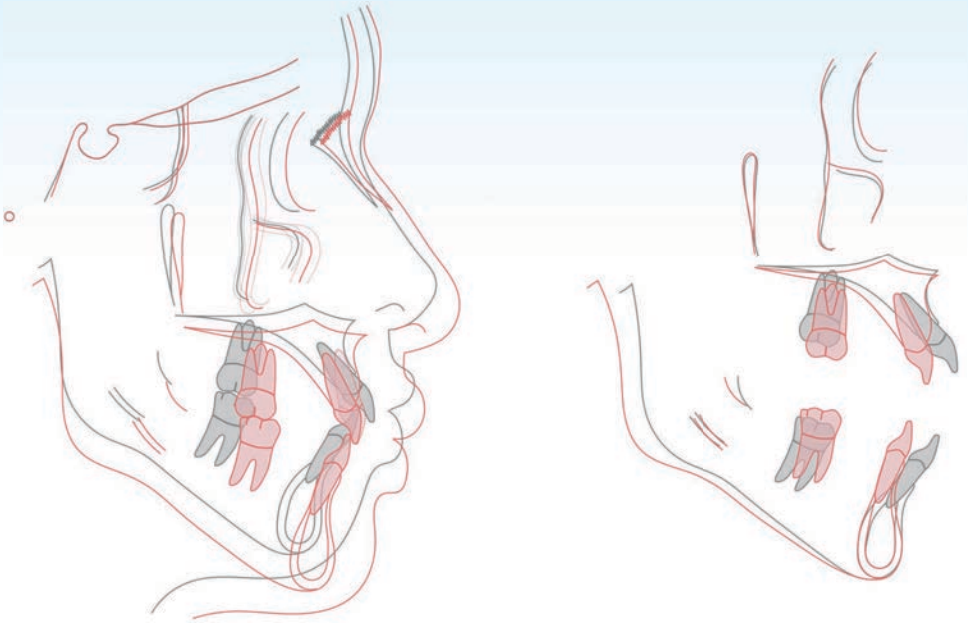


Fig. 15:
Superimposed cephalometric tracings show the dento-facial changes during treatment. Black line and gray-shaded teeth are the pre-treatment tracing, and the red line and pink shaded teeth are the post-treatment tracing. The red dotted maxillary incisor is the post-treatment position of UL central incisor with a labially positioned root. The tracings superimposed on the anterior cranial base (left) show the significant facial growth that occurred during treatment. The superimposed maxillary (upper right) and mandibular (lower right) tracing show the retraction and extrusion of the dentition in both arches. The combination of incisal retraction and anterior displacement of the E-Line resulted in decreased lip protrusion. See text for details.

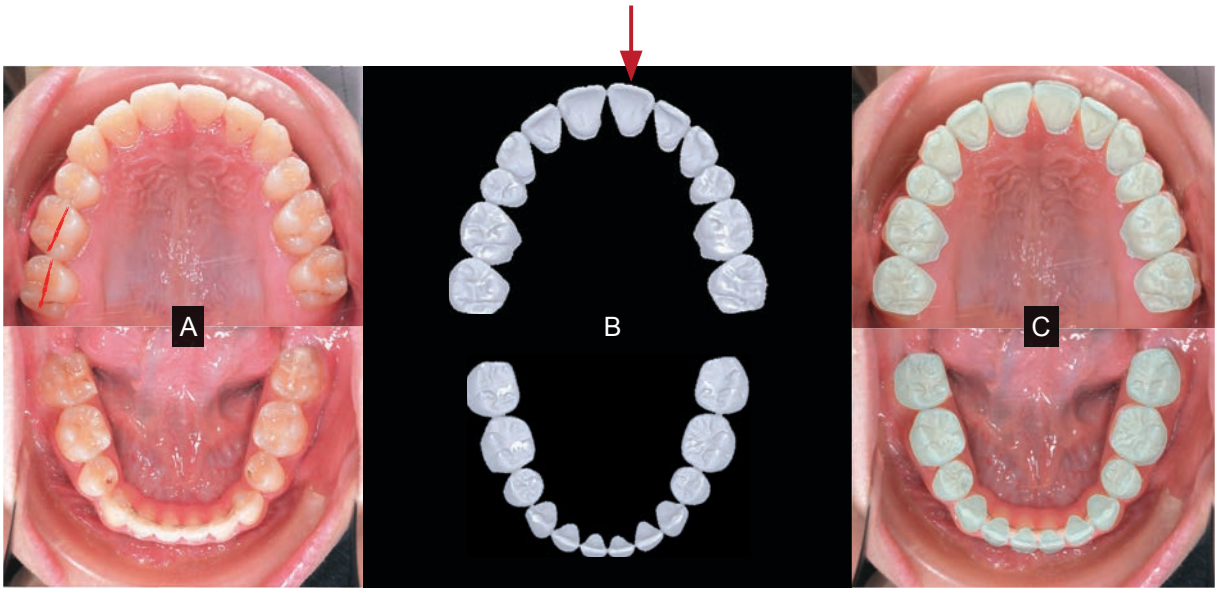


Fig. 16:
The actual treatment results (A) are compared with the digital set-up (B), and both occlusal views (A & B) are superimposed to show any discrepancies (C). The red lines in A show minor rotational problems. Note that the upper left dental central incisor (red arrow in B) is slightly out of alignment consistent with the more labial root position shown in Figure 15. See text for details.

Discussion

Bimaxillary Dentoalveolar Protrusion

Major Principles of Treatment: The goals for correction of bimaxillary protrusion include retraction and decreased axial inclination of both the maxillary and mandibular incisors. Space closure of premolar extraction spaces typically results in a decrease in the soft tissue prominence of the lips and facial convexity. Extraction of four first premolars followed by the retraction of the anterior segments in both arches is an evidence-based approach for correcting incisor protrusion, excessive axial inclination (*proclination*), and protrusive lips.[2,3]

Incisor Retraction: For Class I bimaxillary protrusions, the amount of incisor retraction is expected to be about the same for both arches. However, the anchorage value for the upper molars is less than in the lower arch because of the deceased bone density in the maxilla compared to the mandible.[4] Also the PDL distraction of the leading roots of lower molars forms dense cortical bone that the trailing roots must resorb.[5] Therefore, maximum anchorage of maxillary molars is usually required. Bills, Handelman and BeGole[2] studied the effects of orthodontic correction with maximum anchorage in 48 ethnically diverse bimaxillary protrusion patients. They reported the mean retraction of upper and lower incisors was 5.2 and 3.2mm, respectively. Chen et al.[6] compared the treatment outcomes of self-ligating brackets with micro-implant and headgear anchorages in 31 adults with bimaxillary protrusion; upper incisor retraction was 8.37mm using micro-implant anchorage, and 6.63mm with headgear anchorage.

The current patient was fitted with customized passive self-ligating brackets, and the upper incisors were retracted about 7mm without additional mechanical supplements such as molar bands, transpalatal arch bars, extra-oral headgear, or temporary anchorage devices. The Insignia® system reverse engineers the bracket slot for each tooth to facilitate initial alignment and leveling. Precisely placed custom brackets accelerate alignment to a full-sized rectangular archwire and require few if any detailing adjustments. This efficient approach decreases treatment time and anchorage loss because it controls repetitive PDL necrosis.[13]

Digital Orthodontics: Accuracy, Effectiveness, and Efficiency

The Insignia® System provides a precise virtual set-up of the desired final alignment. However, it is critical for the clinician to carefully examine the digital set-up, and provide torque compensations based on root movement anticipated. Once the clinician has approved the final set-up in 3D, bracket customization and placement are reverse-engineered back to the pre-treatment malocclusion.[13] The use of patient-specific brackets, indirect bonding transfer devices (*jigs*), and customized archwires decrease chairside time and treatment duration to more efficiently produce the desired final alignment.[14-17]

Weber et al.[14] provided comprehensive treatment for 35 patients with the Insignia® system and compared them with 11 conventionally treated cases, in terms of the quality of the result and treatment time. The Insignia® patients were treated to a significantly

lower (*better*) American Board of Orthodontics (*ABO*) Cast-Radiograph Evaluation (*CRE*) score, and the mean treatment time was significantly shorter (*14.23 months vs. 22.91 months, respectively*).

Closing extraction spaces is challenging clinical mechanics. Figures 11-15 document the successful closure of four first bicuspid extraction spaces with a total of 13 visits over 19 months. The final alignment of the dentition in 3D corresponded well with the virtual set-up (*Fig. 16*), except for a few minor discrepancies for the following teeth: UR6, UL1, UL3, and lower incisors. These finishing details are similar to a previous report by Brent, Cristopher and Thorsten.[18] Although the present result (*Figs. 11-15*) required some bracket repositioning and wire-bending during the finishing stage, the clinicians felt the effort involved was considerably less than for most conventionally treated patients, and the the treatment duration was ~50% less. The current patient and his family were well satisfied with the treatment results, and appreciated the benefits of the digital orthodontic appliance because the treatment time was shorter than they expected (*~36 months*).

Three Keys for Correcting Bimaxillary Protrusion with Insignia®

Customized brackets, reverse engineered from a digital set-up, are powerful technology that is very exacting. However, the clinician must visualize the treatment process to anticipate specific compensations to optimize the efficiency of the treatment process.

Key1: Anterior torque compensation

The Insignia® system supplies the interactive software and virtual set-up for clinicians to predict the treatment results so that mechanics "*begin with the end in sight.*" However, there are biologic and physical factors that can affect the axial inclinations of the anterior teeth during and after space closure. Compensations are required to achieve an actual treatment outcome that is comparable to the virtual set-up:

(1) **Extraction Spaces**: The axial inclination of the incisors in both arches requires anchorage (*mesial movement of the buccal segments*) for lingual tipping of the crowns of the teeth or torquing of the roots. Anchorage value of adjacent teeth and resistance to space closure are affected by the size and location of the spaces in each arch. Extraction patterns to reduce bimaxillary protrusion may involve first (*4*) and second (*5*) premolars in the upper (*U*) and lower (*L*) arches. For Class I patients, with no anchorage support for the upper arch (*TADs, headgear*), it is unwise to extract four first premolars (*U4s and L4s*) because more rapid loss of maxillary anchorage during space closure usually results in a Class II molar relationship, which requires additional mechanics and treatment time; U4s and L5s is a preferable approach. If maximal retraction is required, and there is supplemental posterior maxillary anchorage, all four 4s is preferable. Physiologic rationale must be applied for a realistic Insignia® treatment plan. Maxillary premolar spaces

close at a high rate (*1-2mm/mo*) because the buccal segments are susceptible to rapid anchorage loss.[4,19,20] Overbite may be adequate anchorage to close maxillary posterior spaces by protracting the buccal segments.[19] However, mandibular posterior segments have much greater anchorage value than maxillary posterior segments.[5] Relatively rapid mesial movement (*~0.8mm/mo*) is noted for the first 8 months of space closure, but then slows dramatically to ~0.33mm/mo, as the trailing roots engage the dense cortical bone produced by PDL distraction of the leading roots.[5]

(2) **Differential Space Closure Mechanics and Anchorage Selection**: Frictionless (*closing loop mechanics*) or friction-prone (*sliding mechanics*) is an important consideration. Anchorage supplementation with TADs or headgear, and the type of elastics (*Class II or Class III*) planned, are all determining factors for differential anterior torque compensations. If TADs are used to support posterior anchorage, additional torque compensation is required because the incisors will be retracted further. Overall, the torque supplement for the incisor brackets in the digital set-up is directly related to the amount of retraction (*root movement*) planned.

(3) **Original Pattern of Malocclusion**: The amount of incisal torque is inversely related to crowding, but directly related to lingual tipping of the incisors and the depth of the curve of Spee. Torque compensations for mechanics that tend to tip incisors are essential for achieving ideal treatment results.

For treatment planning of the present patient (*Fig. 5*), the digital set-up was supplemented with 3° of lingual root torque. But the final inclination of the lower anteriors was inadequate due to the anterior growth of the jaws and the correction of the deep curve of Spee. In retrospect, a torque supplement of ~10° was warranted because the extraction space was anterior in the mandible (*L4s extracted*), mandibular molars have very high anchorage value,[5] and the curve of Spee was deep (*4mm*) (*Fig. 17*). Excessively retracted lower incisors were an unexpected sequelae that was compensated with torquing auxiliaries during finishing; however, the latter should not be used for more than 3 months. Torquing springs are superior to third order bends in customized wires because insertion of adjusted wires into a custom bracket system can be unpredictable and ineffective.[21]

In retrospect, the root axes between the upper central incisors were not parallel in the original set-up, which is difficult to detect with 2D radiograph and the crown images in the occlusal view of the virtual set-up (*Figs. 18-A&B*). Digital alignment technology is improved with a 3D parametric model to detect the shape and volume of dental roots.[22] In early 2017, TruRoot™ data was introduced for the Insignia® system, which combines CBCT imaging with intraoral scanner or impression data to simulate the actual crown and root anatomy, allowing clinicians to better visualize and predict tooth movement and alignment (*Fig. 18-C*). Unfortunately, this new technology was not available when the current patient was treated.

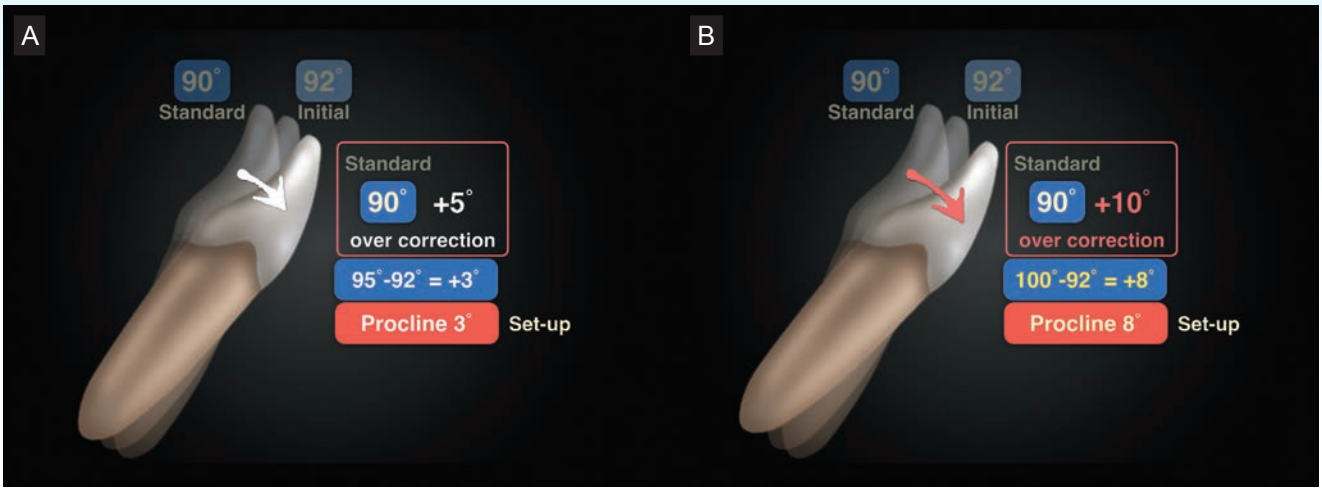


Fig. 17:

Incisor torque compensations are a critical treatment planning consideration that supplements the digital set-up: A. The original set-up for torque over-correction was 5°. B. The specific mechanics required for this growing patient that required first premolar extractions was an addition 5°. Thus, the overall torque over-correction was 10°. The additional torque control was needed because of the anterior positioning of the extraction space and less proclined incisors. See text for details.

Fig. 18:

A. Apical view of the upper digital set-up is rarely used in the pre-treatment planning, but it may be useful for specifying the torque compensation if a discrepancy is not apparent in the occlusal view. The red arrow shows correct torque for the UR1, compared to what appears to be a minor discrepancy on the adjacent central incisor (UL1). B. An intraoral photograph shows the post-treatment torque discrepancies between the maxillary central incisors, and the UL1 root is more prominent (white arrow). C. With additional data from panoramic radiography, CBCT (ex: i-CAT), intraoral scanner, and/or an impression, a 3D images of each root can be constructed. (Illustration C from Dr. Angle Lee's presentation: Increasing Simulation Accuracy of Insignia by CBCT. CC429, newtonsa0301, YouTube™)

Key2: Disarticulation and Early Light Class II elastics

Bite turbos (*occlusal prematurities used to increase the intermaxillary space*) are very useful early in treatment for opening a deep overbite, as well as for leveling a deep curve of Spee to prevent interferences with lower brackets.[23,24] Advantages of bonded bite turbos are: (*1*) no patient cooperation is required, (*2*) it is a full-time alteration of the occlusion, and (*3*) they are easy to bond and remove. Bite turbos are constructed with glass ionomer cement, composite resins or self-curing acrylic resins. To solve Class II occlusions with excessive overjet, early light short elastics can be used in the initial leveling and alignment stage to simultaneously retract the anterior segment, decrease incisor proclination and correct the overjet.

Key3: Archwire selection for space closure

Space closure with a stock Damon Q® bracket appliance usually requires bending a reverse curve of Spee in a lower archwire made with a material such as an 0.016x0.025-in stainless steel (*Fig. 19*). Appropriate treatment planning during the digital set-up eliminates wire bending with the Insignia® system. Following the recommended wire sequence, either an 0.019x0.025-in stainless steel or 0.019x0.025-in Insignia® TMA wire can be used for optimal space closure without bending a reverse curve of Spee.[13] Use of a full-size archwire is designed to prevent tipping when closing spaces (*Fig. 20*).

After all the extraction spaces have been closed, full-sized 0.021x0.025-in CuNiTi or TMA wires are

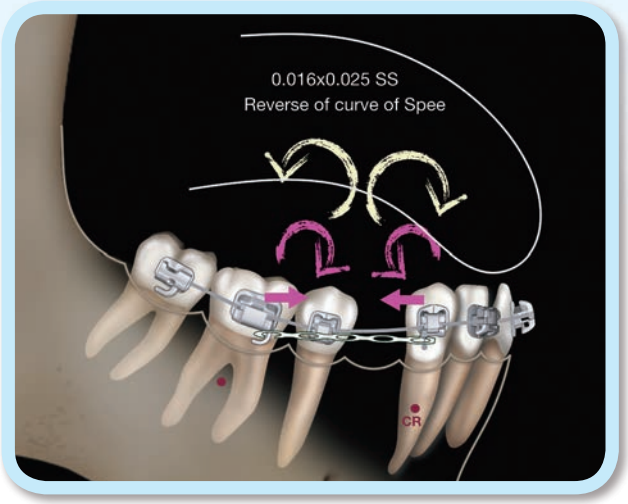


Fig. 19:
An 0.016x0.025-in stainless steel (SS) archwire with a reverse curve of Spee is an ideal configuration for space closure in the lower arch. Note that the moments (magenta equal and opposite curved arrows) produced by the space closure forces (magenta arrows) are offset by the equal and opposite moments (yellow circular arrows) due to the reverse curve of Spee.

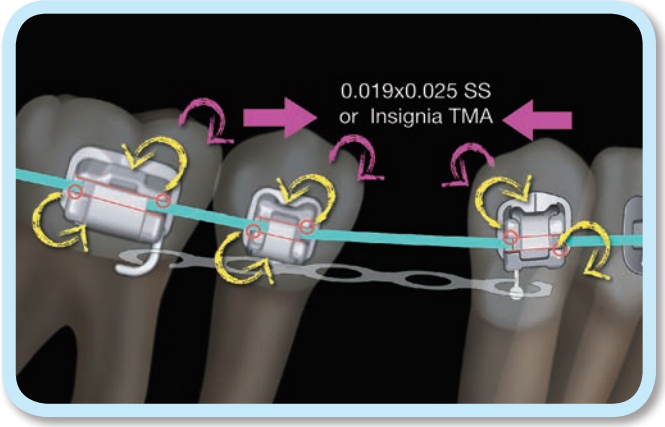


Fig. 20:
A large rectangular archwire (green line) such as an 0.019x0.025-in stainless steel (SS) or Insignia® TMA more completely fills the bracket slots resulting in more predictable space closure. This configuration decreases the play between the bracket and the wire. Space closure force (magenta arrows) produces equal and opposite moments (magenta curve arrows) to translate rather than tip the teeth. During space closure, the load is transferred from the archwire to the brackets by equal and opposite moments (couples) that are produced at the ends of each bracket (yellow curved arrows).

recommended to adjust the final rotation, tip, and torque for all teeth. However for the current patient, only a 0.019x0.025-in TMA wire was used in the finishing stage. To compensate for the unexpected growth response, detailing bends and torque springs were required during the last month. A subsequent full-size archwire would have been helpful for avoiding some of the finishing problems.

Soft Tissue Evaluations and Changes

Facial esthetics with regard to orthodontic treatment mainly focuses on profile convexity (*G-Sn-Pg'*) and lip protrusion relative to the nose-chin plane (*Rickett's E-Line*).[25] Ideal facial convexity is a G-Sn-Pg' angle of 13 degrees (*Table 1*). However, protrusive lips to the E-Line are unfavorable for all variations of facial divergence, particularly for males.[26]

Several factors[7,8] are associated with correcting lip protrusion:

1. Incisal edge retraction
2. Pre-treatment thickness of soft tissue at the subnasale (*lip-nose junction*), lips and mental (*chin*) areas because thinner tissue tends to retract more.
3. Nasal and chin growth during treatment is favorable because lips appear flatter as the the E-Line is positioned more anteriorly.

The current successful treatment for bimaxillary lip protrusion and convex profile was attributed to incisal retraction, as well as to favorable (*anterior*) growth of the nose and chin to anteriorly reposition the E-lIne. Accurate diagnosis, a well planned treatment sequence, and a favorable extraction pattern produced a favorable "*start-to-finish*" outcome that was highly predictable.

Conclusions

1. Extraction of all four first premolars and symmetrical space closure result in maximal incisor and lip retraction for resolving bimaxillary dentoalveolar protrusion.
2. Space closure in all four quadrants is challenging clinical mechanics.
3. The Insignia® system is a well designed digital appliance that features a virtual treatment plan, customized brackets, and sequenced archwires.
4. Anchorage is preserved so that incisors are retracted and aligned into a favorable finished occlusion, without using TAD supplemented anchorage.
5. The 3 keys to success with digitally engineered mechanics are precise estimation of anterior torque compensations, use of auxiliaries as prescribed, and careful adherence to the recommended archwire sequence.

References

1. Chu YM, Chen YR. Bimaxillary protrusion: an overview of the surgical-orthodontic treatment. Seminars in Plastic Surgery 2009;23:32-39.
2. Bills DA, Handelman CS, BeGole EA. Bimaxillary dentoalveolar protrusion: traits and orthodontic correction. Angle Orthod 2005;75:333-9.
3. Tan TJ. Profile changes following orthodontic correction of

bimaxillary protrusion with a preadjusted edgewise appliance. Int. J Adult Orthod Orthognath Surg 1996;11:239–251.

4. Sandusky Jr. WC. Orthodontic anchorage. Am J Orthod 1951;37(11):858-866.
5. Roberts WE, Arbuckle GR, Analoui M: Rate of mesial translation of mandibular molars using implant-anchored mechanics. Angle Orthod 1996;66(5):331-338.
6. Chen M, Li ZM, Liu X, Cai B, Wang DW, Fenge ZC. Differences of treatment outcomes between self-ligating brackets with microimplant and headgear anchorages in adults with bimaxillary protrusion. Am J Orthod Dentofacial Orthop 2015;147:465-71.
7. Liaw JL, Roberts WE. Treatment of bimaxillary protrusion and facial asymmetry with extractions and interradicular TADs. Int J Orthod Implantol 2013;29:24-35.
8. Kook YA, Park JH, Bayome M, Sa'aed NL. Correction of severe bimaxillary protrusion with first premolar extractions and total arch distalization with palatal anchorage plates. Am J Orthod Dentofacial Orthop 2015;148:310-20.
9. Miethke RR, Melsen BE. Effect of variation in tooth morphology and bracket position on first and third order correction with preadjusted appliances. Am J Orthod 1999;116:329-335.
10. Germane N, Bentley BE, Isaacson RJ. Three biologic variables modifying faciolingual tooth angulation by straight-wire appliances. Am J Orthod 1989;96:312-319.
11. Bryant RM, Sadowsky PL, Hazelrig JB. Variability in three morphologic features of the permanent maxillary central incisor. Am J Orthod 1984;86:25-32.
12. Balut N, Klapper L, Sandrik J, Bowman D. Variations in bracket placement in the preadjusted orthodontic appliance. Am J Orthod 1992;102:62-67.
13. Lee SA, Chang CH, Roberts WE. Archwire sequence for Insignia: a custom bracket system with a bright future. Int J Orthod Implantol 2017;46:60-69.
14. Weber DJ, Koroluk LD, Phillips C, Nguyen T, Proffit WR. Clinical effectiveness and efficiency of customized vs. conventional preadjusted bracket systems. J Clin Orthod 2013;47:261-266. quiz 268.
15. Brown MW, Koroluk L, Ko CC, Zhang K, Chen M, Nguyen T. Effectiveness and efficiency of a CAD/CAM orthodontic bracket system. Am J Orthod Dentofacial Orthop 2015;148:1067-1074.
16. Scholz RP, Sarver DM. Interview with an Insignia® doctor: David M. Sarver. Am J Orthod Dentofacial Orthop 2009;136:853-856.
17. Antonio G, Edoardo S, Serena IP, Giulio AB. Individualized orthodontic treatment: The Insignia® system. Orthodontics (CHIC) 2013;14: 2-9.
18. Brent EL, Christopher JV, Thorsten G. Effectiveness of computer-assisted orthodontic treatment technology to achieve predicted outcomes. Angle Orthod 2013;83:557–562.
19. Roberts WE, Nelson CL, Goodacre CJ: Rigid implant anchorage to close a mandibular first molar extraction site. J Clin Orthod 1994;28(12):693-704.
20. Roberts WE. Bone physiology, metabolism and biomechanics in orthodontic practice. In: Orthodontics: Current Principles and Techniques. Chap 10. 5th ed. Graber LW, Vanarsdall RL Jr., Vig KWL (Eds). St. Louis: Elsevier Mosby; 2012. pp287-343.
21. Gerson LUR, Helder BJ. Understanding the basis of space closure in orthodontics for a more efficient orthodontic treatment. Dental Press J Orthod 2016 Mar-Apr;21(2):115-25.
22. Mazzotta L, Cozzani M, Razionale A, Mutinelli S, Castaldo A, Silvestrini-Biavati A. From 2D to 3D: construction of a 3D parametric model for detection of dental roots shape and position from a panoramic radiograph: a preliminary report. Int J Dent 2013; Epub 2013 Mar 11:1-8.
23. Philippe J. Treatment of deep bite with bonded biteplanes. J Clin Orthod 1996;30:396-400.
24. Jackson S, Sandler PJ. Fixed biteplanes for treatment of deep bite. J Clin Orthod 1996;30:283-7.
25. Hooman ZN, Seyed AAS, Elham E, Sepideh T. Esthetic evaluation of lip position in silhouette with respect to profile divergence. Am J Orthod Dentofacial Orthop 2016;149:863-70.
26. Jen S, Ming TC, Hwee BW. A comparative assessment of the perception of Chinese facial profile esthetics. Am J Orthod Dentofacial Orthop 2005;127:692-9.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 20

OVERJET

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

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

Total = 2

OVERBITE

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

Total = 2

ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth
then 1 pt. per additional full mm. per tooth

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 2

OCCLUSION

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

Total = 2

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP

≥ 38° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

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

Total = 4

OTHER (See Instructions)

Supernumerary teeth	_____ x 1 pt. =	_____
Ankylosis of perm. teeth	_____ x 2 pts. =	_____
Anomalous morphology	_____ x 2 pts. =	_____
Impaction (except 3rd molars)	_____ x 2 pts. =	_____
Midline discrepancy (≥3mm)	@ 2 pts. =	_____
Missing teeth (except 3rd molars)	_____ x 1 pts. =	_____
Missing teeth, congenital	_____ x 2 pts. =	_____
Spacing (4 or more, per arch)	_____ x 2 pts. =	_____
Spacing (Mx cent. diastema ≥ 2mm)	@ 2 pts. =	_____
Tooth transposition	_____ x 2 pts. =	_____
Skeletal asymmetry (nonsurgical tx)	@ 3 pts. =	_____
Addl. treatment complexities	4 x 2 pts. =	8

Identify: Close 4 extracted spaces without severe crowding + Deep curve of Spee

Total = 8

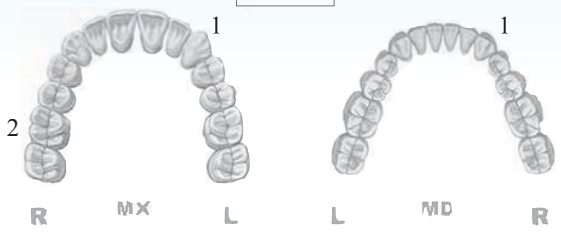
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 21

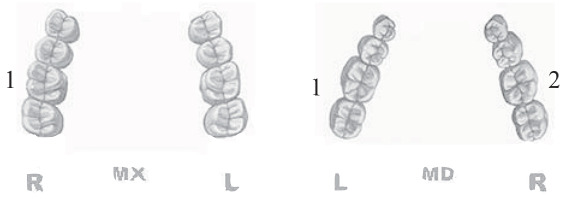
Alignment/Rotations

4



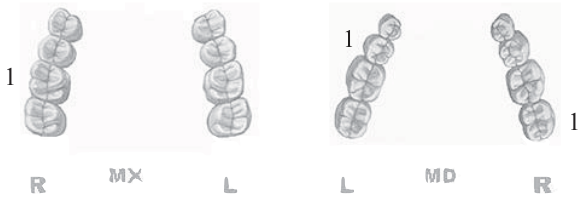
Marginal Ridges

4



Buccolingual Inclination

3

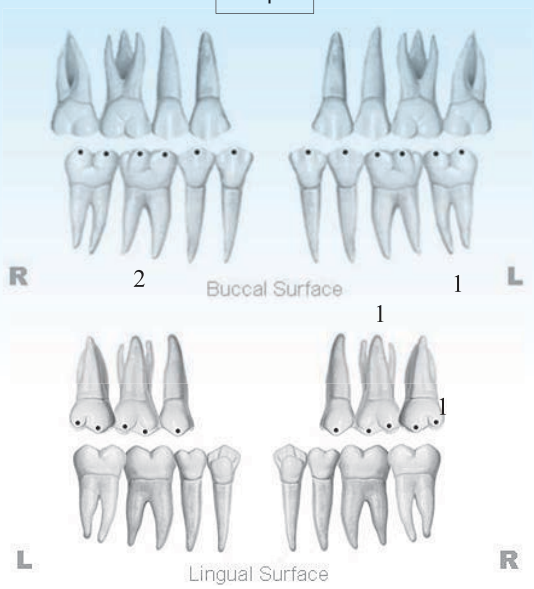


Overjet

3

Occlusal Contacts

4

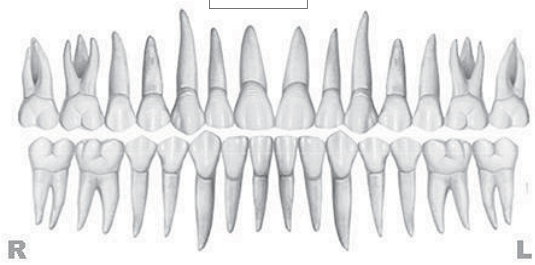


Occlusal Relationships

1

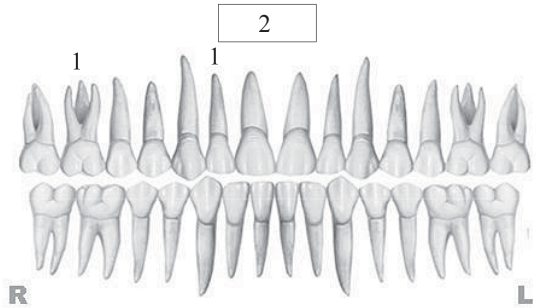
Interproximal Contacts

0



Root Angulation

2



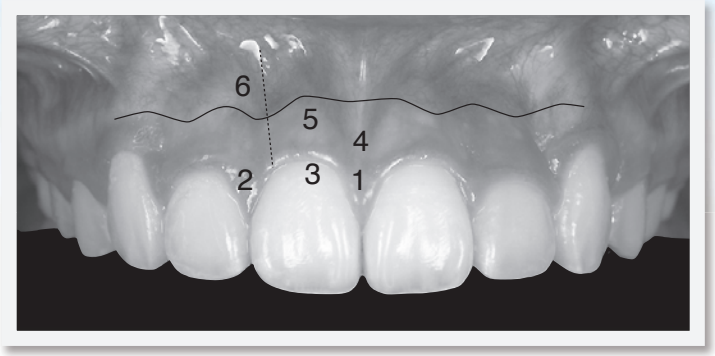
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 5

1. Pink Esthetic Score

Total = 3

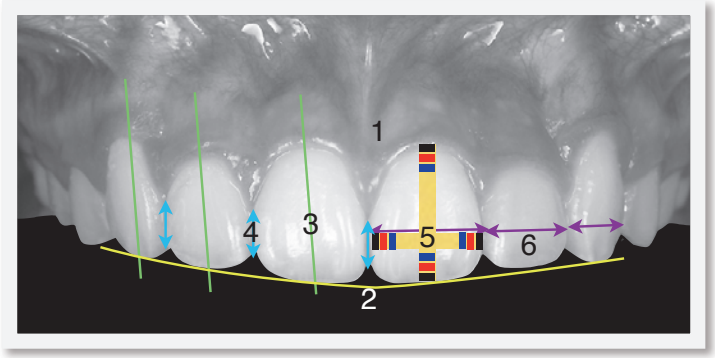


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

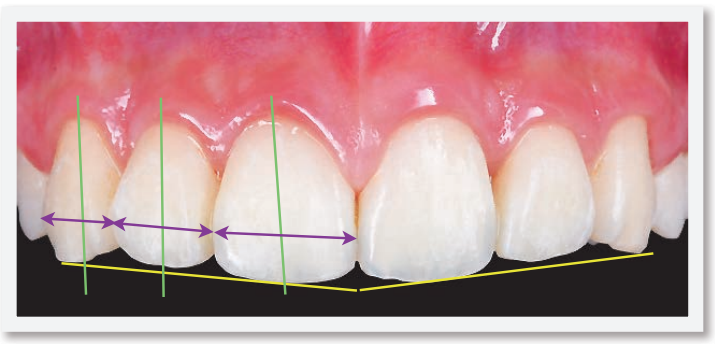
1. M & D Papilla	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	(0)	1	2
5. Root Convexity (Torque)	0	(1)	2
6. Scar Formation	0	1	(2)

2. White Esthetic Score (for Micro-esthetics)

Total = 2



1. Midline	0	1	2
2. Incisor Curve	0	1	2
3. Axial Inclination (5°, 8°, 10°)	0	1	2
4. Contact Area (50%, 40%, 30%)	0	1	2
5. Tooth Proportion (1:0.8)	0	1	2
6. Tooth to Tooth Proportion	0	1	2



1. Midline	(0)	1	2
2. Incisor Curve	(0)	1	2
3. Axial Inclination (5°, 8°, 10°)	0	(1)	2
4. Contact Area (50%, 40%, 30%)	(0)	1	2
5. Tooth Proportion (1:0.8)	(0)	1	2
6. Tooth to Tooth Proportion	0	(1)	2

寄件人：10506 台北市敦化南路一段2號5F-1
湧 傑 YONG CHIEH 02-27788315

當牙周遇上矯正時

11月02日

林志浩 X 邱琬棋

牙周矯正協同治療

齒列不整與牙周疾病常伴隨發生，這兩者間常互為因果且相互影響。在牙周不穩定的情形下，矯正治療難以進行。齒列不整則是會讓牙周治療產生治療上的死角。若是牙周控制的當，矯正治療即可迎刃而解。

有牙周疾病是否可進行矯正？

是否需要牙周手術？是否需要補骨？

治療矯正後若出現牙齦退縮或 gummy smile 又要如何處理？

針對這些臨床上常見的問題。這次的分享將針對如何善用各類牙周手術與矯正的配合來達到理想的牙周矯正協同治療效果。

主辦單位：亞太口腔臨床醫學會

協辦單位：湧傑企業股份有限公司

日　　期：2017/ 11 / 02 (Thu.) 9:00 ~12:00

地　　點：WICC訓練中心
新北市三重區中正南路223號1樓

費　　用：主協辦單位會員$800元，PGY $500元

學　　分：參加者發給繼續教育學分

報名專線：02-27788315#124 王小姐 #125 楊小姐
請於報名後三日內，至郵局劃撥費用
（於通訊欄註明報名場次）
戶名：湧傑企業股份有限公司
帳號：17471807

林志浩 醫師

- 國防醫學院牙周病碩士
- 台灣牙周病學會專科醫師
- 中華民國植牙學會專科醫師
- 現任 信安牙醫診所院長

邱琬棋 醫師

- 台北醫學大學齒顎矯正學碩士
- 中華民國齒顎矯正學會專科醫師
- 永和耕莘醫院矯正專科醫師
- 信安牙醫診所主治醫師

衛部醫器輸壹字第015200，016599號

湧 傑 YONG CHIEH

Newton's A 2017全新設計！

Keynote Workshop 高效簡報學習法

限額優惠

報名 Keynoye 課程，免費送視訊！

（限貝多芬課程學員）

12/2-4 (六～一) 動畫班

精修繪圖及動畫技巧

精緻的視覺化圖例是現代牙科簡報必備的要件，動畫班課程中，Dr. Rungsi 將分享他利用 Keynote 軟體繪製精美牙科插圖的經驗，並一步步教您從構想和草圖到創建出令人驚艷的成果，跟隨簡報美學大師的腳步，您也可以擁有獨樹一格的演講風格、站上世界舞台！

講師：Dr. Rungsi Thavarungkul

11/23 (四) 大師班

賈伯斯的簡報秘訣與設計要素

由國際知名的牙科講師張慧男醫師主講，將以他幽默風趣的演講風格來剖析賈柏斯的美學概念以及演講秘訣，利用實例來說明如何設計出視覺優美且知識性豐富的專業演講。

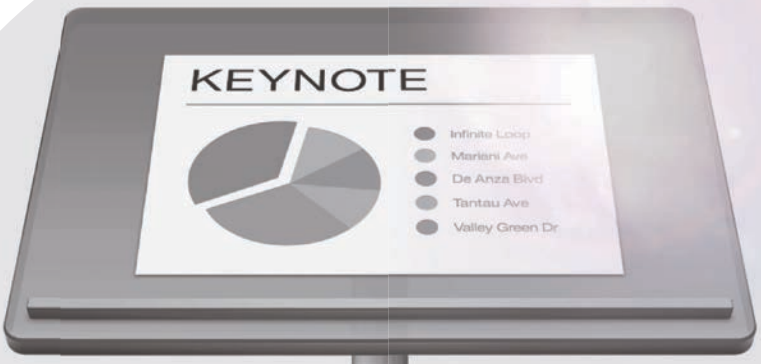
講師：張慧男醫師

11/16 (四) 技巧班

強化你的 Keynote 簡報力

精選介紹 Keynote 的重要工具，學習如何設計合適的動畫，及資料視覺化，並搭配 Mac 內建常用的影音工具來編修圖片和影像剪輯，金牛頓專業的教學團隊教你創造出動人的簡報。

講師：金牛頓工程師



- 若取消報名：開課30天前退款將扣除10%行政手續費；開課30天內退款將扣除30%行政手續費。
- 若請假延課：開課30天前提出，可免費延課一次；開課30天內提出，下次補課則以「舊生重溫價」計費。
- 報名技巧班、大師班，贈2017該課程視訊（限貝多芬課程學員）；報名動畫班，贈2016-17動畫班視訊。
- 舊生享特惠優惠價，限額6名。

03-573-5676
info@newtonsa.com.tw
新竹市建中一路25號2樓

BDE

Knowledge in your pocket

Free App

Available on the App Store

This app is designed for iPad, iPhone and iPad touch

Your personal mobile learning device

Beethoven Dental Encyclopedia

Damon Q Voiced in English is now available!!

BDE offers professional orthodontic and implant video courses. Members can watch the latest dentistry treatment from the comfort of their home. All courses are instructed by Dr. Chris Chang. This step-by-step practical course will make your learning an informative and fun experience. You can also have access to International Journal of Orthodontics and Implantology from the App.

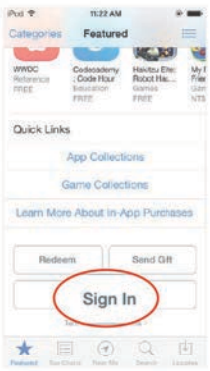
✔ Online access ✔ Offline download and unlimited viewing

Note:

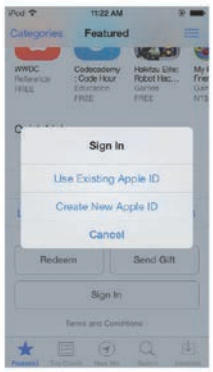
1. Most video course are available in both English and Chinese and are sold separately.
2. Customers who purchase one set of courses will have access to both the narrated and non-narrated version.
3. Some courses, including Damon Q and Advanced, are renewed annually and each renewal is to be purchased separately with a 50% discount.

Step-by-step Instructions

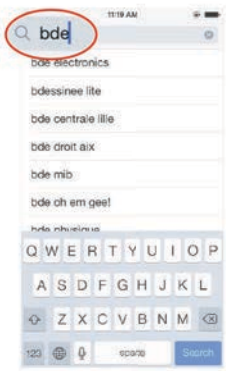
1. Go to App Store on your device.



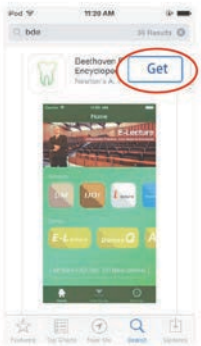
2. "Sign in" with your Apple ID.



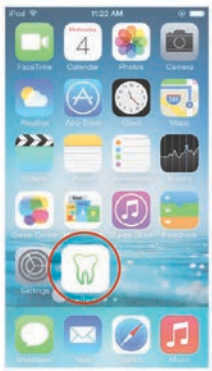
3. "Create Apple ID" if you don't have one.



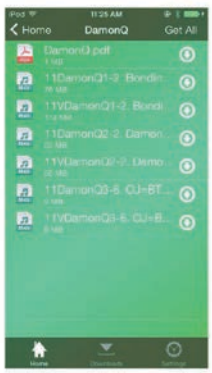
4. Search for "BDE."



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



6. Download completed!



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

If you are interested in our paid video or medical products, contact **app@newtonsa.com.tw** for more information.

+886-3-573-5676

http://orthobonescrew.com

Newton's A

Severe Malocclusion with Openbite, Incompetent Lips and Gummy Smile (DI 29) Treated in 16 Months with Clear Aligners to a Board Quality Result (CRE 18)

Abstract

History: *A 30-year-old male presented with chief complaint (CC) of openbite, occasional TMJ pain, a shift when biting, and "gummy smile" (excessive gingival exposure). Modified Palmer nomenclature for this report is upper (U), lower (L), right (R), left (L), and teeth are 1-8 from the midline.*

Diagnosis: *Facial analysis revealed: decreased facial profile (10.5°), increased lower facial height (LFH)(58.9%), bimaxillary protrusion tendency (SNA 83°, SNB 82.5°), lip incompetence, excessive upper lip elevation when smiling, mandibular deviation to the right, occlusal plane canted up 4° on the right, slightly protrusive mandible, incompetent lips, gummy smile, and dark buccal corridors. Compared to the facial midline, the upper midline was 2mm right, and the lower midline was 4mm right.*

Dental evaluation showed: *Class I occlusion except for a 2-3mm Class II UR3, ~3mm of crowding was noted in each arch, upper incisors tipped lingually (SN 100°), lower incisors tipped labially (MP 93.5°), 2mm $C_R \rightarrow C_O$ shift anterior and to the right due to a crossbite of a LL5, and 1-2mm loss of alveolar bone height between the LR3 and LR4.*

Etiology: *Probable etiology, for this acquired asymmetric malocclusion with increased LFH, was deemed a juvenile airway obstruction that resulted in a low tongue posture, interincisal tongue position, and posterior rotation of the mandible. Facial deviation to the right reflects a habitual sleeping pattern on the left side.*

Treatment: *An iTero Element® intraoral scanner and ClinCheck® treatment planning system were used to specify 31 Invisalign® aligners (Align Technology, Inc, San Jose, CA, USA) to: 1. expand, align and level both arches, 2. resolve the right canine Class II relationship, 3. correct incisor axial inclinations, 4. close the openbite by extruding lateral incisors, and 5. reduce the gummy smile by retracting incisors to correct incompetent lips. Phase 1 was 19 aligners for initial alignment and Phase 2 was 12 aligners to detail and finish. This complex malocclusion was treated in 16 months, and the patient was trained in lip seal exercises, natural lip elevation, and varied sleep positions.*

Outcomes: *A severe complex malocclusion with an American Board of Orthodontics (ABO) Discrepancy Index (DI) of 29 was treated to an excellent result, as documented by an ABO Cast-Radiograph Evaluation (CRE) score of 18, and a Pink and White (P&W) dental esthetic score of 1. Comprehensive analysis revealed an improved facial profile, competent lips, and more natural smile line, but there was no change in facial deviation and cant of the occlusal plane. The patient's CC (TMJ pain, bite shift and gummy smile) was resolved to his satisfaction.*

Conclusions: *This is the first comprehensive case report of a severe, complex malocclusion (DI 29) treated with clear aligners to a board quality result (CRE 18, P&W 1). (Int J Orthod Implantol 2017;48:74-94)*

Key words:
Invisalign, aligner treatment, anterior openbite, gummy smile, intermittent TMJ pain, incisor retraction, competent lips, lower face deviation, function shift

Dr. Diego Peydro Herrero,
Director, Clínica Dental Peydro, Valencia, Spain
Director of Master COIP. International Master Class in Invisalign Technique
Master Class of Beethoven Invisalign International Course (Left)

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

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

Background

As stated in the abstract, this journal (*IJOI*) utilizes a modified Palmer notation: upper arch (*U*), and lower arch (*L*), right side (*R*), and left side. Teeth in each quadrant (*UR, UL, LR, LL*) are numbered 1-8 from the midline. The supplier for this case report (*Align Technology, San Jose, CA*) uses a different method: UR, UL, LR, LL quadrants are numbered 1-4, respectively. The quadrant number is then separated by a period from the tooth number 1-8. Comparing both methods (*IJOI and Align*), the maxillary central incisors are UR1 (*1.1*) and UL1 (*2.1*).

Fig. 1: Pre-treatment photographs

History

A 30-year-old male presented with chief complaints of openbite, occasional TMJ pain, a shift when biting, and excessive gingival exposure (*gummy smile*).

Pre-Treatment Evaluation

Clinical examination showed bilateral Class I molars and left canines, but the right canines were 2mm Class II (*Fig. 1*). Facial analysis (*Fig. 1*) revealed a relatively flat facial profile, incompetent lips, and slightly protrusive mandible. A gummy smile with dark buccal corridors was associated with inadequate transverse development of the maxillary arch. The patient complained of intermittent pain in both temporomandibular joints (*TMJs*), but the contours of the mandibular condyle were within normal limits (*WNL*), based on the panoramic and cephalometric radiographs (*Fig. 2*). There was a 2mm

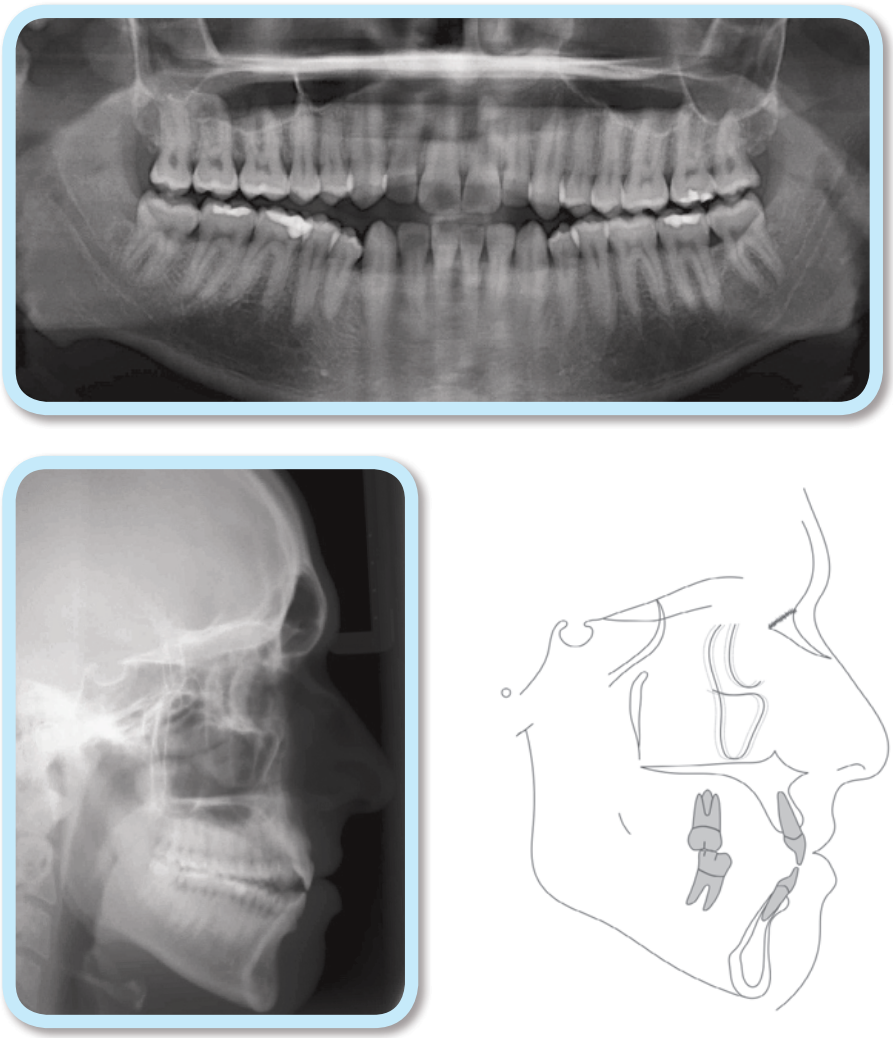


Fig. 2:
Pre-treatment radiographs are: 1. Panoramic view (upper), 2. Lateral cephalogram (lower left), 3. Tracing of the lateral cephalometric radiograph with the central incisors and first molars shaded in gray (lower right).

$C_R \rightarrow C_O$ shift anteriorly and to the right, which was associated with end-on incisal occlusion and LL5 crossbite.

Cephalometrics revealed decreased facial convexity (*10.5°*), increased facial height (*58.9%*), slight bimaxillary protrusion (*SNA 83°, SNB 82.5°*), normal intermaxillary relationship (*ANB 2.5°*), and a mandibular plane angle (*SN 32.5°, MPA 25.5°*) that was WNL. The frontal view (*Fig. 1*) showed lower face deviation, and an occlusal plane cant to the right. A more detailed analysis in maximum interception (C_O) revealed the chin point was 5mm deviated to the right, occlusal plane was canted 4° up on the right, maxillary midline was 2mm to the right of the facial midline, and the mandibular midline was 4mm to the right of the facial midline (*2mm intermaxillary midline discrepancy*). There was crowding in both dental arches (*-3mm/-3mm*), decreased axial inclination of the maxillary incisors (*100°*), lower incisor axial inclination (*SN 93.5°*) WNL, end-to-end incisal occlusion (*no overjet*), and an asymmetric openbite of 1-4mm from UR5-UL4. The panoramic radiograph (*Fig. 2*) documented all permanent teeth were normally erupted, and bone height was WNL except for a 1-2mm loss of alveolar bone height between the LR3 and LR4.

For the current malocclusion (*Figs. 1-2*) the ABO Discrepancy Index (*DI*) was 29 as shown in the subsequent worksheet. According to the ABO evaluation criteria, this malocclusion is classified as severe (*DI>20 points*).[1]

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	83°	82.5°	2.5°
SNB° (80°)	80°	79°	1°
ANB° (2°)	3°	2.5°	0.5°
SN-MP° (32°)	32.5°	31.5°	1°
FMA° (25°)	25.5°	24.5°	1°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	3 mm	2 mm	1 mm
U1 To SN° (104°)	100°	108°	8°
L1 To NB mm (4 mm)	7 mm	5 mm	2 mm
L1 To MP° (90°)	93.5°	83°	0.5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	-8 mm	-9 mm	1 mm
E-LINE LL (0 mm)	-2 mm	-3 mm	1 mm
%FH: Na-ANS-Gn (53%)	58.9%	58.2%	0.7%
Convexity: G-Sn-Pg' (13°)	10.5°	14°	3.5°

■ Table 1: Cephalometric summary

Etiology

The etiology of openbite malocclusion[2] in conjunction with long-face syndrome[3] is controversial, but current evidence increasingly favors environmental factors, such as low tongue position producing an acquired malocclusion (*Fig. 2*). The latter may be related to a history of oropharyngeal airway problems, and/or habitual sleep position.[4] Posturing the tip of the tongue between the incisors to contact the lower lip is associated with openbite and decreased maxillary width.[5,6] Tongue thrust is a compensation to (*not the cause of*) openbite malocclusion.[6] Based on the

current history and records (*Figs. 1-3*), the probable etiology of the current openbite malocclusion was a juvenile airway problem[4] that resulted in an interdental tongue posture.[7] Airway problems may resolve in adults because of lymphoid tissue atrophy in late adolescence,[4] although the openbite persists as an aberrant tongue posture habit. If both the openbite and its proximal etiology (*low tongue posture and lip incompetence*) are corrected, the outcome has a good prognosis.[5,6]

Gummy smile (*excessive gingival display*) is an undesirable esthetic characteristic as perceived by the observer (*usually the patient and/or family*).[8] A careful evaluation is indicated to determine if the problem can be managed to the observer's satisfaction with conservative (*orthodontic*) and/or surgical treatment. However, smile analysis is a dynamic process which is best evaluated in a personal interview or with a video image.[9] A single photograph may be flawed by excessive (*unnatural*) lip elevation. The etiology of the gummy smile for the present patient (*Fig. 1*) was deemed: 1. protrusive maxilla (*SNA 83°*), 2. incompetent lips, and 3. excessive lip elevation.

Treatment Objectives

The priority was to develop a treatment plan that addressed the etiology of the acquired malocclusion (*Figs. 1-3*). The openbite was due to low tongue posture, which was manifest as openbite associated with decreased maxillary width. Gummy smile was related to a protrusive maxilla, incompetent lips

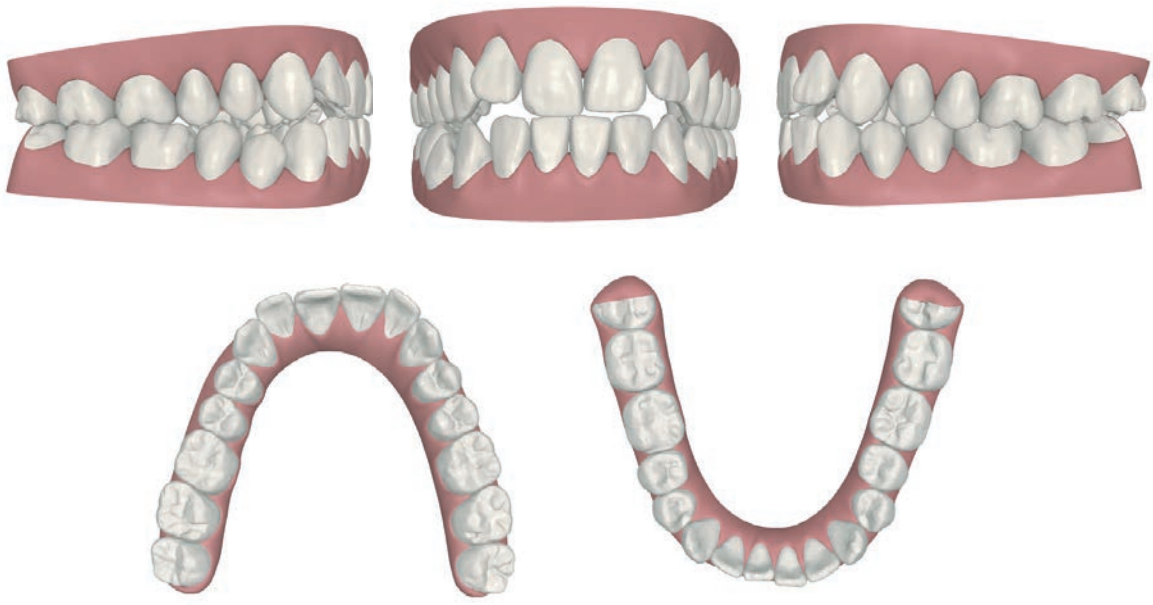


Fig. 3: Pre-treatment images of the dentition were captured by an iTero® intraoral scanner.

and excessive lip elevation. Clear aligners were the therapeutic choice for the patient and the clinician. The treatment objectives were:

1. Level and align the dentition in both arches to correct the openbite.
2. Expand both arches to correct tongue posture and retract the upper and lower incisors.
3. Resolve the right Class II canine relationship.
4. Train the patient to posture the tongue in the roof of the mouth.
5. Increase axial inclination of the upper incisors.
6. Decrease axial inclination of the lower incisors.
7. Correct the gummy smile by correcting lip incompetence, and lip elevation training.
8. Reenforce training of the patient (*in front of a mirror*) to maintain lips in contact, position the tongue in the roof of the mouth, and smile with more natural lip elevation.

Maxilla (*all three planes*):

- A - P: *Retract*
- Vertical: *Maintain*
- Transversal: *Maintain*

Mandible (*all three planes*):

- A - P: *Retract*
- Vertical: *Decrease*
- Transversal: *Maintain*

Maxillary Dentition:

- A - P: *Retract Incisors, maintain molars by expanding the maxillary arch*
- Vertical: *Extrude*
- Transversal: *Expand*

Mandibular Dentition:

- A - P: *Retract Incisors, maintain molars by expanding the maxillary arch*
- Vertical: *Extrude*
- Transversal: *Expand*

Facial Esthetics:

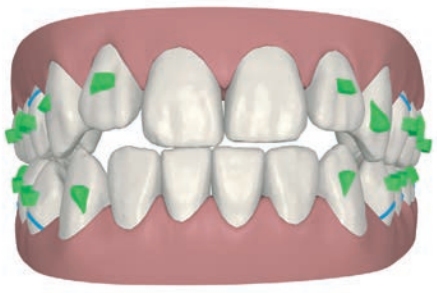
- Retract both anterior segments to correct lip incompetence
- Correct gummy smile: *Lip competence and more natural elevation of the upper lip*
- Eliminate dark buccal corridors

Treatment Plan

An iTero Element® intraoral scanner (*Align Tech, Inc, San Jose, CA, USA*) was used to digitize a 3D dataset of the dentition and supporting tissues (*Fig. 3*). A dedicated treatment planning system (*Invisalign® by Align Technology, Inc, San Jose, CA, USA*) planned the

correction: 1. align and level both dental arches, 2. extrude the lateral incisors, canines and premolars to close the openbite, 3. retract both anterior segments by expanding the arches, 4. resolve the right canine Class II relationship, as well as 5. detail and finish the 3D alignment of the entire dentition.

Two stages of treatment (*Figs. 4 and 5*) were specified by the software to achieve a final occlusion similar to the digital set-up (*Fig. 6*). Aligner tooth movement requirements were determined by 3D superimposition of the original malocclusion (*Fig. 3*) on the desired result (*Fig. 6*). The original treatment plan proposed on ClinCheck® (*Fig. 7*) was unacceptable because of: 1. an emphasis on extrusion of maxillary central rather than lateral incisors to close the openbite, and 2. inadequate expansion of both arches to retract the upper and lower anterior segments. The clinician (*DPH*) entered seven modifications on ClinCheck® to produce the appropriate treatment sequence, including placing extrusive attachments on the



■ *Fig. 5:*
Prior to delivering Aligner 10, horizontal beveled attachments are bonded on both maxillary lateral incisors to apply extrusive loads.

■ *Fig. 4:*
At the second appointment, 20 days into treatment, the initial set of attachments (green) are bonded on the teeth with composite resin. See text for details.

Fig. 6:
Images of the digital set-up show the final planned occlusion after leveling, alignment, and expansion of the arches. See text for details.

maxillary lateral incisors and removing them from the central incisors (*Fig. 8*). This clinician-directed treatment plan was subsequently approved on ClinCheck® prior to designing the iterative series of aligners to reposition the teeth in a step-by-step pattern. Attachments were required on some teeth to apply forces and/or couples to affect tooth movement. The aligner specifications, listed on the left side of the treatment-sequence table (*Fig. 8*), were used to calculate the iterations for each step of initial treatment sequence. Overall, a total of 31 aligners were specified for the entire treatment: 19 for the first phase (*initial alignment*), and 12 for the second phase (*detailing and finishing*). All aligners and treatment auxiliaries (*attachments and elastics*) were supplied by Align Technology.

Phase 1 initial Alignment. The clinical objectives for the first phase were to correct the minor crowding and expand the transverse dimension of the dental arches to retract the incisors. Biomechanics rationale is to expand each arch to decrease its sagittal length, and the incisors are simultaneously retracted because they have less anchorage value than the anterior segments. Class II elastics are required because the lower molars have greater anchorage value than upper molars.[10] Nineteen iterations are specified in the treatment plan (*Fig. 8*) to accomplish the initial alignment. An aligner is constructed for each step-by-step application of a therapeutic load to achieve the progressive alignment. For the first phase (*19 aligners*) the patient is instructed to use each aligner for 10 days and then progress to the next aligner. Class II elastics (*3/16-in 6½-oz*) are planned between cuts in the aligners from the upper first premolars (*U4s*) to the lower second molars (*L7s*). In the third month of treatment, a triangle configuration of vertical elastics (*1/8-in 6½-oz*) is applied from the U4s to both lower premolars, during the sleeping hours for the duration of treatment.

Phase 2 Detailing and Finishing. When the initial alignment (*Phase 1*) is completed, perform a progress scan to plan detailing and finishing with an additional 12 aligners. The frequency of aligner progression is increased to every two weeks during the second phase of treatment, and the pattern of elastics wear is continued.

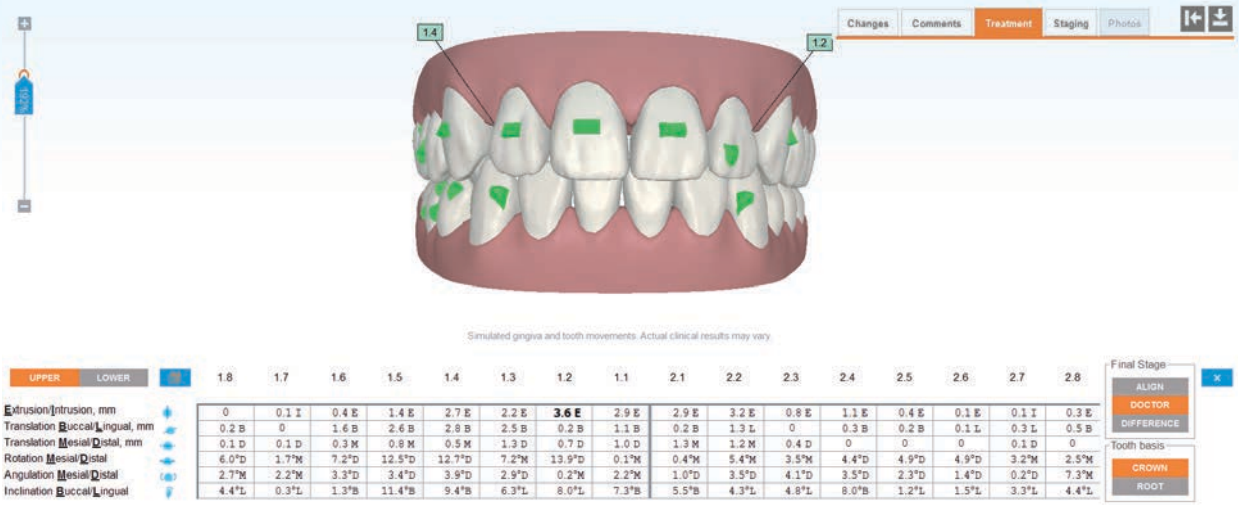


Fig. 7:
A table describes the initial proposal for a progressive sequence and magnitude of loads planned for individual teeth. This treatment plan was not adopted. See text for details.

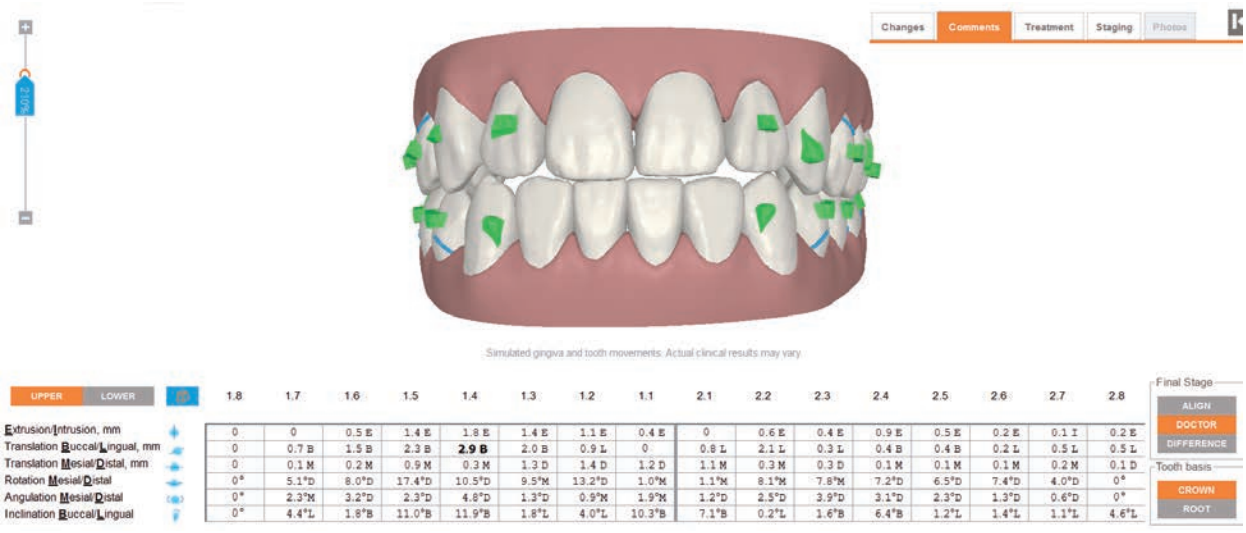


Fig. 8:
Following instructions from the clinician, the treatment plan (Fig. 7) was adjusted with seven modifications to Clincheck® before formulating the definitive treatment plan, as outlined in the table at the bottom. See text for details.

Appliances and Treatment Progress

Phase 1: Treatment at the first appointment began as soon as the first two aligners were delivered. The patient was instructed to consistently wear them 20-22 hours a day, and only remove them for eating and tooth brushing. The initial aligners were worn 10 days each. They were programmed to bring about expansion and proclination, but not extrusion or rotation movements, because the latter required placing attachments (*Figs. 4 and 8*). The second clinical appointment was planned for 20 days into treatment, when the attachments were bonded on the selected teeth using at the composite Tetric EvoCeram (*Ivoclar Vivadent, Inc. NY, USA*):

UPPER MAXILLA (*per tooth*) :

- 1.6 Horizontal gingival beveled 4mm
- 1.5 Optimized (*to achieve and hold ideal position*)
- 1.4 Horizontal gingival beveled 4mm
- 1.3 Optimized for extrusion
- 1.2 Horizontal attachment 3mm on the palatal surface
- 1.2 Optimized for extrusion (*bonded in aligner 10*)
- 2.6 Horizontal gingival beveled 4mm
- 2.5 Optimized
- 2.4 Horizontal gingival beveled 4mm
- 2.3 Optimized for rotation
- 2.2 Optimized for extrusion (*bonded in aligner 10*)

MANDIBLE (*per tooth*) :

- 3.7 Vertical 3mm
- 3.5 Horizontal gingival beveled 3mm
- 3.4 Horizontal gingival beveled 4mm
- 3.3 Optimized for rotation
- 4.7 Vertical 3mm
- 4.5 Horizontal gingival beveled 3mm
- 4.4 Horizontal gingival beveled 4mm
- 4.3 Optimized for rotation

After placing the attachments, aligners 3-9 were delivered, with instructions to wear each aligner for 10 days and then progress to the next. Aligners 3-9 were designed primarily for expansion and anterior tipping of the incisors, in addition to rotational corrections of the canines, premolars and molars. It was also necessary to correct upper lateral incisor rotations before commencing extrusion. Interproximal reduction (*IPR*) in the lower arch was also performed at this appointment. Each contact point from the distal of the LR3 to distal of the LL3 were reduced an average of 0.3mm per surface to provide lower anterior space (*12x0.3=3.6mm*) to align the incisors, reduce lower incisor axial inclination, and increase lingual root torque.

Aligner 10 was programmed with extrusive attachments on the maxillary lateral incisors (*Fig. 5*) to complete rotation and extrude UR2 and UL2 to the level of the adjacent central incisors. A 1mm

space was created between the central and lateral incisors, as the arch expanded, to provide space for alignment of the maxillary anterior segment with the openbite closed. When the patient wore aligners 10-15, he was instructed to use the following elastics at night:

- 3/16-in 8-oz Class II elastics worn from the first premolars to a button bonded in the second lower molars bilaterally
- 1/8-in 6½-oz elastics attached through cuts in the aligners from the first premolars to both lower premolars

Starting with aligner 10, the patient was instructed to progress to the next aligner in the series every two weeks. The programmed mechanics involved continued maxillary expansion and increased upper central incisor torque to establish a normal overbite and overjet relationship. Aligners 10-19 were designed to extrude lateral incisors 2mm, expand the maxilla, improve interdigitation with nine months of treatment. As the buccal segment, interdigitation and overbite relationships were corrected the mandible was postured 1-2mm more posteriorly and superiorly to decrease LFH, correct lip competence, and improve the gummy smile. The planned initial alignment was achieved during Phase 1.

Phase 2: A new scan was performed to design the second phase of 12 aligners for final detailing. The same elastics wear was continued during the sleeping hours. After the 6 month finishing phase, active treatment was completed. Occlusal adjustments and esthetic detailing were performed to ensure stability, eliminate occlusal interferences, and improve the shape of incisors and canines. After 15 months of treatment, all attachments were removed, and the last set of aligners was worn passively for three months to stabilize the final alignment.

Treatment Results

Compared to the pre-treatment records (*Figs. 1-3*), the post-treatment facial photographs (*Fig. 9*) and cephalometric documentation (*Fig. 10*) show that the profile and smile esthetics were markedly improved with 15 months of clear aligner treatment. Dental alignment (*Fig. 1*) is near ideal as originally specified by the digital set up (*Fig. 6*). The panoramic radiograph (*Fig. 10*) reveals that axial inclinations of the dentition are not ideal but quite acceptable for 15 months of treatment. More ideal axial inclinations (*second order alignement*) was not warranted because it would require a much longer treatment time with minimal additional benefit.

Pre-treatment and post-treatment cephalometric tracings (*Fig. 11*) were revealing. Superimposition on the anterior cranial base showed the incisors were retracted about 3-4mm in each arch. The axial inclinations of the incisors was improved: maxillary incisors were increased to 108°, and mandibular incisors were decreased to 93°. The alignment of the dentition resulted in interdigitation that was consistent with a 1-2mm more distal and superior position to the mandible. The latter was probably related to the TMJ symptoms the patient reported prior to treatment, because those pre-treatment problems were no longer evident after the functional shift was corrected. Before and after treatment tracings superimposed on the maxilla and

mandible revealed stabilization of the molars while the anterior segments were retracted 1-3mm in the sagittal plane. The anterior segments were extruded 1-2mm in each arch to close the openbite (*Fig. 11*).

Despite the severe openbite, crowding, and midline deviation, this severe malocclusion (*DI 29*) was corrected to a Class I molar and canine relationship. Intermaxillary second and third order alignment was WNL (*Fig. 6*). Overjet and overbite were near ideal. C_R and C_O were coincident. Signs and symptoms of TMJ disfunction were resolved. The dental result was excellent as documented by a ABO Cast-Radiograph Evaluation (*CRE*) score of 18, and a Pink & White (*P&W*) dental esthetic score of 1. For scoring details refer to the worksheets at the end of this report.

Maxilla (*all three planes*):

- A - P: *Retracted*
- Vertical: *Maintained*
- Transversal: *Maintained*

Mandible (*all three planes*):

- A - P: *Retracted*
- Vertical: *Maintained*
- Transversal: *Maintained*

Fig. 9:
Post-treatment intraoral and facial photographs document the final outcome in the same order as the pre-treatment Figure 1. See text for details.

Maxillary Dentition:

- A - P: *Retracted*
- Vertical: *Slight extrusion*
- Transversal: *Expansion*

Mandibular Dentition:

- A - P: *Retracted*
- Vertical: *Maintained*
- Transversal: *Expansion*

Retention

The patient used the last set of aligners for three months as the initial retainers. After the post-treatment settling, new impressions were made to fabricate clear overlay retainers with ESSIX® thermoplastic (*Dentsply International Raintree Essix, Sarasota, FL USA*). The new retainers were delivered and the patient was instructed to wear them at night (*sleeping hours*).

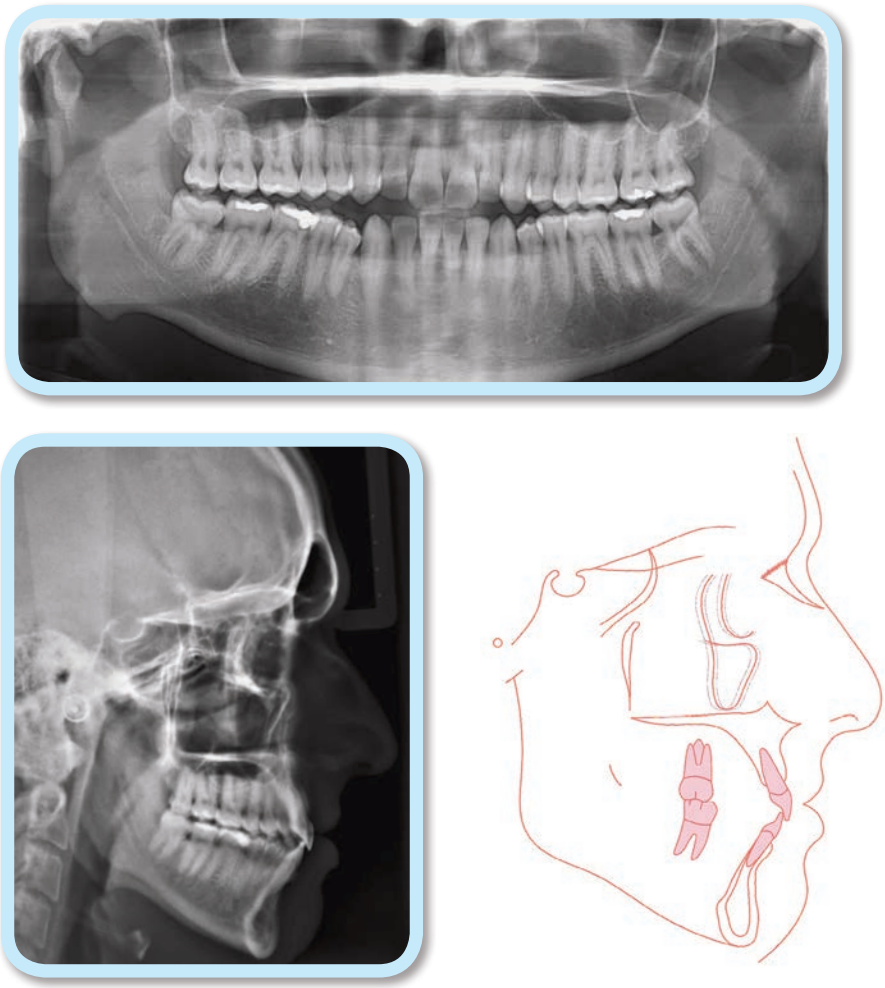
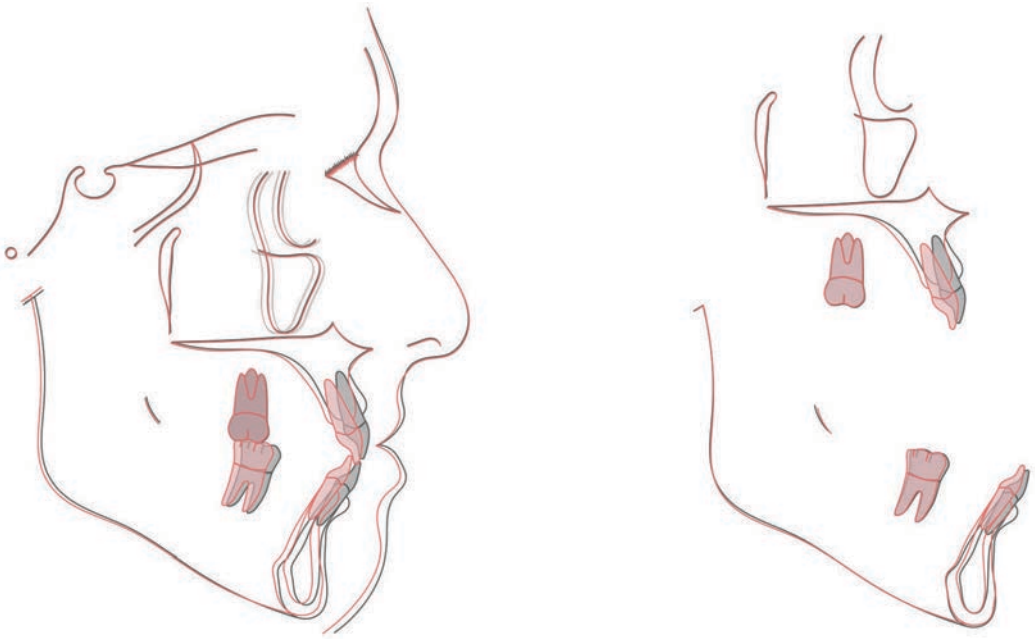


Fig. 10:
Post-treatment radiographs are: 1. Panoramic view (upper), 2. Lateral cephalogram (lower left), 3. Tracing of the lateral cephalometric radiograph, with the central incisors and first molars shaded in red (lower right).

Discussion

Invisalign® technicians proposed a treatment plan that focused on closing the openbite primarily by extruding the upper incisors (*Fig. 7*), but that plan failed to address all of the treatment objectives. It is important to understand that technicians are experts at moving teeth with aligners but they are not doctors. It's important for the clinician to carefully evaluate the treatment plan relative to the overall objectives. Technicians are essential, for planning tooth movement to accomplish each phase of treatment, but the orthodontist is ultimately responsible for making sure the plan that is approved addresses all of the treatment objectives.

Biomechanics of progressive aligner loads must be carefully considered when treating complex malocclusions. Differential arch expansion was effective for resolving the $C_R \rightarrow C_O$ shift due to cusp interference associated with crossbite. In the absence of severe crowding, expansion of both arches results in retraction of the incisors, because molars have more osseous anchorage compared to incisors. Since lower molars have more anchorage value than upper molars,[10] crowding must be carefully managed relative to the original interdigitation of the buccal segments in each arch. IPR and intermaxillary elastics are the principal adjustments for differential mechanics to manage asymmetries or anchorage discrepancies. The treatment plan (*Fig. 8*) was carefully coordinated with the auxiliaries (*IPR and elastics*) to achieve an excellent outcome (*Figs. 9-11*).



■ *Fig. 11:*
Cephalometric tracings from before (black) and after (red) treatment are superimposed to show the dentofacial changes during treatment. The anterior cranial base superimposition is on the left. Maxillary and mandibular superimpositions are upper right and lower right, respectively.

Although the patient was told third molar extractions might be necessary because they are distally positioned in the ramus area, at the end of treatment they remained asymptomatic and therefore retained. However, longterm monitoring for operculum inflammation is recommended as part of the retention recall evaluations.

Numerous reports in the literature advocate clear aligners for treatment of openbite,[11-15] transverse deficiencies,[16] smile discrepancies,[17] and a variety of other malocclusions.[18-20] To the authors' knowledge the current case is the most severe malocclusion (*DI 29*) treated with clear aligners to be reported in the literature. This appears to be the first ABO style case report for aligner treatment that is documented with dental alignment (*CRE 18*) and esthetics (*P&W 1*) scores. Furthermore, comprehensive analysis of the excellent case records document correction of the dental midlines, facial profile, lip incompetence, gummy smile, $C_R \rightarrow C_O$ discrepancy, and TMJ problems. The current results, for non-extraction aligner treatment of a complex malocclusion (*DI 29*), are impressive. Malocclusions with a combination of openbite,[21,22] facial asymmetry,[23,24] and midline discrepancy[24-26] are challenging problems with conventional mechanics, orthognathic surgery and/or prosthodontics.

The efficient correction, of a complex malocclusion (*Figs. 1-3*) in 15 months with 31 clear aligners, required rigorous planning: detailed history, thorough diagnosis, careful assessment of the etiology, and a comprehensive treatment plan focused on reversing the etiology. Fixed mechanics can exacerbate openbite problems because they tend to extrude posterior teeth during alignment. All lateral loads tend to extrude teeth because the tapered form of an alveolus creates an inclined plane effect.[10] Clear aligners are superior mechanics for conservative correction of anterior openbite because two layers of aligner material overlay occlusal contacts in the posterior intermaxillary space. Thus, the success of aligner therapy for correction of openbite is usually predicable.[11,15,19] Double overlays of aligner plastic deliver intrusive force to both arches, which intrudes or at least maintains the vertical dimension of occlusion (*VDO*) (*Fig. 10*).[11,15,19]

Anterior openbite correction is a longterm stability problem. Many anterior openbite patients relapse after conservative fixed appliance and/or surgical treatment[28-30] probably due to recurrent airway and/or low tongue posture problems, that result in recurrent inter-incisor tongue posture.[6,7] Axial loads on the molars, using a maxillary intrusion splint, improved stability for openbite malocclusions treated with fixed appliances, supplemented with temporary anchorage devices (*TADs*).[31] Following this principle, the longterm retention strategy for the current patient is based on controlling the VDO with routine lip contact (*competence*) during the waking hours, and delivering axial loads to the posterior segments, via clear overlay retainers at night.

Clear aligner therapy is practiced by both general

practitioners and orthodontic specialists, but clinical expertise and perceptions relative to the applied technology vary greatly.[32,33] Positioners[34] can play an important role in the functional finishing of the occlusion and developing of lip competence. In addition, aligners may be a better option for periodontally compromised patients.[35] Clear aligners were the first routine application of computer aided design and manufacturing (*CAD-CAM*) engineering to the clinical practice of orthodontics (*~1997*). However, to date there are no case reports in the literature utilizing an ABO style analysis to assess aligner therapy relative to: 1. classification of the complexity (*severity*) of the malocclusion with a discrepancy index (*DI*), and/or 2. scoring the outcome with a cast-radiograph evaluation (*CRE*).[1] For fixed appliances, the DI is a documented index for predicting the clinical effort required to resolve a malocclusion,[36-38] and the CRE is established tool for assessing and improving clinical outcomes.[36,39-43] Comparative studies for aligner therapy are overdue.

The present case report documents the effectiveness of clear aligner therapy for treating a severe malocclusion (*Figs. 1-3*) to a board quality result (*Figs. 9-11*). This opens a new era for the serious consideration of aligners for the management of challenging malocclusions, but the lack of appropriate clinical data on discrepancies and outcomes is a deterrent. If aligners are to evolve into a competitive method, for resolving a broad range of malocclusions in orthodontic practice, clinical studies are needed to determine the range of discrepancies that clear aligners can resolve to a board quality result, presently defined as a CRE ≤ 26 points.

Conclusions

- Invisalign® clear aligners are capable of managing a severe malocclusion with openbite, incompetent lips, gummy smile and TMD (*DI 29*) to a board quality result (*CRE 18*).
- Successful management of complex malocclusions requires careful planning: detailed history, thorough diagnosis, assessment of the etiology of the problem(s), and a comprehensive treatment plan that focuses on reversing the etiology.
- The Invisalign® team provides a technical service to design a unique sequence of aligner loads, that are coordinated with differential IPR and application of elastics, to achieve the objectives of treatment.
- The clinician is ultimately responsible for approving the treatment plan using the ClinCheck® software.
- With adequate patient cooperation and an appropriate treatment plan, it is possible to achieve excellent results in terms of occlusion, function, and dentofacial esthetics.
- To evolve as a competitive orthodontic technique for resolving substantial malocclusions (*DI>10*), clinical studies with clear aligners are needed to

determine the range of discrepancies treatable to a board quality result (*CRE≤26 points*).

References

1. ABO Discrepancy Index (DI) and Cast-Radiograph Evaluation (CRE), website accessed 6 October 2017 <https://americanboardortho.com/search?q=Discrepancy%20Index>
2. Rijpstra C, Lissen JA. Etiology of anterior openbite: a review. J Orofac Orthop 2016;77(4):281-284.
3. Schendel SA, Eisenfeld J, Bell WH, Epker BN, Mishelevich DJ. The long face syndrome: maxillary vertical excess. Am J Orthod 1976;70(4):398–408.
4. Chang MJ, Lin JJ, Roberts WE. Probable airway etiology for a severe Class III openbite malocclusion: conservative treatment with extra-alveolar bone screws and intermaxillary elastics. Int J Orthod Implantol 2017;45:4-20.
5. Mason RM. A retrospective and prospective view of orofacial myology. Int J Orofacial Myology 2005 Nov;31:5-14.
6. Proffit WR. Equilibrium theory revisited: factors influencing position of the teeth. Angle Orthod 1978;48(3):175-186.
7. Knösel M, Nüser C, Jung K, Helms HJ, Engelke W, Sandoval P. Interaction between deglutition, tongue posture, and malocclusion: A comparison of intraoral compartment formation in subjects with neutral occlusion or different types of malocclusion. Angle Orthod 2016;86(5):697-705.
8. Izraelewicz-Djebali E, Chabre C. Gummy smile: orthodontic or surgical treatment? J Dentofacial Anom Orthod 2015;18:102.
9. Desai S, Upadhyay M, Nanda R. Dynamic smile analysis: changes wth age. Am J Orthod Dentofacial Orthop 2009;136(3):310. e. 1-0.
10. Roberts WE. Bone physiology, metabolism and biomechanics in orthodontic practice. In: Orthodontics: Current Principles and Techniques, Chapter 10, 5th ed. Graber LW, Vanarsdall RL Jr, Vig KWL (Eds). St. Louis: Elsevier Mosby; 2012. pp. 287-343.
11. Harnick DJ. Using clear aligner therapy to correct malocclusion with crowding and an openbite. Gen Dent 2012;60(3):218-23.
12. Paik CH, McComb R, Hong C. Differential molar intrusion with skeletal anchorage in open-bite treatment. J Clin Orthod 2016;50(5):276-89.
13. Reichert I, Figel P, Winchester L. Orthodontic treatment of anterior openbite: a review article. Is surgery always necessary? Oral Maxillofac Surg 2014;18(3):271-7.
14. Matsumoto MA, Romano FL, Ferreira JT, Valério RA. Openbite: diagnosis, treatment and stability. Braz Dent J 2012;23(6):768-78.
15. Giancotti A, Garino F, Mampieri G. Use of clear aligners in openbite cases: an unexpected treatment option. J Orthod 2017;44(3):114-125.
16. Houle JP, Piedade L, Todescan R Jr, Pinheiro FH. The predictability of transverse changes with Invisalign. Angle Orthod 2017;87(1):19-24.
17. Levrini L, Tieghi G, Bini V. Invisalign ClinCheck and the aesthetic digital smile design protocol. J Clin Orthod 2015;49(8):518-24.
18. Malik OH, McMullin A, Waring DT. Invisible orthodontics part 1: invisalign. Dent Update 2013;40(3):203-4, 207-10, 213-5.
19. Boyd RL. Complex orthodontic treatment using a new protocol for the Invisalign appliance. J Clin Orthod 2007;41(9):525-47.
20. Kuncio DA. Invisalign: current guidelines for effective treatment. NY State Dent J 2014;80(2):11-4.
21. Almuzian M, Almukhtar A, O'Neil M, Benington P, Al Anezi T, Ayoub A. Innovation in prediction planning for anterior openbite correction. Aust Orthod J 2015;31(1):78-86.
22. Cruz-Escalante MA, Aliaga-Del CA, Soldavilla L, Janson G, Yatabe M, Zuazola RV. Extreme skeletal openbite corrections with vertical elastics. Angle Orthod 2017 Sep 12. doi: 10.2319/042817-287.1. [Epub ahead of print]
23. Tyan S, Park HS, Janchivdorj M, Han SH, Kim SJ, Ahn HW. Three-dimensional analysis of molar compensation in patients with facial asymmetry and mandibular prognathism. Angle Orthod 2016;86(3):421-30.
24. Kai R, Umeki D, Sekiya T, Nakamura Y. Defining the location of the dental midline is critical for oral esthetics in camouflage orthodontic treatment of facial asymmetry. Am J Orthod Dentofacial Orthop 2016;150(6):1028-1038.
25. Williams RP, Rinchuse DJ, Zullo TG. Perceptions of midline deviations among different facial types. Am J Orthod Dentofacial Orthop 2014;145(2):249-55.
26. Cardash HS, Ormanier Z, Laufer BZ. Observable deviation of the facial and anterior tooth midlines. J Prosthet Dent 2003;89(3):282-5.
27. Jayalakshmi NS, Ravindra S, Nagaraj KR, Rupesh PL, Harshavardhan MP. Acceptable deviation between facial and dental midlines in dentate population. J Indian Prosthodont Soc 2013;13(4):473-7.
28. Geron S, Wasserstein A, Geron Z. Stability of anterior openbite correction of adults treated with lingual appliances. Eur J Orthod 2013;35(5):599-603.
29. Fontes AM, Joondeph DR, Bloomquist DS, Greenlee GM, Wallen TR, Huang GJ. Long-term stability of anterior open-

bite closure with bilateral sagittal split osteotomy. Am J Orthod Dentofacial Orthop 2012;142(6):792-800.

30. Proffit WR, Bailey LJ, Phillips C, Turvey TA. Long-term stability of surgical open-bite correction by Le Fort I osteotomy. Angle Orthod 2000;70(2):112-7.
31. Scheffler NR, Proffit WR, Phillips C. Outcomes and stability in patients with anterior openbite and long anterior face height treated with temporary anchorage devices and a maxillary intrusion splint. Am J Orthod Dentofacial Orthop 2014;146(5):594-602.
32. Best AD, Shroff B, Carrico CK, Lindauer SJ. Treatment management between orthodontists and general practitioners performing clear aligner therapy. Angle Orthod 2017;87(3):432-439.
33. Heath EM, English JD, Johnson CD, Swearingen EB, Akyalcin S. Perceptions of orthodontic case complexity among orthodontists, general practitioners, orthodontic residents, and dental students. Am J Orthod Dentofacial Orthop 2017;151(2):335-341.
34. Pravindevaprasad A, Therese BA. Tooth positioners and their effects on treatment outcome. J Nat Sci Biol Med 2013;4(2):298-301.
35. Han JY. A comparative study of combined periodontal and orthodontic treatment with fixed appliances and clear aligners in patients with periodontitis. J Periodontal Implant Sci 2015;45(6):193-204.
36. Deguchi T, Honjo T, Fukunaga T, Miyawaki S, Roberts WE, Takano-Yamamoto. Clinical assessment of orthodontic outcomes using peer assessment rating, discrepancy index, objective grading system, comprehensive clinical assessment. Am J Orthod Dentofac Orthop 2005;127:434-443.
37. Schafer S, Maupome G, Eckert GJ, Roberts WE. Discrepancy index relative to age, sex, and the probability of completing treatment by one resident in a 2-year graduate orthodontics program. Am J Orthod Dentofacial Orthop 2011;139:70-3.
38. Parrish LD, Kula KS, Roberts WE, Maupome G, Stewart KT, Bandy RW. The relationship between the ABO discrepancy index and treatment duration in a graduate orthodontics clinic. Angle Orthod 2011;81:192–197.
39. Pinskaya Y, Hsieh T-J, Roberts WE, Hartsfield JK Jr. Comprehensive clinical evaluation as an outcome assessment for a graduate orthodontics program. Am J Orthod Dentofacial Orthop 2004;126(5):533-543.
40. Vu CQ, Roberts WE, Hartsfield JK Jr, Ofner S. Treatment complexity index for assessing the relationship of treatment duration and outcomes in a graduate orthodontics clinic. Am J Orthod Dentofacial Orthop 2008;133(1):9. e. 11-13 (ISSN: 1097-6752-Electronic).
41. Alford TJ, Roberts WE, Hartsfield JK, Eckert GS, Snyder RJ. Clinical outcomes for patients finished with the SureSmile method compared to conventional fixed orthodontics therapy. Angle Orthod 2011;81:383–388.
42. Knierim K, Roberts WE, Hartsfield Jr JK. Assessing treatment outcomes for a graduate orthodontics program: follow-up study for classes of 2001-2003. Am J Orthod Dentofacial Orthop 2006;130(5):648-655. e. 1-3.
43. Campbell CL, Roberts WE, Hartsfield Jr JK, Qi R. Treatment outcomes in a graduate orthodontic clinic for difficult malocclusions as defined by the American Board of Orthodontics malocclusion categories. Am J Orthod Dentofacial Orthop 2007;132:822-829.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 29

OVERJET

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

Negative OJ (x-bite) 1 pt. per mm. per tooth = 3

Total = 3

OVERBITE

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

Total = 0

ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth
then 1 pt. per additional full mm. per tooth

Total = 10

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 12

CROWDING (only one arch)

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

Total = 1

OCCLUSION

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

Total = 1

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 1

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP

≥ 38° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

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

Total = 0

OTHER (See Instructions)

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

Identify: Incompetent lips

Total = 2

Cast-Radiograph Evaluation

Case # **Patient**

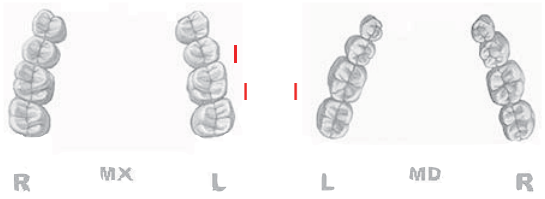
Total Score: 18

Alignment/Rotations

0

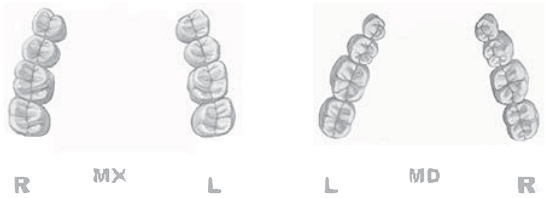
Marginal Ridges

3



Buccolingual Inclination

0

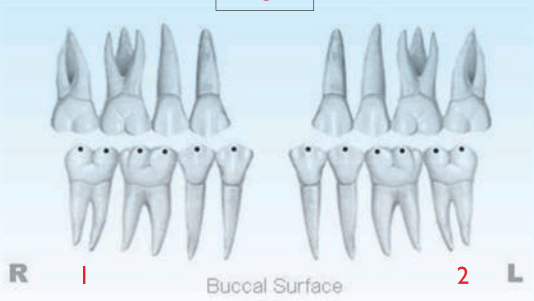


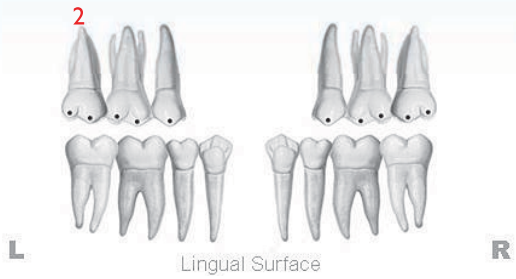
Overjet

7

Occlusal Contacts

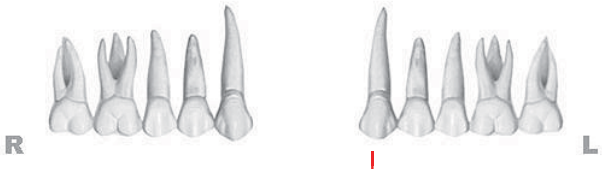
5





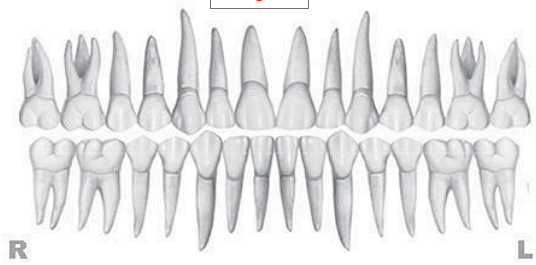
Occlusal Relationships

1



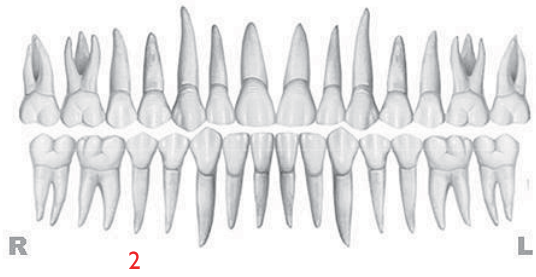
Interproximal Contacts

0



Root Angulation

2



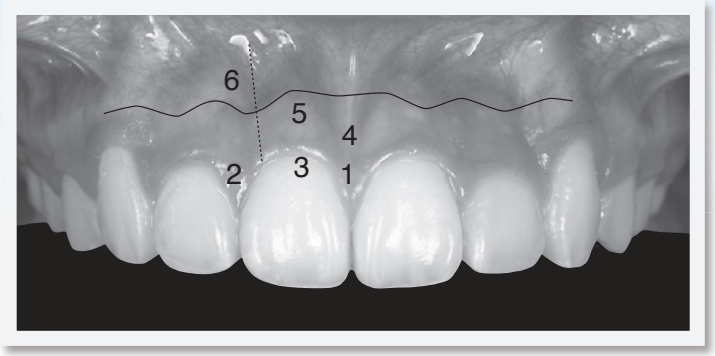
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 1

1. Pink Esthetic Score

Total = 1

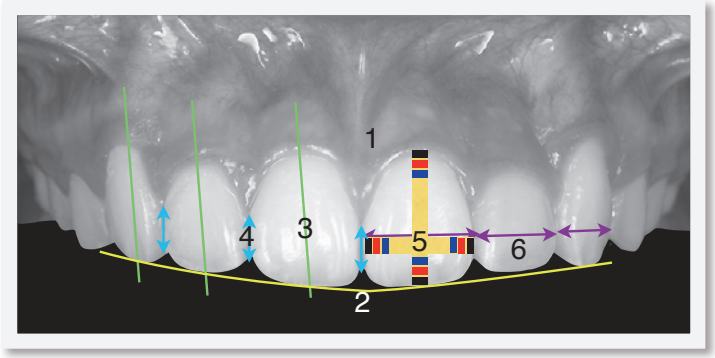


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

2. White Esthetic Score (for Micro-esthetics)

Total = 0



1. Midline	0	1	2
2. Incisor Curve	0	1	2
3. Axial Inclination (5°, 8°, 10°)	0	1	2
4. Contact Area (50%, 40%, 30%)	0	1	2
5. Tooth Proportion (1:0.8)	0	1	2
6. Tooth to Tooth Proportion	0	1	2

1. Midline	(0)	1	2
2. Incisor Curve	(0)	1	2
3. Axial Inclination (5°, 8°, 10°)	(0)	1	2
4. Contact Area (50%, 40%, 30%)	(0)	1	2
5. Tooth Proportion (1:0.8)	(0)	1	2
6. Tooth to Tooth Proportion	(0)	1	2

2018

iAOI Symposium

Dr. Diego Peydro

05 / 27 (Sun)

Location:
National Tsing Hua University, Delta Building
B1 Conference Hall
(No. 101, Section 2, Kuang Fu Road, Hsinchu, Taiwan)

ALIGNER ORTHODONTICS: New Paradigm and challenges

Dr. Peydro Diego is the Associate Professor of the Master program in Orthodontics at the European University of Madrid and Master Collaborator Professor of Orthodontics at the University of Valencia, Spain. Dr. Peydro is the co-director of two continuing training programs focusing on the Invisalign system and teaches globally on Invisalign. His lecture will address some of most common problems that clinicians face as they begin to offer aligner therapy, including effective communication with technicians, setting up treatment plan using Clincheck, attachment selection and offer his recommended protocols.

New Vision of Aligner Orthodontics Aligner

The winning FORMULA: THINK + PLAN + EXECUTE

Attachment selection based on the treatment plan: When and why we should change the attachments?

A New Paradigm of the Transversal Dimension to Get Amazing Results

Planning for critical simultaneous movement

Miniscrews and elastics: Exceeding the limits of the expansion

How to Deal with Vertical Malocclusions?

Big mistakes to avoid in Clincheck planification

Attachments vs sequence of movements. Which is more important?

Treating Severe Open Bite and Deep Bite with Miniscrews

G5 protocol modification, Bite turbos and more

	By 2018/03/01	After 2018/03/01
Registration	USD 250	USD 300

▲ Payment: wire transfer (no credit card)

Beneficiary Bank	JIH SUN INTERNATIONAL BANK (SWIFT CODE : JSIBTWTP)
Beneficiary Bank Address	NO.10, SEC. 1, CHONGQING S. RD., TAIPEI CITY, TAIWAN R.O.C.
Beneficiary Name	IAOI
Beneficiary A/C NO.	326-2737621-00

Cancellation policy:
Cancellation before March 1 is subject to 10% of cancellation fees or 30% after March 1.

Phone: +886-3-573-5676 Registration: http://iaoi.pro Contact: Michelle Tsai contact@iaoi.pro

2018

iAOI Symposium 年中大會

Dr. Diego Peydro

05／27（日）

地點：國立清華大學校本部 台達館 B1 璟德講堂
（新竹市東區光復路二段101號）

ALIGNER ORTHODONTICS:
全新典範與挑戰

Dr. Diego Peydro Herrero 為西班牙的矯正專科醫師，並於馬德里和瓦倫西亞大學開設矯正專業課程。此外，他也是隱適美系統的專家，在歐洲和中東地區開設隱適美系統的國際繼續教育課程-Clear Ortho Inter-national Program (COIP)。本次演講將針對醫師在開始提供 Aligner 治療後會遇到的常見問題，包含與技師的溝通，如何快速有效的確立治療計畫，進行 Clincheck，選擇 Attachments 等等，提出他建議的 Protocols。

9:00-10:30 ▶ **矯正的新視野**

適用於 Aligner 的矯正力學

致勝方程式：思考＋計畫＋執行

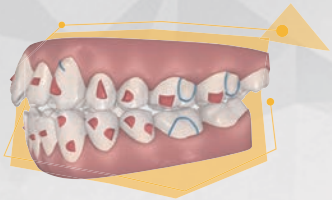
立基於治療計畫的 Attachment 選擇

11:00-12:30 ▶ **處理 Transversal 面向的新典範**

數位化設計理想的牙弓形狀

計畫關鍵牙齒的整體性移動

迷你螺絲和橡皮筋：如何超越移動的限制？



13:30-15:00 ▶ **如何處理 Vertical 問題？**

在計畫擬定時考量「臉」的重要性

如何避免在計畫擬定時的重大錯誤

Attachments 和牙齒移動的順序，何者比較重要？

15:30-17:00 ▶ **利用迷你螺絲治療嚴重開咬和錯咬**

G5 protocol 的修訂，BT 及其他

報名專線：03-5711377　報名網址：iaoi.pro　聯絡方式：蔡小姐 contact@iaoi.pro

ALIGNER ORTHODONTICS - Workshop

ALIGNER x MINISCREW

Diego Peydro x 張慧男

Dr. Diego Peydro

地點：新竹市東區建中一路25號2樓
（金牛頓藝術科技）

05 / 28（一）

張慧男 博士

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

09:00-11:00 **Class II and III, extraction or not? Dr. Peydro's protocols**
Hands on: Excel in the Clincheck Software

11:30-12:30 **如何處理 Sagittal 問題以及嚴重案例？**

13:30-15:00 **Miniscrews in the tuberosity. A new paradigm**
Hands on: Miniscrews application

特別演講：Diego Peydro x 張慧男醫師

15:30-17:00 **如何利用 Aligner 輕鬆有效地處理阻生齒？**

	2018/03/01前		2018/03/01後	
	會員	非會員	會員	非會員
大會單場報名	$5,000	$6,600	$6,600	$8,000
大會＋Workshop（含年費 3,000）	$25,000	–	$28,000	–

- Workshop 不開放非會員報名

▲學分：依衛福部醫事人員繼教育積分管理辦法登錄授與專科醫師認證學分。

▲匯款資訊：日盛國際商業銀行815光復分行0347　帳號：105-27376210-000　戶名：國際矯正植牙學會
2018/4/27前因故退費，需扣除10%行政費用；4/27後因故退費，需扣除30%行政費用。

主辦單位：IAO 國際矯正植牙學會

TruRoot®: Increasing simulation accuracy of Insignia® by CBCT

Abstract

CBCT-generated TruRoot® data is integrated in the Insignia® system for precise root positions and low dose radiation exposure, which provides more reliable Insignia-simulated treatment results. Furthermore, clinicians using the Insignia Approver® software, no longer have to guesstimate root problem while fine-tuning the final occlusion. In addition, any signs of root resorption can be more easily identified by CBCT and checked in the Approver®. (Int J Orthod Implantol 2017;48:98-99)

Key words:

Insignia system, passive self-ligating bracket, custom bracket, CBCT

The Insignia® system used panoramic radiographs and intraoral scanner/impression data to simulate root positions. However, the 2-dimensioned (*2D*) panoramic imaging could create compromising accuracy in the representation of roots. In January 2017, Ormco® introduced TruRoot® data integration, a root recognition algorithm, which uses cone beam computed tomography (*CBCT*) to provide precise root positions and morphology (*Fig. 1*). The TruRoot® technology has the ability to map each individual root position using low dose radiation scans, enabling clinicians to reduce patients' radiation exposure.

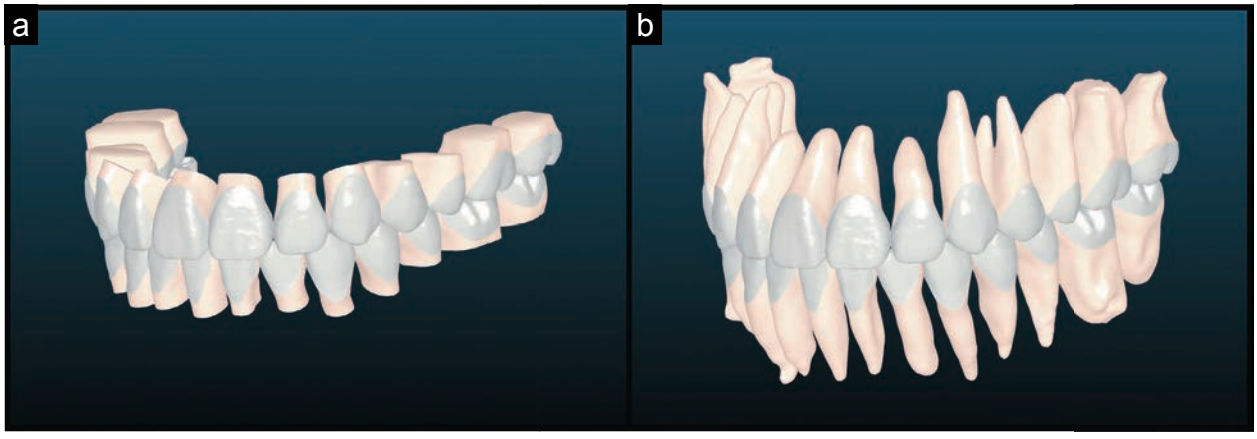


Fig. 1:
(a) Lateral and frontal views of the digital set-up using 2D panoramic radiograph.
(b) Digital setup using 3D CBCT TruRoot data integration, which provides more reliable root positions.

Dr. Angle Lee,
Director, Beethoven Orthodontic Center, Taiwan Editor, International Journal of Orthodontics & Implantology (Left)

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

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

Furthermore, any signs of root resorption can be more easily identified by clinicians and be avoided by prescribing lighter, more stable forces during alignment (*Fig. 2*).

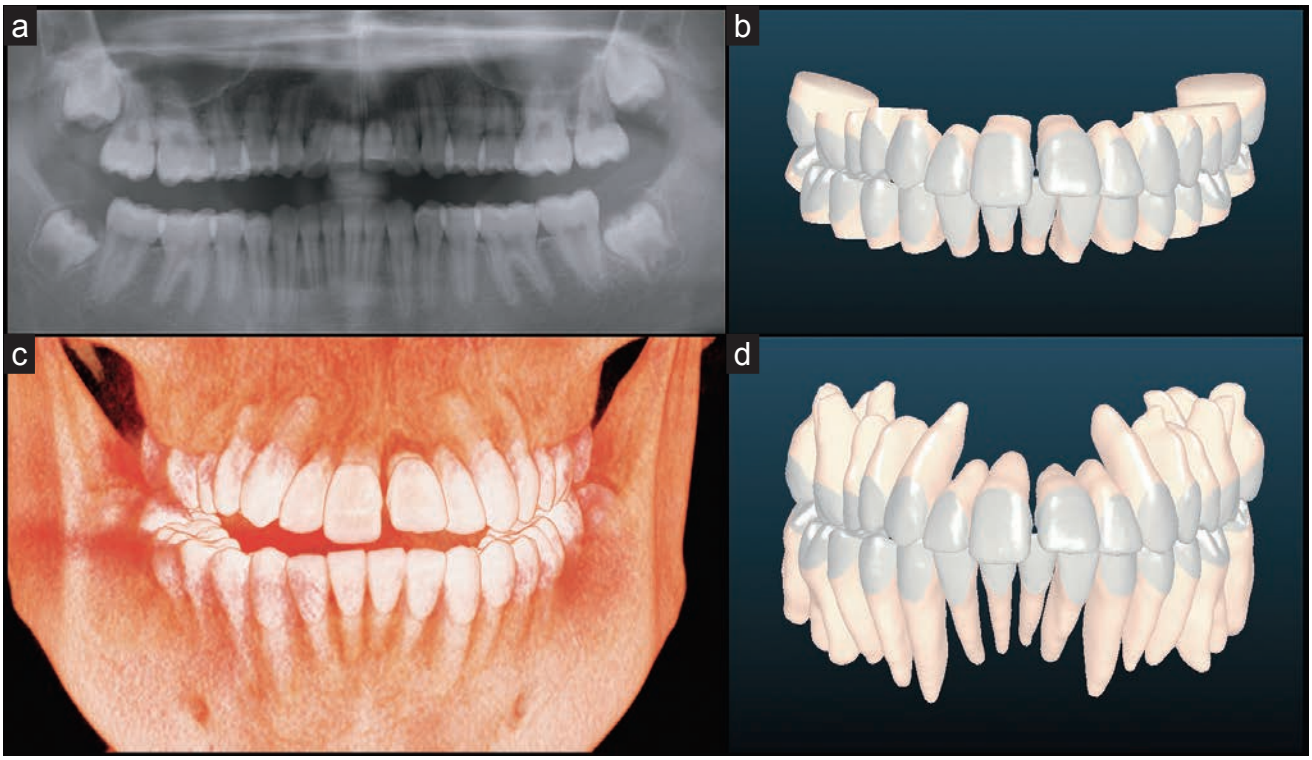


Fig. 2:
(a) Panoramic film
(b) Pre-treatment digital simulation without roots by 2D panoramic film
(c) Frontal view of the CBCT imaging, taken by KAVO 3D eXam®+ (KAVO, Biberach/Riss, Germany)
(d) Pre-treatment digital simulation with CBCT TruRoot® technology, which shows significant upper incisor root resorption.

Conclusion

Advantages of TruRoot® includes: (1) precise root position and morphology, (2) low dose radiation exposure, (3) root resorption can be easily identified.

KERR精選商品優惠

優惠期間：*2017/6/26 - 12/25* 止

Kerr

『Cement & Bonding』

任選一

Herculite Précis Flow ×5盒
新一代流動性樹脂
(定價NT$2,200/2g×2支/盒)

或

Herculite Précis Unidose ×10盒
奈米變色龍樹脂
(定價NT$1,100/2g/盒)

+ ***OptiBond All-In-One*** ×1瓶
三合一自酸蝕黏著劑
(定價NT$3,800/6ml/瓶)

特價 **NT$5,500**/組

· 衛部醫器輸字第028594號
· 衛署醫器輸字第022166號
· 衛署醫器輸字第018552號

買 ***Maxcem Elite 12*** 盒
二合一多功能樹脂黏著劑
(定價NT$5,000/5gx2支/盒)

送 **無線LED光聚機** x1台
Demi Plus 或 ***Demi Ultra***
輕巧無線式LED光聚機 / 電容式無線LED光聚機
(定價NT$50,000/台) (定價NT$55,000/台)

特價 **NT$60,000**/組

· 衛署醫器輸字第019918號 · 衛署醫器輸字第023384號
· 衛部醫器陸輸字第000752號

『2 罐1支的完美搭配』

Kerr 生產的 ***NX3*** 樹脂黏著劑 及 ***OptiBond™ Versa*** 黏著劑的組合為提供牙醫最先進的解決方案，兩者搭配將是您 CAD / CAM 牙體復形的最佳選擇。
特色包含： · 方便清除 · 顏色穩定性佳· 高黏著度 · 減少術後敏感

更多OptiBondVersa＋NX3詳情

OptiBond™ Versa
Primer + Adhesive (各6ml)
自酸蝕二瓶式黏著劑
(定價 NT$2,800/瓶)

+

NX3 Dual-Cure
第三代全方位永久性樹脂黏著劑
(定價NT$3,100/支)

特價 **NT$4,999**/組

衛署醫器輸字第020145, 衛署醫器輸字第022545號

『加成型矽膠印模材』

Take 1 Advanced
Cartridge Wash (Light body) (50mlx24) x1 箱(24支裝)

+

Take 1 Advanced
Volume Tray (380mlx2) x2 盒

· 衛署醫器輸字第021479號

24支箱 2盒

特價 **NT$20,000**/組
(定價NT$46,400/組)

湧傑 YONG CHIEH 訂購專線：北區 (02)2778-8315 · 中區 (04)2305-8915 · 南區 (07)226-0030

Obturation System
elementsfree Package

ENDO精選商品優惠

優惠期間：*2017/6/26 - 12/25* 止

Kerr ENDODONTICS

・衛部醫器輸壹字第016766號・衛部醫器輸壹字第015275號・衛署醫器輸字第011611號

Elementsfree x 1 台
無線雙功能根管充填機

＋ *GP Cartridge* x 10 盒 *(23, 25 Gauge任選)*
子彈型銀膠針

＋ *Pulp Canal Sealer EWT* x 1 盒
長效型氧化鋅根管充填劑

特價 **NT$129,999**/套

(定價NT$252,800/套)

TF Adaptive Starter Kit

- (1) Elements Motor w/ contra angle (8:1手機)
- (5 pks) TF Adaptive Small in 23mm
- (2 pks) TF Adaptive Small in 27mm
- (5 pks) TF Adaptive Medium / Large in 23mm
- (2 pks)TF Adaptive Medium / Large in 27mm
- (2 pks) #8 K-files in 25mm
- (2 pks) #10 K-files in 25mm
- (2 pks) #15 K-files in 25mm
- (1) LA Axxess 2.0 Kit

・衛部醫器輸壹字第014069號 ・衛署醫器輸壹字第009148號

(定價NT$185,000/套)

特價 **NT$99,999**/套

買 *Endo Hand Files* x *100* 盒
手動根管銼針系列(號碼任選)

- K-Files #06-#40
- Triple-Flex #08-#40
- Reamers #06-#40
- K-Flex #06-#40
- Hedstrom #15-#40
- Pathfinder 21mm/25mm

贈 好禮 2選1 *M4 Safety Handpiece* x 1 支 或
根管擴大慢速安全手機

Touch'n Heat x 1 台
馬來膠熱融機

或

・衛署醫器輸字第010982號
・衛署醫器輸壹字第009148號
・衛部醫器輸壹字第013962號

特價 **NT$38,000**/套

(定價NT$71,000-75,500/套)

買 *LA AXXESS KIT 2.0*
根管冠部擴大器械

限量50套

贈 好禮 3選1 *Sealapex* x 3盒 或 *Tubli-Seal* x 3盒 或
氫氧化鈣根管充填劑　丁香油根管充填劑

Pulp Canal Sealer EWT x 1 盒
長效型氧化鋅根管充填劑

・衛署醫器輸字第013794號
・衛署醫器輸字第013633號
・衛署醫器輸字第011611號

特價 **NT$7,200**/套

(定價NT$13,000-13,200/套)

OBS
OrthoBoneScrew

OrthoBoneScrew Super Set

Created by Dr. Chris Chang, OrthoBoneScrew(OBS) is made of medical grade, stainless steel and is highly praised by doctors for its simplistic design, low failure rate and excellent quality. Beethoven's OBS super set is your must-have secret weapon toprovide a consistent traction force in a minimally invasive approach.

Smooth Mushroom Head
For comfort & retention of elastic chain

4-way Rectangular Holes
For lever arm to solve impacted tooth

Double Neck Design
Easy hygiene control & extra attachment

FDA

ISO 9001 SGS ISO 13485 SGS

Directive 93/42/EEC G.M.P. MEDICAL DEVICE

Made in Taiwan

Screw Type	
1.5	1.5x8mm
2.0	2.0x12mm
2.7	2.0x14mm (with holes)

Buy a Super Set, get ***OBS Clinical Guide*** **(ebook on iPad)** for free.

Newton's A +886-3-573-5676 http://orthobonescrew.com info@newtonsa.com.tw

Products

Dental Products Essential Kit

NEW

Double Retractors Autoclavable!

Double Retractors x2, Black Board x2

While keeping the same lip & cheek two-way design, the new Double Retractors 2.0 is upgraded to medical grade PPSU. This new material is more durable, resilient and most importantly, autoclavable. Its smooth edges and translucent quality make it the best aid to perfect intra-oral photography.

Stainless Steel Mirror

Size : L (Recommanded), M, S

Strong, durable stainless steel, autoclave-proof, the specially designed size, shape and thickness ensure maximum intra-oral view without sacrificing patient comfort.

Bite Turbo 2.0

Handle x1, BT molds x6, BT extended molds x6, Button molds x6

A simple but power set of tools to correct severe deep bite and cross efficiently. The bite turbos and lingual button molds, made with silicon and filled with flowable resin, can be reused and adjusted depending on treatment progress. The longer one allows you to solve all kinds of deep bite and large horizontal overjet.

Refinement of Gingival Margins: Biological Depth vs. Zone, and a Diode Laser

Abstract

Gingivectomy refines dental esthetics by correcting gingival margins and improving dental crown forms to enhance outcomes for orthodontic and interdisciplinary treatment. The predictability of a gingival revision depends on preoperative planning, which is based on a thorough understanding of the form and function of a healthy periodontium. The epithelial attachment (EA) is composed of three periodontal tissues: sulcus depth (SD) of marginal gingiva, connective tissue attachment (CTA), and junctional epithelium (JE). The combination of two anatomical tissues (CTA and JE) is defined as the biologic or biological width. It is the physical barrier that protects sterile internal tissues from the microbes of the oral cavity. The tissues of the biological width are bordered and protected by an immunologic buffer zone (SD). In effect, all three tissues (SD, CTA, JE) function together as a biological zone, which is an essential physiologic barrier between the oral cavity and alveolar bone. The biological zone must be preserved during a gingivectomy procedure, to avoid the longterm chronic inflammation due to a biological width violation. The traditional method for removing excessive gingival tissue is excision with a scalpel, which has the disadvantages of a long and relatively complex operation, followed by an extended healing interval. Oblation of excessive gingival tissue with a diode laser reduces the duration and complexity of the surgical procedure, plus it shortens the recuperative (healing) period. Additional advantages of laser surgery are minimal probability of infection, and little or no pain. Diode lasers are a superior gingivectomy option for both patients and clinicians, but the biological zone must be respected. (Int J Orthod Implantol 2017;48:104-108)

Key words:

Gingivectomy, biologic or biological width, connective tissue attachment, junctional epithelium, sulcus depth, biologic or biological zone, diode laser.

Introduction

Kings and emperors constructed castles with moats for protection from invaders. This is analogous to the oral physiologic triad that protects the monarch of the periodontium: alveolar bone. A castle wall and moat (*Fig. 1*) are similar barriers compared to the connective tissue attachment (*CTA*) and the junctional epithelium (*JE*) concept of Cohen.[1] In effect, alveolar bone is protected from the invasion of bacteria, foreign materials, infection, and disease by an anatomic barrier.

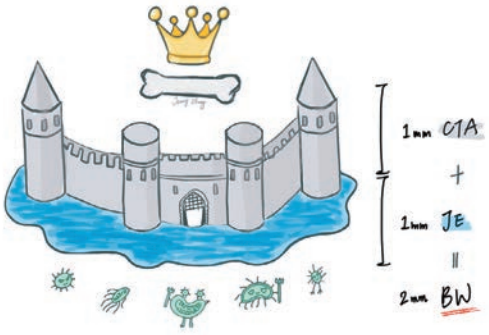


Fig. 1:
The king of the periodontal realm is bone as denoted by the crown. A castle wall is analogous to the 1mm connective tissue attachment (CTA), and the moat represents the 1mm junctional epithelium (JE). The CTA (1mm) and JE (1mm) combine to provide a biological width (2mm) that serves as a barrier to microbe invasion from the biofilm that coats teeth (below).

Dds. Jennifer Chang,
Clerk, Beethoven Orthodontic Center (Left)
Dds. Laurel Shern,
Clerk, Beethoven Orthodontic Center (Center left)
Dds. Kristine Chang,
Clerk, Beethoven Orthodontic Center (Center right)
Dr. W. Eugene Roberts,
Editor-in-chief, International Journal of Orthodontics & Implantology (Right)

Biological Width or Biological Zone?

What is the distinction between the anatomic term biological width and the more physiologic concept biological zone? The EA or dentogingival junction is the linear dimension of the soft tissue that links the attached gingiva to the cervical portion of a tooth root, coronal to the crest of the alveolar bone. Gargiulo et al.[2] described a healthy human dentogingival junction as a biological zone of about 3mm of soft tissue extending from the gingival margin to the crest of the alveolar bone (*Fig. 2A*). It was subdivided into ~1mm of connective tissue attachment (*CTA*), ~1mm of junctional epithelium (*JE*), and ~1mm of sulcus depth (*SD*). According to Ingber, Rose and Coslet,[1] Cohen is credited with introducing the term biological width to describe the combined width of the CTA and JE. Kois[3] expanded the term to biological zone to embrace the entire concept of Gargiulo et al.[2] who included sulcular depth as an integral component of the attachment apparatus (*Fig. 2B*). From a restorative perspective, the definition of Kois[3] is more practical because the 3mm biological zone is readily identified clinically from the marginal crest of the gingiva.

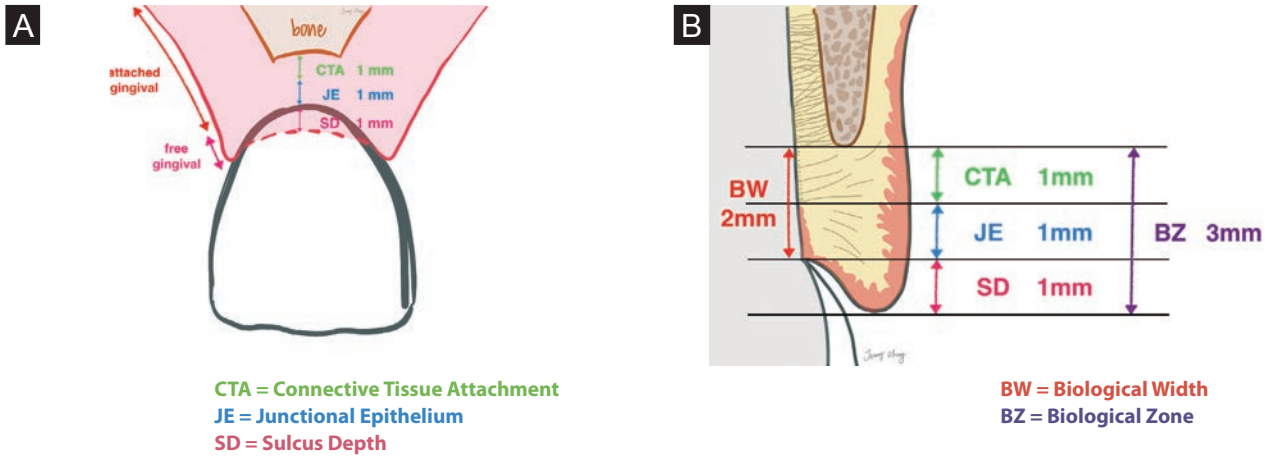


Fig. 2:

A. A healthy periodontium has a ~3mm biological zone of epithelial attachment composed of three tissue layers (CTA, JE and SD) which protects the bone form the oral environment.

B. The combined height of CTA and JE is defined as the biological width (BW). The combined height of CTA, JE and SD is defined as the biological zone (BZ).

Monitoring gingival health

The gingival sulcus is the clinical window to periodontal health[4] so it is a critical component of the biological zone. Although gingival health is easily monitored by sulcus depth and bleeding on probing, these routine methods do not detect all periodontal disease,[5] but they are good clinical measures for planning a gingivectomy for esthetic purposes. A healthy periodontium is a prerequisite for all gingival revisions related to the refinement of esthetics. A healthy gingival sulcus has an important immunologic role in protecting the underlying attachment tissues, as part of the overall protection of the gastrointestinal tract.[6] In addition, the increased flow of crevicular fluid in response to inflammation helps to further protect the epithelial attachment.[7] Returning to the analogy of the castle (*Fig. 1*), crevicular fluid from an inflamed sulcus is much like an overflowing moat that repels invaders. Thus maintaining a healthy periodontium requires that the gingival margin be at least 3mm occlusal to the alveolar crest of bone.

How is this applied to patients?

Marginal gingivitis must be controlled with good oral hygiene prior to planning gingival modification to enhance dental esthetics. The clinician carefully evaluates the nature of the EA when considering a gingivectomy. Simply measuring the depth of the gingival sulcus is inadequate. A good understanding of the fundamentals defining the biological width and zone are essential for determining how much soft tissue can be safely removed from the gingival margin. The critical step in planning a gingivectomy is bone sounding under local anesthetic with a periodontal probe to determine the height of the alveolar crest relative to the gingival margin. If the dimension exceeds 3mm, the surplus gingiva is expendable. For example, a patient with a sounding depth of 4mm (*Fig. 3a*) is a candidate for a 1mm gingivectomy (*Fig. 3b*). Removing too much gingival tissue creates a biological zone violation which is often manifest as chronic gingival inflammation.[4] Maintaining ~1mm of sulcular depth is important for the physiology of the biological zone to preserve the integrity of the anatomic barrier. Violating the biological width usually must be corrected with a surgical reduction of the alveolar crest.[4]

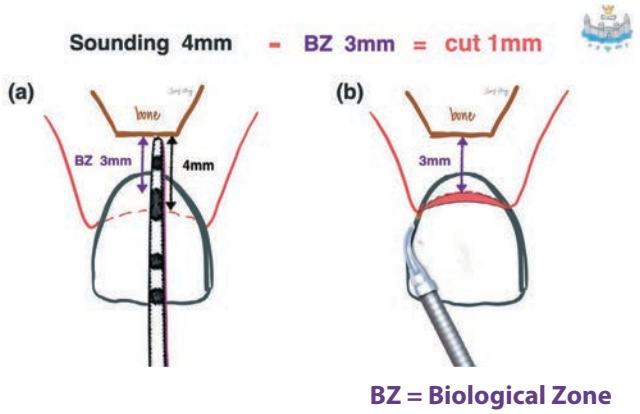


Fig. 3:
(a) Bone sounding of 4mm is performed with a periodontal probe. Subtract the BZ of 3mm and then 1mm of marginal gingiva can be removed.
(b) The pink shaded portion is the 1mm of soft tissue removed with the laser.

Fig. 4:
A. A frontal view of the anterior maxillary segment shows irregular gingival margins, a hypertrophic maxillary frenum, and two bleeding sites where miniscrews were removed from between the roots of the central and lateral incisors.
B. Following the diode laser gingivectomy the gingival margins are near ideal, and a frenectomy has been performed.
C. Following soft tissue healing, the gingiva margins are maintained and no scarring is evident.

Diode laser

For a patient with a bone sounding depth of 5mm, 3mm was subtracted to preserve the biological zone, so a maximum of 2mm of gingival height could be selectively removed (*Fig. 4A*). An Epic X® (*Biolase, Irvine, CA*) diode laser (*Fig. 5*) was used to refine the gingival margins and simultaneously perform a frenectomy (*Fig. 4B*). The soft tissue healed uneventfully resulting in enhanced dental esthetics (*Fig. 4C*). The laser emission wavelength is 812 to 980 nm which is maximally absorbed by the pigmentation (*melanin*) of the soft tissue, thereby producing excellent hemostasis. The Epic X® diode laser is designed (*power and wavelength emission*) to only cut soft tissue, with little appreciable effect on hard tissue (*bone or enamel*). It also provides tactile feedback in the contact mode to facilitate precise contouring of gingiva during the surgical procedure.[8] In addition, the intense coherent light seals off blood vessels and lymphatics at the surgical site resulting in a dry, more visible field. Postoperatively the wound is sealed with a biological dressing, to help prevent infection, control damage to adjacent tissue, minimize pain, reduce swelling, and eliminate scars. Overall, the diode laser has a shorter operative time and faster postoperative recuperation compared to traditional gingivectomy using a scalpel.[8] In addition to soft tissue oblation, the Epic X®diode laser is capable of tooth whitening and TMJ pain relief. Furthermore, it delivers faster pulses, as short as one

Fig. 5:
Epic X® diode laser advantages are listed as: versatile, powerful, efficient and portable. See text for details.

millionth of a second, to decrease the heat delivered to the tissue which increases patient comfort. The unit is small, portable, and uses disposable tips, which cuts down on setup and procedure time.

Conclusion

Gingival shape, contour and crown length are easily adjusted with a diode laser, but all gingivectomy procedures must respect the ~3mm biological zone.

Bone sounding under local anesthesia is the most reliable method for defining the height of the alveolar crest. Ideal tooth proportionality and harmonious gingival contours contribute to more esthetic outcomes.

Acknowledgement

Thanks to Mr. Paul Head and Ms. Tzu Han Huang for proof reading this article.

References

1. Ingber JS, Rose LF, Coslet JG. Te "biologic width"—a concept in periodontics and restorative dentistry. Alpha Omegan 1977;70:62–5.
2. Gargiulo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. J Periodontol 1961;32:261-7.
3. Kois JC. New paradigms for anterior tooth preparation. Rationale and technique. Oral health 1998;88(4):19-22, 25-17, 29-30.
4. Nugala B, Kumar BS, Sahitya S, Krishna PM. Biologic width and its importance in periodontal and restorative dentistry. J Conserve Dent 2012;15(1):12-17.
5. Ito H, Numabe Y, Sekino S, Murakashi E, Iguci H, Hashimoto S, Sasaki D, Yaegashi T, Kunimatsu K, Yakai H, Mezawa M, Ogata Y, Watanabe H, Hagiwara S, Izumi Y, Hiroshima Y, Kido J, Nagata T. Evaluation of bleeding on probing and gingival crevicular fluid enzyme acivity for detection of periodontally acive sites during supportive periodontal therapy. Odontology 2014;102(1):50-56.
6. Zhang Q, Shi S, Liu Y, Uyanne J, Shi Y, Shi S, Le AD. Mesenchymal stem cells derived from human gingiva are capable of immunomodulatory functions and ameliorate inflammation-related tissue destruction in experimental colitis. J Immunol 2009;183(12):7787-7798.
7. Golub LM, Kleinberg I. Gingival crevicular fluid: a new diagnostic tis in managing the periodontal patient. Oral Science Review 1976;8:49-61.
8. Sarver DM, Yanosky M. Principles of cosmetic dentistry in orthodontics: part 2. Sof tissue laser technology and cosmetic gingival contouring. Am J Orthod Dentofacial Orthop 2005;127:85-90.

2018
貝多芬高爾夫邀請賽
Beethoven Golf Invitational

本年度邀請賽已正式登錄 R&A 賽事行程

宗旨

秉持貝多芬齒顎矯正堅持完美與感動之創院精神，藉由高爾夫運動參與，養成健康運動的習慣，活絡人際間的互動，致力推動高爾夫運動人口倍增回饋於社會並鼓勵具潛力之青少年選手參與，開拓選手的國際視野。

日期

練習賽：2017 年 12 月 29、30 日
預　賽：2017 年 12 月 31 日
決　賽：2018 年元旦

地點

寶山高爾夫俱樂部（新竹縣寶山鄉寶新路二段 465 號）

資格

23 歲以下，限額 100 名。

報名

12/1 日前向新竹市體育會高爾夫委員會報名。
電話：03-5385155；傳真：03-5380951
E-mail：chunhong@mail.ypu.edu.tw

主辦單位：貝多芬齒顎矯正中心　承辦單位：新竹市體育會高爾夫委員會

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

『矯正配件與器械專區』

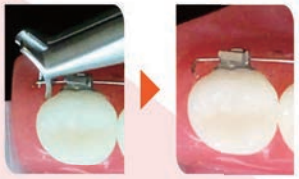
Ormco
Your Practice. Our Priority

買 Copper Ni-Ti Archwire x 5盒
感溫性鎳鈦合金線（傳統 或 Damon Form）
(定價NT$2,600/盒(10's)) (線徑任選)

或 Ni-Ti wire x 5盒
鎳鈦合金線
(定價NT$2,100/盒(10's)) (線徑任選)

二種任選

贈 Hu-Friedy Hammerhead Plier x 1支
鎳鈦線尾彎折器械
(定價NT$5,800/支)



HF678-502
Slim Hammerhead
NiTi Pliers

或 Distal End Cutter x 1支
尾線剪
(定價NT$6,400/支)

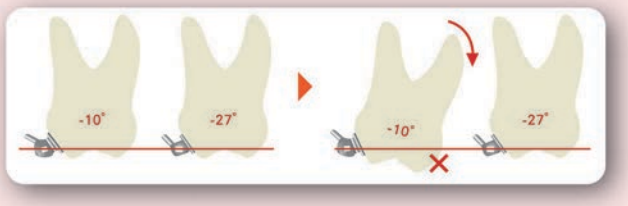
HF678-101L
Universal Cut &
Hold Distal End Cutter,
Long Handle

ACCENTmini (Bondable Tube)

買2盒 送2盒
(定價NT$3,500/10顆/盒)

Dr. Menzel 課程建議使用更大角度的 molar tube，降低 upper 2nd molar palatal cusp hanging down 的機率

Dr. Menzel



特價 **NT$7,000/組**
(定價NT$14,000/組)

Crimpable Hook x 2包(50個/包)
矯正舒適球形鉤（定價NT$3,200/包）

+ DM Hook Plier x 1支
Hook Applying Forceps (20.088.14D)（定價NT$7,200/支）

DEWIMED SMART INNOVATION

特價 **NT$8,800/組**
(定價$13,600/組)

買 Zoo Pack Elastics x 5盒
動物圈（定價NT$2,750/盒）

贈 Power Chain x 5卷
矯正專用彈力鏈（定價NT$2,200/卷）

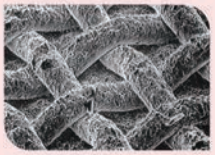
・衛部醫器輸壹字第014665號 ・衛署醫器輸醫字第010513號
・衛署醫器輸醫字第010432號 ・衛署醫器輸醫字第000808號

『矯正器專區』

買 Mini Diamond Bracket x 30人份

5+5 / 5+5，3th有 Hook (定價NT$4,120/人份)

- **17-4 SS 鋼質** 體積小、不易變形
- **底座 Optimesh XRT** 增加黏著強度
- **Hemi Hook 設計** 使彈力裝置穩固不彈飛



Optimesh XRT 100gauge
增加黏著強度

Hemi Hook
使彈力裝置穩固不彈飛

再加贈 Light Cure x 1台

無線LED光聚機

Demi Plus
輕巧無線式LED光聚機(定價NT$50,000/台)

或

Demi Ultra
電容式無線LED光聚機(定價NT$55,000/台)

特價 **NT$92,700/組**
(定價NT$173,600-178,600元/組)

・衛署醫器輸壹字第010432號 ・衛署醫器輸字第023384號 ・衛部醫器陸輸字第000752號

DAMON Q

Damon Q single patient Kit
戴蒙Q矯正器 5+5 / 5+5 Standard / 2 人份

Damon Q opening tool
矯正器專用開關器械 / 1 支

Damon .014 Copper Ni-Ti
感溫性鎳鈦合金線 / 1 盒 (10's)

Damon .014x.025 Copper Ni-Ti
感溫性鎳鈦合金線 / 1 盒(10's)

Damon .017x25 Low Friction TMA
低摩擦力鈦鉬合金線 / 1 盒(10's)

Damon .016x.025 SS
不銹鋼合金線 / 1 盒(10's)

Enlight Unidose
光照含氟矯正專用黏著劑-子彈型 / 1包 (2gx2盒/包)

Ortho Solo
多功能光照基底劑 / 1瓶 (5ml/瓶)

特價 **NT$35,000/組**
(定價NT$51,000/組)

加購

林錦榮醫師著作《Creative Orthodontics》
加購價 **NT$999** 限量100本
2007.12 出版 (定價NT$6,000/本)

優惠期間：自2017/6/26-12/25止

・衛署醫器輸字第010924號 ・衛署醫器輸字第010954號
・衛署醫器輸壹字第006857號 ・衛署醫器輸壹字第009295號 ・衛署醫器輸壹字第010513號

湧傑 YONG CHIEH 訂購專線：北區 (02)2778-8315・中區 (04)2305-8915・南區 (07)226-0030

Feedback from the Beethoven Master Program

Fun learning and eyes opening session with great hospitality from Dr. Chris and the team. Thumbs up!

Liew Pik San,
MALAYSIA

As this is my first time attending a orthodontic course, I can't really compare it with others. I know Orthodontics involves a lot of theories and the subject is sometimes dull and dry, but Dr. Chris made it very interesting and simple -- really amazing! He managed to cover the whole orthodontic subject in just 2 days, and moreover, he also included hand-on exercises and exposed us with his clinical session. Congratulations to you, Dr. Chris.

I managed to listen to lectures, try out new skills in the hands-on workshop, and experienced how the Orthodontics was applied to patients in his clinical session. I mean I could see the whole treatment process -- from consultation for gathering information, to treatment planning, bonding, placing bone screws, changing wires, elastic band, ligature wires and de-bonding in just one afternoon session! He was busy treating patients and yet managed to teach us and made jokes!

One thing really good about Dr. Chris that no other speaker has -- he will never give up! He will go further; learning and practicing and there is no end to it! And he wants us to follow him. Practice makes perfect! He wants us to practice using the best tools so that we will never regret. And lastly he wants us to start Orthodontics with collecting patient's data in a systematic and presentable way. It is important for treatment planning, asking his advice, learning the progress of treatment, comparing pre & post result, present the case or get them published. I'm impressed with the effort he has already put in his clinic and now every one of his staff is practicing it! Amazing!

Congrats to you again, Dr. Chris!

Dr. Hon Wei Ng,
MALAYSIA

I would like to express my sincere gratitude and appreciation for the great hospitality that Newton's A team has provided us during the entire short trip. We feel very welcomed and satisfied with the service provided. Everything is well taken care of, including the welfare of our companion.

Also, not to forget to thank Dr. Chris who selflessly thought us all the relevant orthodontic knowledge and techniques. He is truly an inspiration!!

Dr. Chong Zee Ling, Jacqueline
MALAYSIA

Feedback from the Beethoven International Workshop, May, 2017.

I don't know of any other mini-implant course in the world where one can experience what Dr. Chris Chang's course has to offer. The most impressive part of the course was the clinical part where we were able to observe Dr. Chang place with ease so many mini-implants. But then we had the hands-on part of the course where we learned to do different techniques. Each person had his own animal head surrounded by a very efficient and capable team of assistants and orthodontists.

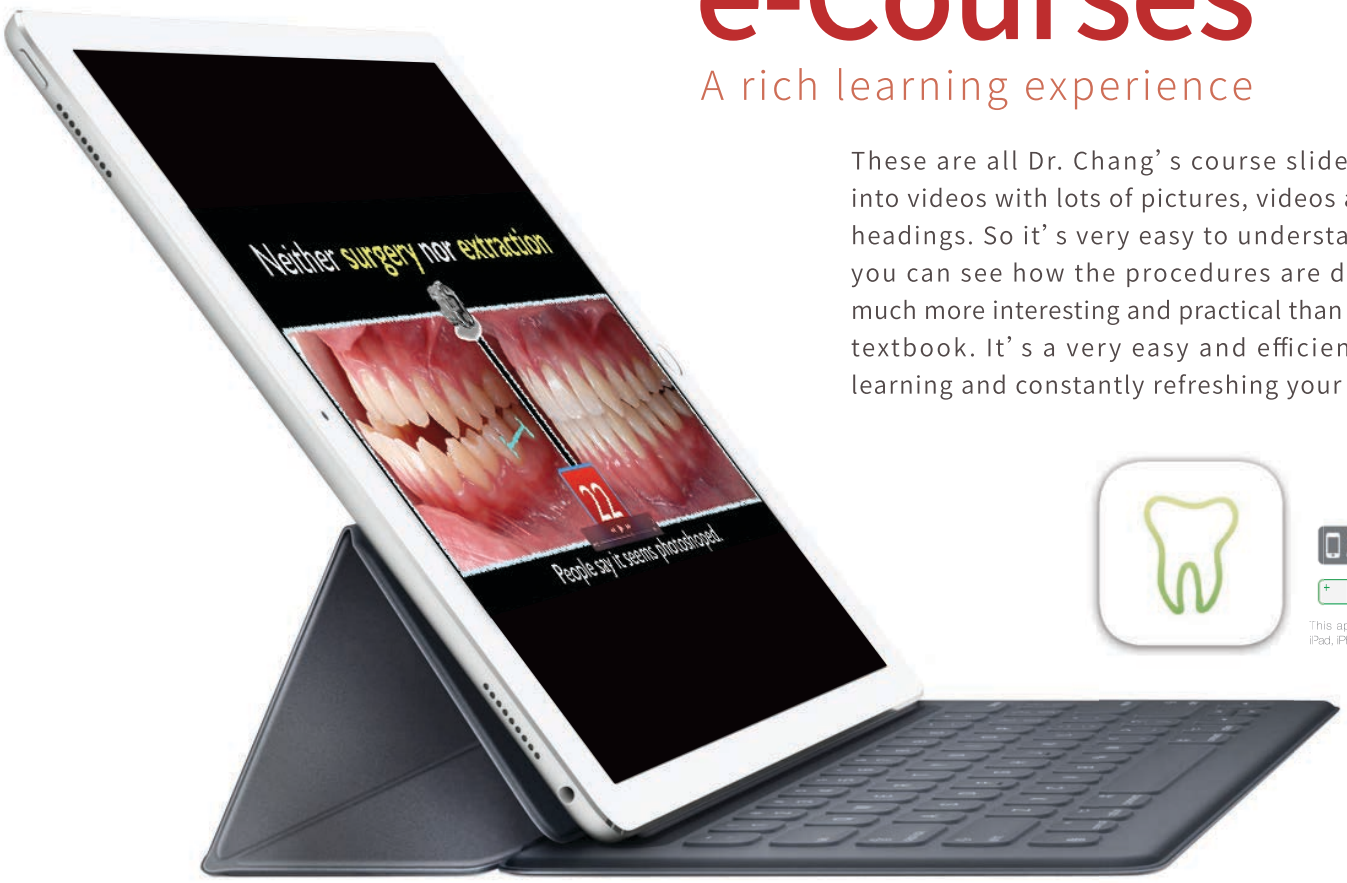
Dr. Chang once said that to be able to place a mini-implant, one had to observe at least 30 pieces being placed. Well during this course, I witnessed Dr. Chang placing so many that I stopped counting after 60. But there were surely more placed after that. His clinical team and staff were so organized that their support made it possible for each member in our group to be able to observe this with ease. An incredible learning experience!

Our accommodation was very comfortable and our meals were very good. I thoroughly enjoyed this course and the only thing I could suggest to make this better is maybe add 1 day more for the clinical part. I wouldn't mind coming back and doing it again as it was a very good learning experience.

Dr. Amelia Fissore,
MONACO

e-Courses

A rich learning experience



These are all Dr. Chang' s course slides turned into videos with lots of pictures, videos and clear headings. So it' s very easy to understand when you can see how the procedures are done. It' s much more interesting and practical than reading a textbook. It' s a very easy and efficient way of learning and constantly refreshing your memory.

Series

Voiced — Damon Q

Voiced — Advanced

Voiced — OrthoBoneScrew

Voiced — E-Lecture

Finishing (7 Sessions)

E-Ortho

E-Implant

E-Pedo

Assistant

Note:

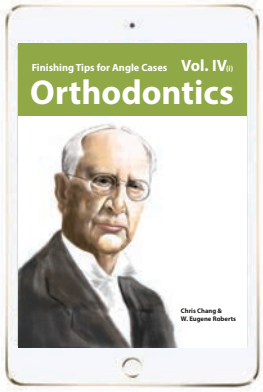
1. Most video courses are available in both English and Chinese and are sold separately.
2. Customers who purchase one set of courses will have access to both the narrated and non-narrated version.
3. Some courses, including Damon Q and Advanced, are renewed annually and each renewal is to be purchased separately with a 50% discount.

Newton's A +886-3-573-5676 http://orthobonescrew.com info@newtonsa.com.tw

e-BooK

Learn it your favorite way!

Best of all



BUY BOOK

This book requires iBooks 3.0 or later and iOS 5.0 or later.

The World's Best e-Textbook

Beethoven Dental Encyclopedia

e-Books collection

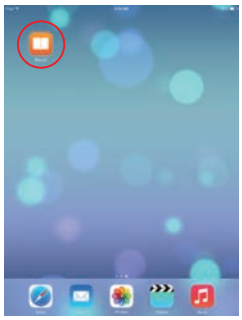
Beethoven Orthodontic and Implant Group has been publishing the International Journal of Orthodontics and Implantology since 2007. This Journal features excellently finished case reports evaluated by objective grading systems. **The Orthodontics and Implant Dentistry eBook series** is a special selection of exciting cases with interactive functions and multimedia resource. Once opening this book, your understanding of dentistry will never be the same!

Now available in iBooks Store in 51 countries:

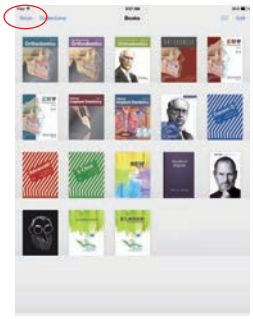
Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States, and Venezuela.

Available on the iBookstore

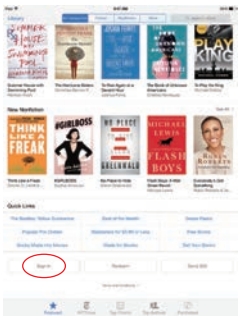
Step-by-step Instructions



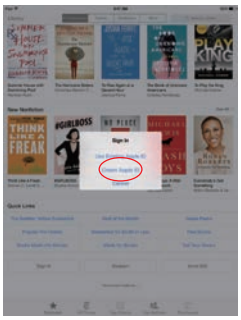
1. Launch "iBooks" app on your iPad.



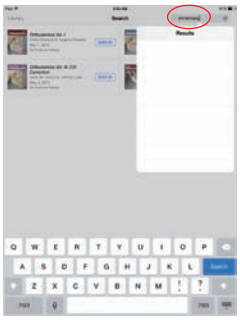
2. Click "Store."



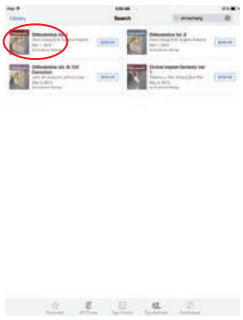
3. "Sign in" with your Apple ID.



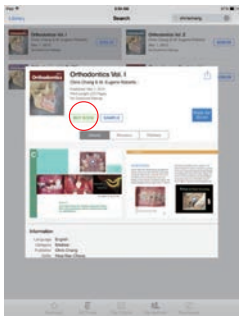
4. "Create Apple ID" if you don't have one.



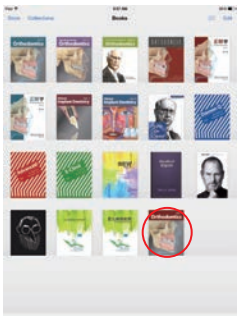
5. Search for "chrischang."



6. Click the book's icon.



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



8. Once downloaded, click the book's icon to launch the e-book and enjoy.

If you are interested in our paid video or medical products, contact **app@newtonsa.com.tw** for more information.

+886-3-573-5676

http://orthobonescrew.com

app@newtonsa.com.tw

Newton's A

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

Dr. John JJ Lin, Taipei, Taiwan

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

Dr. Tom Pitts, Reno, Nevadav, USA

"A great idea! The future of textbooks will go this way." *Dr. Javier. Prieto, Segovia, Spain*

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

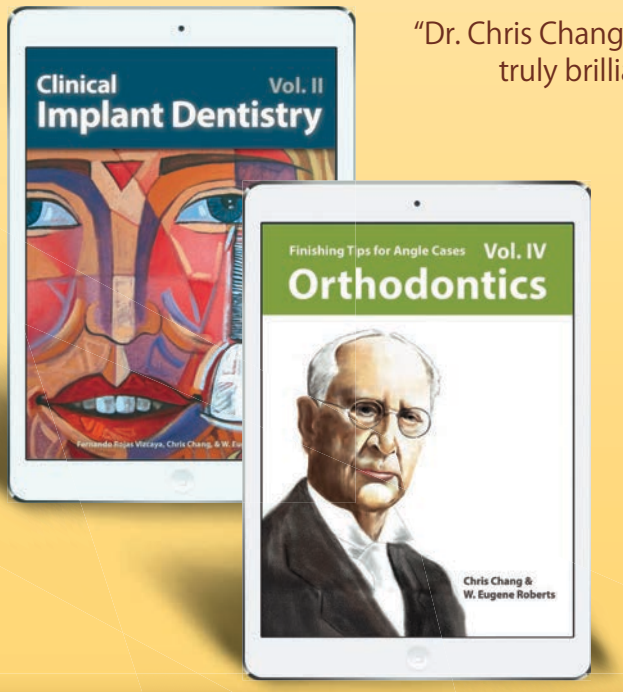
Dr. Don Drake, South Dakota, USA

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

This method of learning is quantum leap forward. My students at Oklahoma University will benefit greatly from Chris Chang's genius. *Dr. Mike Steffen, Oklahoma, USA*

"Dr. Chris Chang's innovation eBook is at the cutting edge of Orthodontic Technology... very exciting! " *Dr. Doraida Abramowitz, Florida, USA*

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



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

Dr. John Freeman, California, USA

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

Dr. Keyes Townsend Jr, Colorado, USA

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

Dr. Jerry Watanabe, California, USA

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

Dr. Errol Yim, Hawaii, USA

"Beyond incredible! A more effective way of learning." *Dr. James Morrish Jr, Florida, USA*

The 42nd Angle International Biennial Meeting, Chicago, September 10, 2017.

ISSN 2079-6862