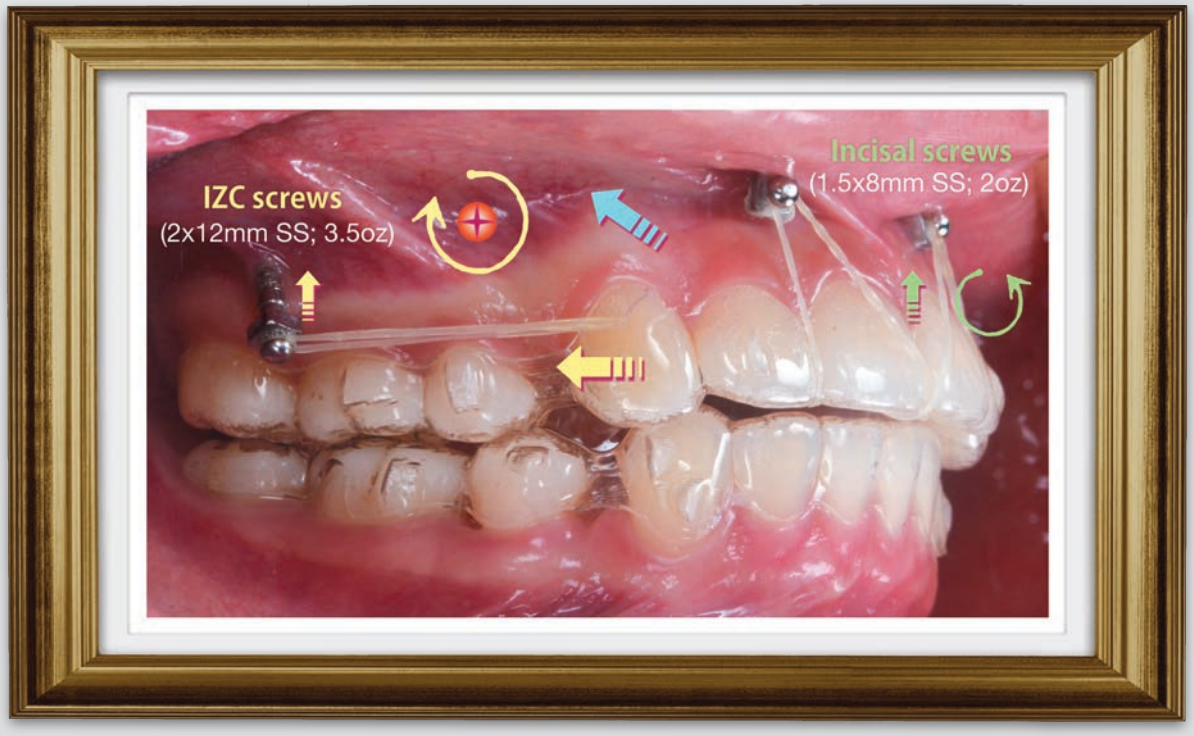
JDO

Journal of **D**igital **O**rthodontics

International Journal for Orthodontists and Implantologists

Vol. 58 Apr 1, 2020



Prevention is better than cure. While the IZC screws maximize the posterior anchorage, the incisal screws aim to compensate the anterior dumping tendency. This four-mini-screw setup allows en-masse retraction in four bicuspid extraction slinger cases with minimal side effects.

ISSN 2523-9392

977 2523939 006

This journal is available for free download at iJDO.pro.

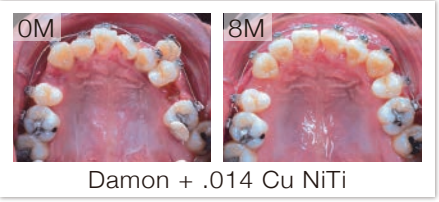
2020-21
熱愛學矯正

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。

Damon Master
(Thu) 9:00-5:00 中文授課

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

2020-21
Module 1 - **4/23, 5/7**（擇一）
Module 2 - **5/21**
Module 3 - **6/4**
Module 4 - **7/2**
Module 5 - **8/20**
Module 6 - **9/24**
Module 7 - **10/15**
Module 8 - **11/19**
Module 9 - **12/17**
Module 10 - **1/7**/21'



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 XI
Module 1 - **8/27**
Module 2 - **9/10**
Module 3 - **10/22**
Module 4 - **11/12**
Module 5 - **12/10**
Module 6 - **1/14**/20'
Module 7 - **2/25**
Module 8 - **3/24**
Module 9 - **4/14**
Module 10 - **5/19**
Module 11 - **6/16**

Damon Clear

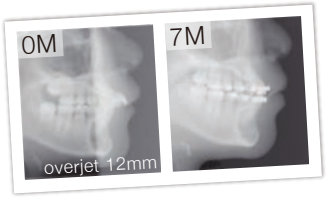
International Workshop
(Digital Orthodontics, OBS & VISTA)
English Class

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 Annie

2020
Class 1 - ~~May 12-15~~ cancelled
Class 2 - **Dec 08-11**

2021
Class 1 - **May 18-21** Class 2 - **Dec 07-10**



Damon + Bite Turbo + Early Light Short Elastic

每次上課請依最新一期 JDO 公告為主

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)

Expect the Unexpected

Recently I was invited to speak at the AAO Mid-Winter Meeting and was honoured to have been on the stage with the world's best 20 open-bite speakers. The organizer, Professor Greg Huang from the University of Washington, issued a specific format and several guidelines as to how he wished each speaker to present – 45 minutes in length, structured with Introduction, Literature, Case Report and Conclusion sections.

This is all well and good, but I couldn't help wondering if we are actually being constrained by such strict guidelines. How is one, not only in the orthodontic world but also generally speaking, supposed to expand the limits and push the boundaries if one is not given the freedom to do so? Would our profession have evolved as it has if we had only stuck with what Dr. Angle had first taught a century ago?

Of course, it can be argued that for scientific research, a certain format is required for writing, and I could agree with that. However, for presentations, I feel that more freedom for self-expression and being allowed to deliver something unexpected add to the spice of life and variety, as opposed to format and guidelines.

It is often said that it requires courage to change people's hearts, just as it takes courage to challenge the status quo, which, of course, is also not necessarily expected. I followed my whim at the AAO meeting, wanting to prove more to myself than to others that I could do something unexpected. Judging from the other attendees' reactions, I believe it turned out rather successful and I hope I didn't ruffle Professor Huang's feathers too much.

I have never considered myself to be overly-rebellious (*even though my wife would disagree with that!*), but I feel it is an important part of the development and evolution of any skill or profession that the status quo should be periodically questioned, challenged and, consequently, maybe even altered. Only in this way can any profession allow itself the freedom to move further along the path to glory. Keep marching and dare yourselves to expand not only yourselves, but also our profession.

P.S. Recently, I have received several questions regarding the screw mechanics used when extracting four bicuspids and treating with Aligners. For those who asked and those who wish to fully understand, you can find the answer in this issue of JDO. A MUST READ.

Chris Chang PhD, ABO Certified, Publisher of JDO

Correction of Generalized Interdental Spacing, Gummy Smile and Implant Site Development with Invisalign®

Abstract

A 30-year-old male presented with a Class I malocclusion: congenitally missing lower lateral incisors, generalized anterior spacing in both arches, and a gummy smile. Motivation for orthodontic consultation was smile improvement without wearing braces. Clear aligners were used to retract the maxillary incisors, close upper anterior spaces, and prepare implant sites to restore the missing lower lateral incisors. Retraction of the maxillary incisors was associated with a relative intrusion of the central incisors to improve the gummy smile. After 26 months of aligner treatment, the patient declined further refinement to improve axial inclinations because he was satisfied with the results. Overall, a malocclusion with a Discrepancy Index of 10 was corrected to a Cast-Radiograph Score (CRE) of 12, with a Pink & White dental esthetic score of 5. (J Digital Orthod 2020;58:4-18)

Key words:

Invisalign®, aligner treatment, gummy smile, spacing, congenital missing lower incisors, implant site preparation, second order tooth movement

Introduction

A 30-year-old male presented with chief complaints of spacing, missing teeth and a gummy smile (*Fig. 1*). The clinical exam revealed normal facial convexity, protrusive lips, Class I occlusion, missing lower lateral incisors, and generalized anterior spacing in both arches (*Fig. 2*). There was a total of 10.5mm and 3.5mm of interdental space in anterior segments of the mandibular and maxillary arches, respectively. No contributory medical or dental history was reported, nor were there any signs or symptoms of temporomandibular disorder (*TMD*). This case report demonstrates how to close interproximal spaces and create sites for implants with clear aligners. Second order tooth movement is difficult and time consuming with aligners. This technically challenging treatment procedure was facilitated with a digital custom appliance and two refinement procedures. The successful outcome after 26 months of active treatment is shown in Figs. 3 and 4. Pre-treatment (*Fig. 5*) and post-treatment (*Fig. 6*) radiographs illustrate morphology of the mineralized tissues. Superimposition of cephalometric tracings (*Fig. 7*) and cephalometric analysis (*Table 1*) document the dentofacial aspects of comprehensive treatment.

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

Dr. Eric Hsu,
Lecturer , Beethoven Orthodontic Course (Left)

Dr. Chris H. Chang,
Founder, Beethoven Orthodontic Center
Publisher, Journal of Digital Orthodontics (Center)

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

Fig. 1: Pre-treatment facial photographs, 30 y/o male

Fig. 3: Post-treatment facial photographs, after 26 months of active treatment

Fig. 2: Pre-treatment intra-oral photographs

Fig. 4: Post-treatment intra-oral photographs

Diagnosis

Facial:

- Length: *Long tapered face in the frontal plane*
- Facial Convexity: *Profile (G-Sn-Pg'=10˚) was within normal limits (WNL) (Fig. 5).*
- Smile: *Excessive gingival exposure*
- Symmetry: *WNL*

Skeletal:

- Intermaxillary Relationship: *Maxillary protrusion (SNA 85˚, SNB 80˚, ANB 5˚)*
- Mandibular Plane: *WNL (SN-MP 36˚, FMA 29˚)*
- Vertical Dimension of Occlusion (*VDO*): *Increased (Na-ANS-Gn 56%)*
- Symmetry: *Mandible is deviated to the left about 2mm.*

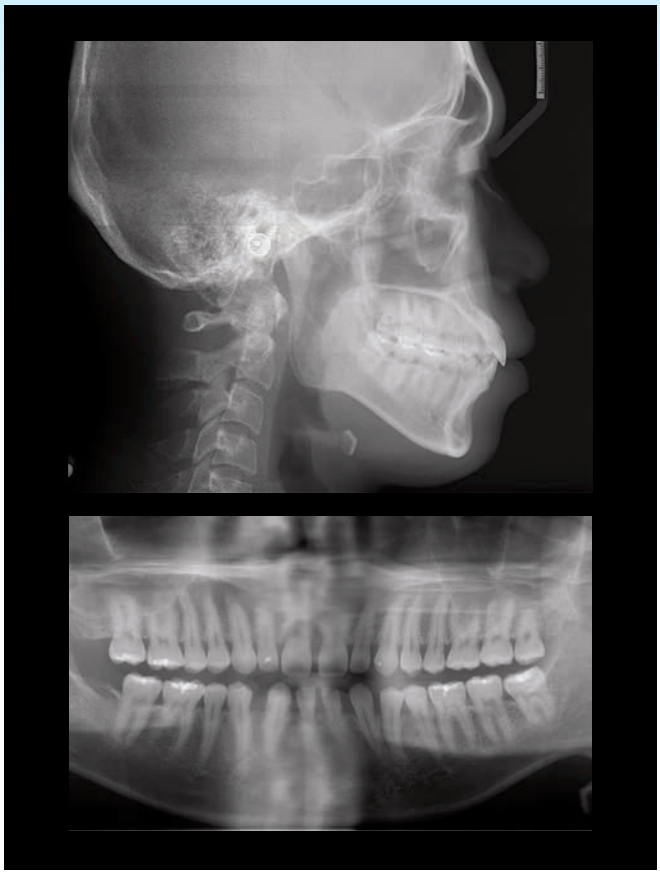


Fig. 5:
Pre-treatment cephalometric and panoramic radiographs document the original dentofacial morphology. The panoramic film reveals missing lower lateral incisors, axial inclination problems and generalized lower anterior spacing.

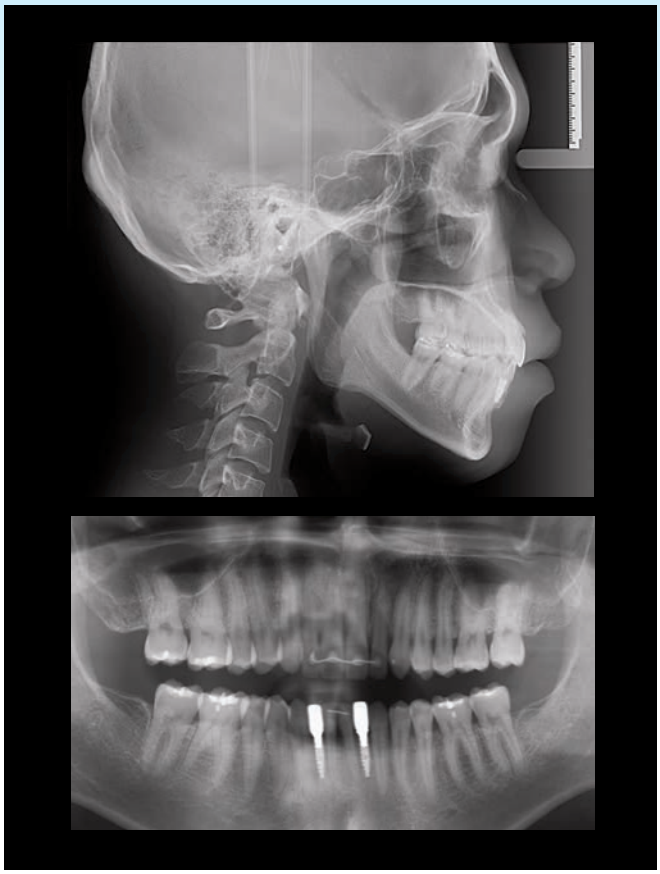


Fig. 6:
Post-treatment cephalometric and panoramic radiographs reveal the dentofacial morphology immediately after Invisalign® attachments were removed. Upper and lower incisors were aligned and spaces were closed, but multiple second order alignment problems are noted in the lower anterior segment: 1) central incisors and implants are tipped to the right; and 2) left central incisors encroach on the implant space.

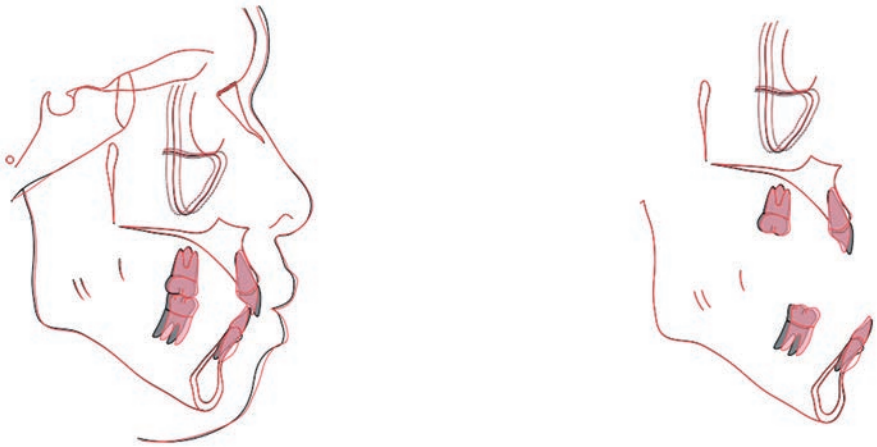


Fig. 7:
Pre- and post-treatment cephalometric tracings are superimposed on the anterior cranial base (left), the maxilla (upper right), and the stable internal structures of the mandible (lower right). The upper incisors appear to be slightly intruded and tipped distally using Invisalign®. Lower incisors were slightly extruded and tipped distally.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	85°	85°	0°
SNB° (80°)	80°	80°	0°
ANB° (2°)	5°	5°	0°
SN-MP° (32°)	36°	36°	0°
FMA° (25°)	29°	29°	0°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	5	4	1
U1 To SN° (104°)	99.5°	93.5°	6°
L1 To NB mm (4 mm)	9.5	9.5	0
L1 To MP° (90°)	96°	89.5°	5.5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	3	3	0
E-LINE LL (0 mm)	5	5.5	0.5
Convexity: G-Sn-Pg' (13°)	10°	9.5°	0.5°
%FH: Na-ANS-Gn (53%)	56%	56.5%	0.5%

Table 1: Pre- and post- treatment cephalometric analysis

Dental:

- Classification: *Class I molar and canine relationship bilaterally*
- Overbite: *3mm deep bite*
- Overjet: *2mm*
- Missing Teeth: *Congenital absence of lower lateral incisors (Fig. 5)*
- Spacing: *3.5mm in maxillary anterior, and 10mm in mandibular anterior*

The ABO Discrepancy Index (*DI*) was 10 as shown in Worksheet 1 at the end of this report.

Treatment Alternatives

To close missing lower lateral incisor space, extraction of upper first premolars is an option, but space closure is challenging with Invisalign® and may result in undesirable side effects,[1] such as tipping and extrusion of upper anterior teeth which would exacerbate the gummy smile. Placing implants to restore mandibular incisors is a risky procedure because of the thin alveolar process associated with missing teeth in the lower anterior region. A better prosthetic option is to move the lower canines mesially to close space and substitute for the missing lateral incisors while simultaneously creating implant sites distal to the canines. This is a viable option with fixed appliances,[2] but is well beyond the reasonable capability of aligners.[1]

The non-extraction treatment plan was :

1. Close all spaces except for the lower lateral incisor implant sites.
2. Intrude upper incisors to correct gummy smile.[3,4]
3. Restore missing lateral incisors with implant-supported prostheses.
4. Retract upper incisors to close space and help correct the gummy smile.

Appliances and Treatment Progress

A digital scan with iTero Element® (*Align Technology, Inc, San Jose, CA*) was performed to start the analysis and planning. Multiple ClinCheck® (*Invisalign System, Align Technology, Inc, San Jose, CA*) modifications established a reasonable biomechanics design to reach the stated objectives.[1,3,4]

An initial set of 25 aligners was planned. The duration of use for each aligner was 10-14 days depending on the specific objective(s). The treatment began with the delivery of the first 2 aligners. The patient was

instructed to wear the clear overlay appliances 20-22 hours per day, and to remove them only while eating or brushing his teeth.

The selected attachments required for optimal tooth movement were:

- Optimized attachment: *UR3, UR4, UL4, LL4, LL5, LR4, LR5*
- Vertical rectangular attachment: *UL3, LL3, LR3*

Attachments, made of composite produced by Tetric Evoceram (*Ivoclar Vivadent, Inc, NY, USA*), were placed during the second visit. After installing the attachments, aligners 3-11 were delivered to the patient with instructions to progress in the numbered sequence every 10 days. The objectives for the first set of aligners were primarily intrusion and retraction of upper incisors, along with space opening of lower lateral incisor implant sites.

Interproximal reduction (*IPR*) was performed prior to aligner 12. In the upper arch, IPR was performed from the mesial of UR3 to the distal of UL3. In the lower arch, IPR was performed on the distal of LR3 and on the mesial of both LL1 and LR1 (*Fig. 8*). The objectives of the selective IPR procedure was to create space, facilitate intrusive movement of the incisors, reduce black triangles between the incisors, improve smile esthetics, and enhance the anatomical form of the teeth.

After finishing with the original 25 aligners at 13 months, there wasn't enough intrusion of the upper incisors and the width of the implant sites was insufficient (*Fig. 8D*). The first refinement of 16 additional aligners commenced with the following selected attachments:

- Optimized attachment: *UR3, UR4, UL3, UL4, LL3, LL4, LR3, LR4*
- Vertical rectangular attachment: *LL1, LR1*

IPR was performed between the lower central incisors and distal surface of LR3 to create more space for right lateral incisor implant (*Fig. 8E*). Power ridges were used in aligners 1-13 to increase the axial inclination of the maxillary incisors. Five months later, after a total active treatment duration of 18 mo, preprosthetic aligner treatment was completed (*Fig. 8F*).

Implant

There were 6mm spaces between the lower central incisors and canines bilaterally (*Fig. 8F*). A cone-beam computed tomography (*CBCT*) scan was performed and the implant surgery was scheduled. The anatomical structure of the implant site was studied in multiple slices of the 3D image. Guided bone regeneration (*GBR*) surgery was required for each implant site because of labial bone concavity (*Fig. 9*). Two implant fixtures (*Ø3x10mm*) from the NobelActive® was chosen. A surgical stent was designed according to the 2B-3D rule[5] to achieve precise implant placement and an optimal gingival

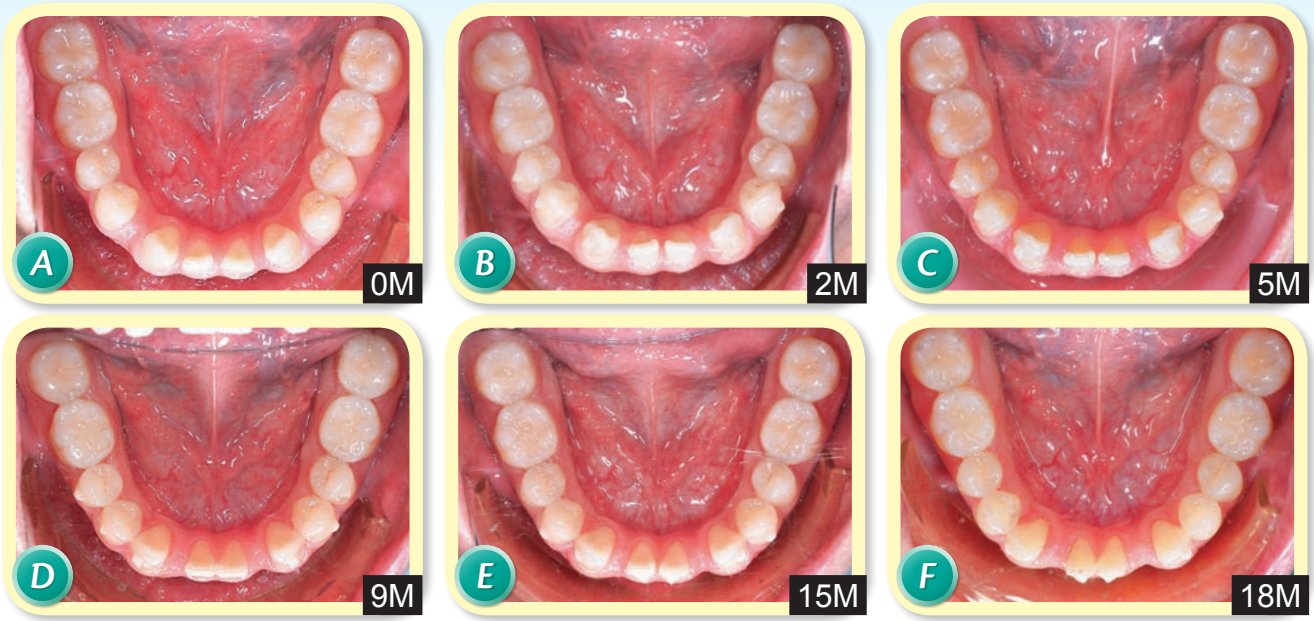


Fig. 8:
The space closure and implant site development process is shown in progressive lower occlusal photographs from 0-18 months (M). The first set of aligners was completed at 9 months (D). Both implant sites were deficient in width, 2mm on the right side and 1mm on the left. IPR was utilized to create space (E), and addition aligner wear resulted in a 6mm wide space for both lateral incisor implant sites (F).

margin in all three dimensions: mesial-distal (*M-D*), buccal-lingual (*B-L*) and axial.

Under local anesthesia, a #15c scalpel blade was used for a mid-crestal and vertical incision. A sulcular incision was performed with a #12 blade from the distal line angle of lower right canine to the distal line angle of lower left canine on the buccal surface, and a full thickness soft tissue flap was reflected. Exposure of the bone revealed an adequate ridge to place a 3mm diameter implant. A surgical stent was fitted to guide the first lancer drill for the initial osteotomy, and the guide pin was placed. A periapical film was exposed to check the insertion path and orientation of the osteotomy as revealed by the guide pin (*Fig. 10*).

Following the specifications of the implant manufacturer, the fixtures were installed in the center of the ridge according to the 2B-3D rule: 2mm buccal bone thickness, and fixture 3mm apical to the expected crown margin.[5] The fixtures were

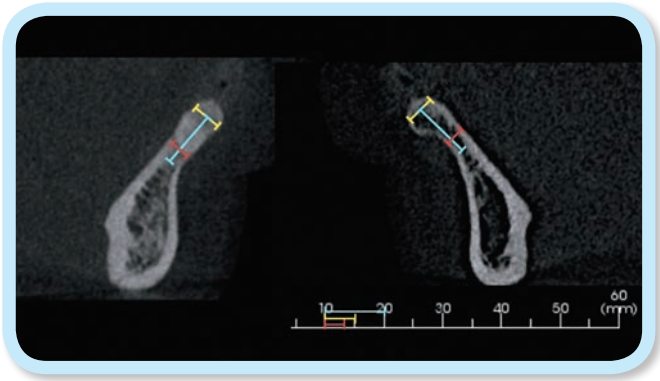


Fig. 9:
CBCT cuts provided cross-sectional views of the implant sites: LR2 (left) and LL2 (right).

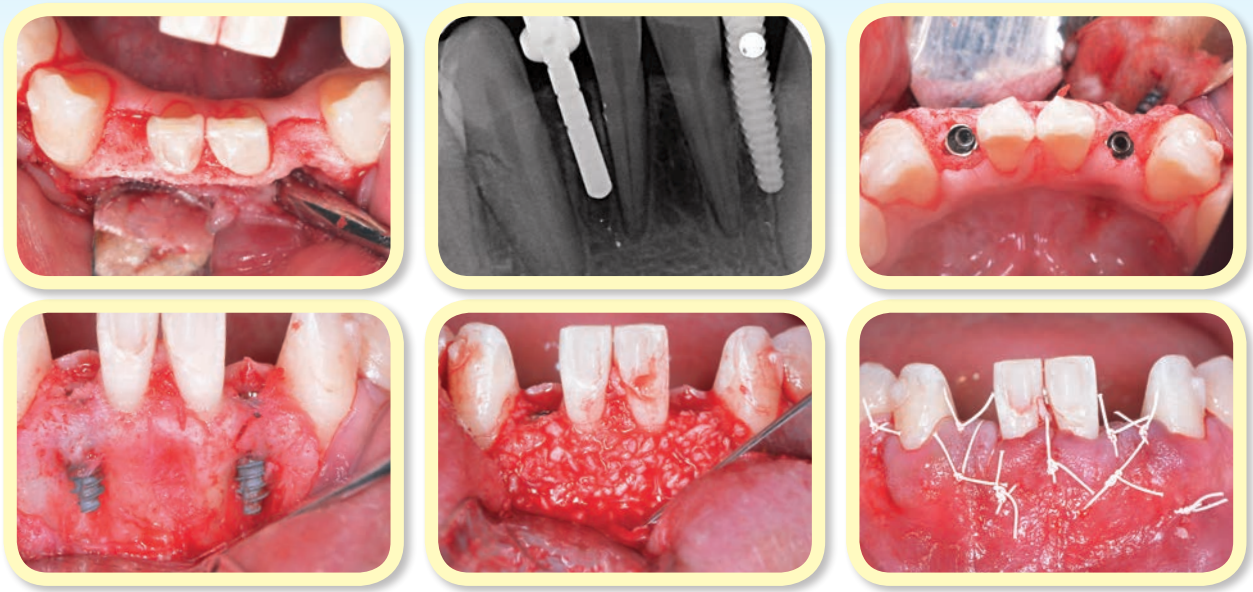


Fig. 10:
Implant surgery and GBR grafts were placed to cover the exposed implants in the depth of curvature of the mandibular alveolar process.

fitted with cover screws, and the GPR surgery was performed utilizing freeze-dried bone allograft (*FDBA*) bone graft material (*Corticocancelleus graft, Maxxeus ™ Dental, OH, USA*) and resorbable collagen membrane. The flap was sutured with interrupted 5-0 GORE-TEX® (*Flagstaff, AZ*). After 3 weeks, the sutures were removed and the bone was allowed to heal for 6 mo prior to restoring the implants.

Orthodontic Finishing Stage

The panoramic film showed that the lower left central incisor was tipped mesially and there was no occlusal contact of the molars. A second aligner refinement began at 19 months into treatment, and 19 additional aligners were produced to improve the occlusion and upright the tipped incisor. Overall, the total duration for aligner treatment was 26 months prior to restoring the implants.

Implant Prothesis Fabrication

After 6 months of post-operative healing, the implants were well integrated. Second stage surgery was performed to expose the fixtures and connect Ø3.2x5mm healing abutments. Two weeks later, the healing abutments were removed, prosthetic abutments were seated with 15 N-cm of torque, and an impression was made. Two single, all ceramic crowns were fabricated by a commercial laboratory for the lower lateral incisors. The marginal integrity for each crown was verified with a dental explorer and an appropriate tightness of the contact area was confirmed with dental floss. After clinical adjustment and verification of fit and occlusion, the crown removing lugs on the lingual side were trimmed away. The permanent crowns were then luted into place with permanent cement.

Retention

After 26 months of treatment, all aligner attachments were removed and fixed lingual retainers were bonded on all maxillary and mandibular incisors. Clear overlay retainers (*Vivera*®) were delivered for each arch. Traditional clear overlay retainers are compared to the advanced Vivera® material in Fig. 11. The patient was instructed to wear the retainers full time for the first six months and nights only thereafter. Instructions were provided for the home hygiene as well as for maintenance of the retainers.

Fig. 11:
Traditional clear retainers (upper) are compared to the Vivera® retainers (lower).

Treatment Results

Satisfactory smile esthetics, occlusal interdigitation, and functional alignment are documented in the post-treatment extra-oral and intra-oral photographs (*Figs. 3 and 4*). All spaces were closed, and Class I molar and canine relationships were achieved bilaterally. Three stages of aligner treatment over 26 months produced a final result that was close to the original 3D ClinCheck® projection.

Discussion

1. Spacing

The etiology of interdental spaces may be heredity, functional disorder and/or an acquired habit. Inherited problems include tooth size to arch size discrepancies, congenitally missing teeth, macroglossia, microdontia, hypertrophic maxillary frenum, and supernumerary teeth blocking eruption of permanent teeth, resulting in impactions. Functional causes include crossbites and deviated paths of eruption. Acquired malocclusions are due to pernicious habits with digits, lip and/or tongue, pathologic increase in tongue size, missing teeth, delayed eruption of permanent teeth, impactions and uncontrolled drift associated with periodontal disease.[6] Periodontally compromised patients usually require fixed retainers after orthodontic treatment[7,8] because the damaged or destroyed supracrestal fibers are inadequate to maintain arch integrity.

2. Posterior Open Bite

Aligner treatment is a form of indeterminate mechanics because the appliances engage all the teeth simultaneously. Unfortunately, neither anchorage nor active mechanics can be precisely defined. In addition there are two layers of aligner material between the posterior teeth, so aligners usually have an intrusive effect on the molars because of the wedge manner in which the jaws close. Although the ClinCheck® plan may be

directed at defined loads on certain teeth, other teeth must serve as anchorage for the mechanics to be in equilibrium. Furthermore, there is an inherent intrusive load on the molars due to material thickness. In the present case, for example, the posterior bite opened in the early stage of treatment (*7th month*), although the ClinCheck® plan was for the posterior teeth to remain rigid to achieve maximum anchorage (*Fig. 12*). This iatrogenic open bite problem may appear to be an overcorrection of upper incisor intrusion, but the etiology is difficult to define because of the indeterminate nature of the mechanics. Success with aligners in treating complex malocclusions is a trail and error procedure because the net effect of a sequence of aligners is only clear after that sequence of treatment is completed. For this reason staged treatment and multiple refinements are usually required.

Fig. 12:
In the 7th month, a side effect of posterior open bite was noted in the molar region (lower). The ClinCheck® was adjusted to 0mm anterior overbite (upper) to provide additional intermaxillary space to close the posterior open bite (yellow arrows). See text for details.

An additional complicating factor was the greater severity of the posterior open bite on the side of preferential chewing. When refinement aligners are designed, compensations can be programmed into the digital adjustment of the set-up. In retrospect, the patient's initial facial photographs were reexamined to determine if there was a hypertrophic masseter muscle that contributed to the asymmetry. There was no obvious facial asymmetry (*Fig. 1*) so the right side preference in mastication appears to be WNL.

3. Root Angulation

The lower left central incisor was mesially inclined after space closure, and the problem failed to be corrected during the first refinement, despite the fact that vertical rectangular attachments were added. During the implant surgical procedure, an error in the auxiliary placement was noted. Although the attachment on the lower right central incisor was parallel to its long axis, the left one was oriented mesially (*Fig. 13*).

The position of the inappropriate attachment was changed in the second refinement, and the ClinCheck® looked promising. However, there was no improvement in the axial inclination with additional aligner wear. The residual problem was diagnosed as an anatomical impairment of the lower incisor root striking cortical bone (*Fig. 14*), and it appeared that a third refinement of the aligners could correct the problem if lingual root torque was added. Unfortunately, the third refinement was not attempted because the patient decided to accept the result after 26 months of aligners and declined further treatment.

Correcting gummy smile without bone screw anchorage is challenging (*Fig. 15*). Overcorrection with sequential ClinCheck® planning may be effective for achieving differential intrusion of specific teeth.[3,4] For the present patient, the digital set-up of the opposing incisors was set at 0mm overbite, so that when the ideal normal overbite was achieved, there was in fact a premature contact on incisors (*Fig. 12*). On the other hand, there were two layers of aligner material between the molars which produced a relative intrusion that resulted in premature contact of the incisors. In any event the iatrogenic intrusion of the molars required a substantial change during refinement to allow them to extrude back into occlusion. In this regard, horizontal gingiva bevel attachments on upper molars were prescribed to improve molar occlusal contact during the second refinement.

4. Aligners vs. Fixed Appliances

Aligners are an attractive "*no braces*" alternative for orthodontic treatment, but they have limitations[1] that both clinicians and patients must understand.

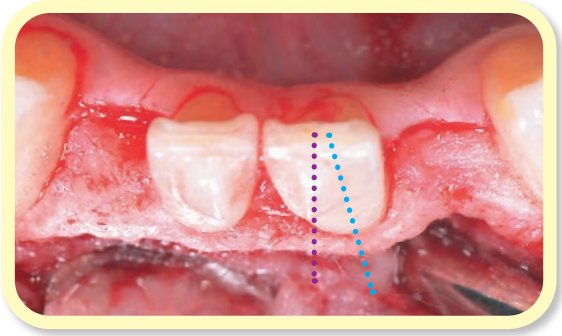


Fig. 13:
When the lower central incisors were exposed during the implant surgery, malalignment of the vertical auxiliary attachment was noted. It was oriented along the purple broken line, rather than along the blue broken line, which approximates the axial inclination of the tooth.

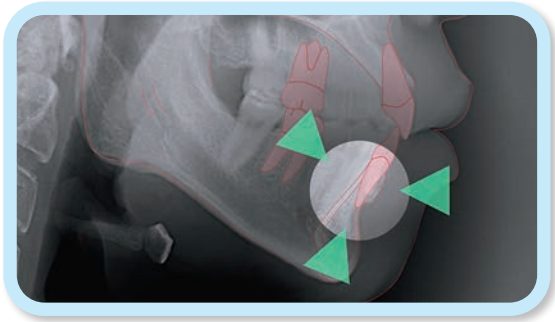


Fig. 14:
Cephalometric radiography shows the root tip of lower central incisor may have engaged cortical bone that is resistant to resorption. Correcting the tipped lower left central incisor is enhanced by also programming lingual root torque with ClinCheck®. The patient was satisfied with the current result and declined further refinement so that axial inclination problems were not corrected. See text for details.

Fig. 15:
The initial gummy smile (left) was corrected during aligner treatment (right). Several factors contributed to this favorable change: 1) retraction of maxillary incisors, 2) slight intrusion of the upper central incisors, and 3) training the patient to smile with less forced lip elevation.

First, like all removable alliances, aligners are very compliance dependent, so they tend to be more effective in adults who agree to make the commitment for full-time wear. Second, aligners have distinct limitations with respect to biomechanics. Because of the double layer of aligner material between the molars, aligners are more effective for open bite compared to deep bite malocclusions. Severe deepbite occlusion and a deep curve of Spee are relative contraindications for aligners.

In general, aligners are effective for first order tooth movement when crowding is managed with IPR. Third order alignment problems can be corrected with tipping, and auxiliary attachments are effective for moderate root movement. However, second order problems like space closure and implant site preparation are more challenging because it is difficult to apply second order moments.[1] Vertical attachments (*Fig. 13*) are designed to achieve a mechanical couple, i.e. two parallel forces that are equal in magnitude, opposite in sense, and do not share a line of action. Although a couple can create a moment in a desired plane, the moments generated by aligner attachments tend to be relatively inefficient. These mechanics failed to achieve the desired outcome for the present patient (*Figs. 6, 12 and 13*).

Aligners are popular with patients because it is not necessary to wear braces, but the indeterminate mechanics they deliver are difficult to control. In effect, the ClinCheck® is a "*magic wand*" to help the technician achieve a digital set-up that will result in appropriate loads on the teeth to achieve the desired changes. However, the loads applied are limited by the requirement that the force system be in equilibrium (*Newton's Laws*), so the only way to know the actual consequence of a planned treatment sequence is to observe the result. Consequently, unplanned side effects are inherent in aligner therapy and must be corrected with a continuing series of refinements. For the present patient, the correction was satisfactory, but it required 26 months. Aligners may be a viable alternative for achieving a satisfactory result without braces, but all concerned must understand the limitations of the process.

Conclusions

Invisalign® clear aligners are capable of managing interproximal spacing, gummy smile and implant site development. However, the mechanics are indeterminate, require multiple refinements, and demand a high level of patient cooperation. With adequate patient cooperation and treatment time, it is possible to achieve satisfactory outcomes in terms of occlusion, function and dentofacial esthetics without wearing braces. Overall, a malocclusion with a Discrepancy Index of 10 was corrected to a Cast-Radiograph Score (*CRE*) of 12, with a Pink & White dental esthetic score of 5.

Fig. 16 documents the current condition of the patient around 1 year and 9 months post-treatment.

Fig. 16: Facial and intraoral photographs at 1Y9M follow-up

References

1. Chiu GSC, Chang CH, Roberts WE. Interdisciplinary treatment for a compensated Class II partially edentulous malocclusion: orthodontic creation of a posterior implant site. Am J Orthod Dentofacial Orthop 2018;153(3):422-435.
2. Phan X, Ling PH. Clinical Limitations of Invisalign. J Can Dent Assoc 2007;73(3):263-6.
3. Turatti G, Womack R, Bracco P. Incisor intrusion with Invisalign treatment of an adult periodontal patient. J Clin Orthod 2006;40(3):171–4.
4. Simon M, Keilig L, Schwarze J, Jung BA, Bourauel C. Forces and moments generated by removable thermoplastic aligners: incisor torque, premolar de-rotation, and molar distalization. Am J Orthod Dentofacial Orthop 2014;145(6):728–36.
5. Chang CH. The 2B-3D rule for implant planning, placement and restoration. Int J Orthod Implantol 2012;27:96-101.
6. Gkantidis N, Psomiadis S, and Topouzelis N. Teeth spacing: etiology and treatment. Hellenic Orthodontic Review 2007;10:75-92.
7. Zachrisson BU. The bonded lingual retainer and multiple spacing of anterior teeth. Swed Dent J Suppl 1982;15:247-55.
8. Zachrisson BU. Multistranded wire bonded retainers: from start to success. Am J Orthod Dentofacial Orthop 2015;148(5):724-7.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 10

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 = 0

OVERBITE

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

Total = 0

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 0

OCCLUSION

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

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 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 = 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	2	x 2 pts. =	4
Spacing (4 or more, per arch)	2	x 2 pts. =	4
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 = 10

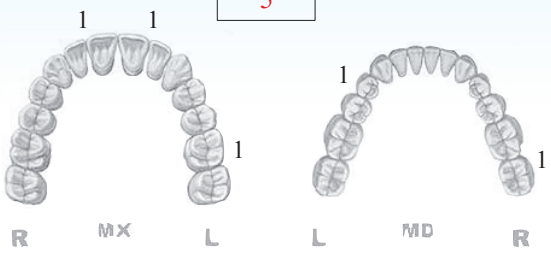
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 12

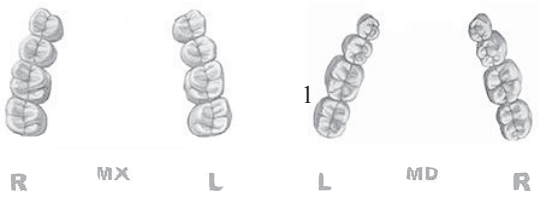
Alignment/Rotations

5



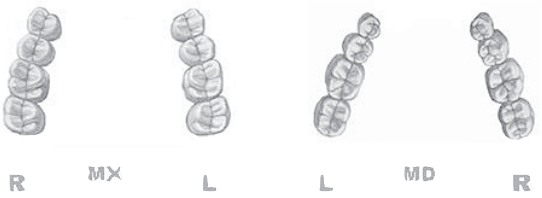
Marginal Ridges

1



Buccolingual Inclination

0

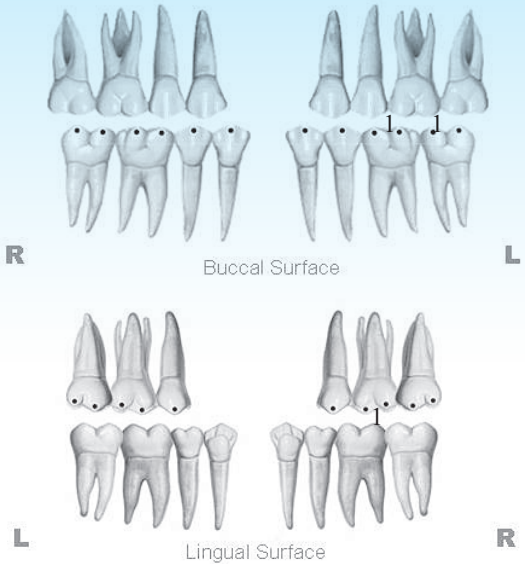


Overjet

1

Occlusal Contacts

3

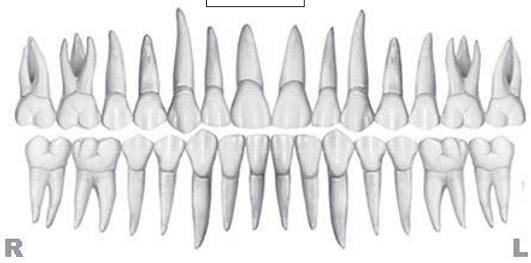


Occlusal Relationships

1

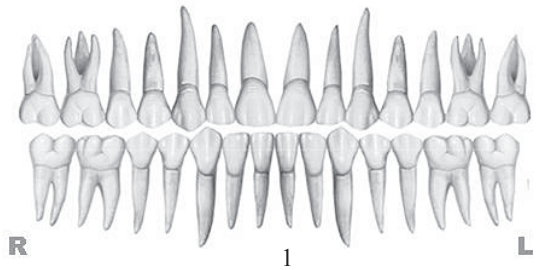
Interproximal Contacts

0



Root Angulation

1



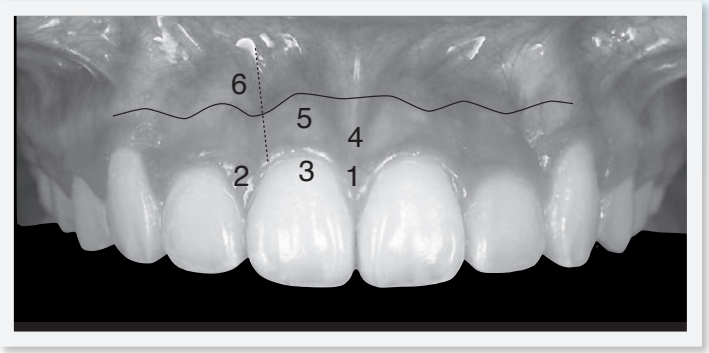
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 5

1. Pink Esthetic Score

Total = 2

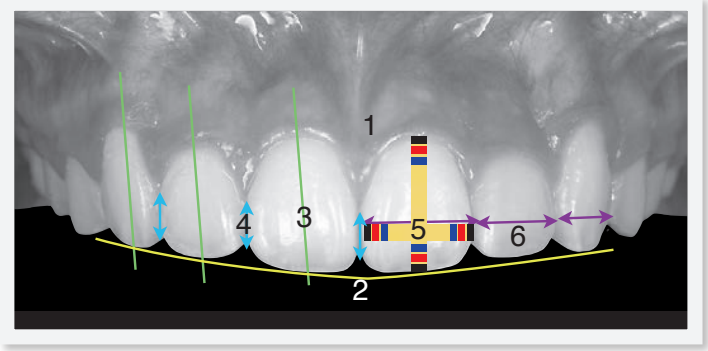


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

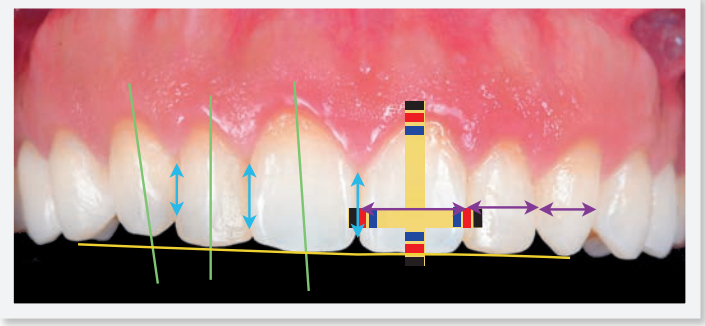
1. M & D Papilla	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	0	1	(2)
5. Root Convexity (Torque)	(0)	1	2
6. Scar Formation	(0)	1	2

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 (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

優惠期間自2020/1/1-6/25止

德 國 精 湛 工 藝

carl marlin Solingen

NEW

隱形矯正必備器械 Clear Aligner Pliers

1.5mm Point Elevation Plier
OLS-1510

Reverse Plier
OLS-1520

特價 NT$3,720/支

手術雙寶驚喜優惠

LS781TC/18
18cm
GERALD
組織鑷

LS1152TC/18
18cm
CASTROVIEJO
持針器

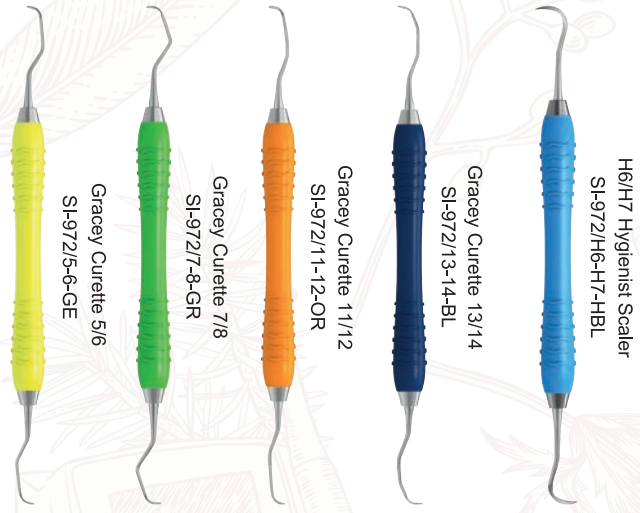
Final Sale
最後20套

特價 NT$8,999/組
整組販售，恕不拆換

· 衛部醫器輸壹字第017989號

德製牙周刮刀特惠組 SI-Paro-Set1

Curettes GRACEY — Scaler



限量100盒

特價 NT$3,500/1盒
優惠 NT$10,000/3盒
整組販售，恕不拆換

顯微手術必備組 Micro Surgery Kit

Scalpel holder
LS871MH/6
顯微手術刀柄

Needle holder
1171RH/18
顯微持針器

Tissue forceps
LS782/18
有齒顯微組織鑷

Tissue forceps
LS783/18
無齒顯微組織鑷

限量50組

特價 NT$20,000/組
整組販售，恕不拆換

· 衛部醫器輸壹字第015200號

your best dental supplier YONG CHIEH 湧傑 客服專線：北區 (02)2778-8315 · 中區(02)2305-8915 · 南區(07)226-0030

· 本文宣品僅供牙科診所及牙醫師參考，禁止張貼或擺置於公眾可瀏覽及取閱之處
· 本優惠專案僅適用於牙醫診所 · 本公司保留更改及終止活動辦法與條款之權利

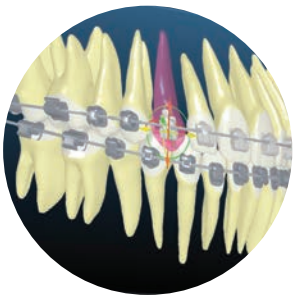
Dental Clinic Established 1996
Beethoven

International Workshop

Digital Orthodontics, OBS, VISTA

		Digital Orthodontics, OBS, VISTA	Keynote (optional)
2020	Session B	12/08–10	12/11
2021	Session A	05/18–21	05/22
	Session B	10/07–10	10/11

@Taiwan



INSIGNIA

OBS

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

VISTA Vertical Incision Subperiosteal Tunnel Access

Registration:

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

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

For more information and registration, visit

http://iworkshop.beethoven.tw

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

Course Schedule

Day 1 **Chair–side observation**

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

Chris' Lecture:
Digital Orthodontics with TAD

Day 3 **VISTA Lecture & workshop**

Chris' Lecture:
VISTA for Impacted Cuspids

* The topics for VISTA workshop:

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

Prof. Dr. Paulo Fernandes Retto, Portugal

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

Digital Orthodontics, OBS & VISTA

Day 4 **Keynote workshop** (Optional)

by Newton's A team

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

Dr. Rungsi Thavarungkul, Thailand

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

KEYNOTE

THE LECTURER

Dr. Chris Chang

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

OBS Super Set

Created by Dr. Chris Chang, OBS is made of medical grade, stainless steel and titanium, and is highly praised by doctors for its simplistic design, low failure rate and excellent quality. OBS is your must-have secret weapon for maximum, reliable anchorage.

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

New

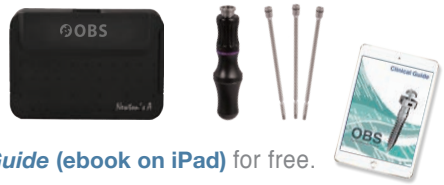
Titanium Higher biocompatibility*

1.5 | **1.5X8mm**

Stainless Steel**

2.0 | **2.0x12mm**

2.7 | **2.0x14mm (with holes)**



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

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

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

iNewton +886-3-573-5676 orthobonescrew.com inewton.dental@gmail.com

Products

Dental Products Essential Kit

NEW

Double Retractors 2.0 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

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.

Class II Malocclusion with Blocked-Out Maxillary Canines and a Steep Mandibular Plane: Non-Extraction Treatment with 5-Year Follow-Up

Abstract

***History**: A 10-year-old female was referred because of bilateral unerupted maxillary canines.*

***Etiology**: Insufficient arch perimeter resulted in the premature loss of the upper deciduous canine (Uc) space due to ectopic eruption of adjacent maxillary lateral incisors.*

***Diagnosis**: Increases in lower facial height (56%), mandibular plane angle (SN-MP 40.5˚), intermaxillary relationship (ANB 4˚), and lip protrusion (1mm/2mm to the E-Line) were associated with full cusp Class II molar relationships, bilaterally. Both upper canine spaces were lost due to tipping of adjacent teeth into the exfoliated Uc spaces, and the upper left first premolar (UL4) was rotated mesial-in. The upper right canine (UR3) was well positioned, but its path of eruption was blocked. The UL3 was high in the alveolar process and at risk for impaction. The maxillary arch perimeter was deficient (-8mm) due to premature loss of upper deciduous canines, but no significant root resorption was apparent. The American Board of Orthodontic (ABO) Discrepancy Index (DI) was 25.*

***Treatment**: A full fixed passive self-ligating (PSL) appliance was bonded on all permanent teeth. Compressed coil springs were inserted to open space and the maxillary canines erupted spontaneously. Intermaxillary growth helped correct the Class II molar relationship as the canines erupted, and the occlusion was finished with vertical elastics. Retention was with clear aligners.*

***Outcomes**: After 27 months of active treatment, the blocked-out maxillary canines were well aligned. The supporting gingiva was healthy, periodontal form was near ideal, and no root resorption was noted. Final alignment and dental esthetics were excellent as evidenced by an ABO Cast-Radiograph Evaluation (CRE) score of 18, and an International Board of Orthodontics and Implantology (IBOI) Pink & White Esthetic Score of 3. Follow-up records 5 years later documented the stability of the correction.*

***Conclusions**: The etiology of a blocked-out canine indicates the most efficient timing for orthodontic intervention. Space maintenance is indicated if an Uc is lost due to ectopic eruption of the lateral incisors. Otherwise adjacent teeth may drift into the canine space preventing normal eruption of the permanent cuspid(s). Phase I treatment is required to prevent ectopic buccal eruption or impaction. (J Digital Orthod 2020;58:24-39)*

Key words:
Impacted maxillary canine, eruption, etiology, ectopic eruption, spontaneous correction, Class II malocclusion

Introduction

With the exception of third molars, a maxillary canine (*U3*) is the tooth most susceptible to impaction. The etiology may involve ectopic loss of a deciduous canine (*Uc*) followed by mesial drift of the buccal segment to create a Class II intermaxillary discrepancy. This type of malocclusion affects about 2% of the general population and 4% of patients referred to orthodontists.[1,2] In ethnic Chinese adolescents, U3 impaction occurs labially or within the alveolus 49.9-67.7% of the time.[3,4] Only about one-third of U3 impactions are labial in North American.[5] Arch length deficiency is associated with labial impactions. Jacoby[6] found that

Dr. Lexie Y. Lin,
Resident, Beethoven Orthodontic Center (Left)
Dds. Jennifer Chang,
Clerk, Beethoven Orthodontic Center (Center left)
Dds. Kristine Chang,
Clerk, Beethoven Orthodontic Center (Center right)
Dr. W. Eugene Roberts,
Editor-in-chief, Journal of Digital Orthodontics (Right)

only 17% of labially impacted canines had sufficient space to erupt. Normal eruption can be achieved with orthodontic mechanics that create space, selective removal of deciduous canines, and/or extraction of an adjacent premolar.[7,8] However, if the canine does not erupt spontaneously, surgical intervention is indicated.[9]

Spontaneous eruption is preferred because surgical intervention may result in a deficient band of attached gingiva especially for labial impactions. Periodontal health depends on the amount of attached gingiva apical to the tooth crown after eruption.[10] Furthermore, gingival re-intrusion of a recovered impaction and gingival scarring are common complications.[11] Anomalous development of adjacent teeth is linked to canine impaction.[12]

Fig. 1: Pre-treatment facial and intraoral photographs

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

History and Etiology

A 10-year-old female was referred by her pedodontist for orthodontic evaluation because both unerupted maxillary canines were blocked-out (*Figs. 1-3*). The UL3 was high in the alveolar process and at risk of impaction. No contributing medical problems were reported. Oral hygiene was acceptable, and there was no history of dental trauma, oral habits, or temporomandibular dysfunction. Clinical examination revealed a straight profile, facial symmetry, and slightly protrusive lips to the E-line (*Fig. 4, Table 1*). Overbite and overjet were within normal limits, but the buccal segments were full cusp Class II (*Fig. 5*). Upper primary canines

Fig. 2:
An anterior left intraoral photograph shows the UL2 and UL4 are tipped into the UL3 space pretreatment. See text for details.

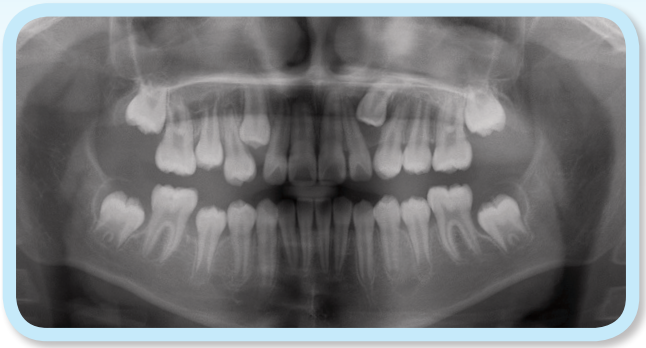


Fig. 3: Pre-treatment panoramic radiograph

Fig. 4: Pre-treatment lateral cephalometric radiograph

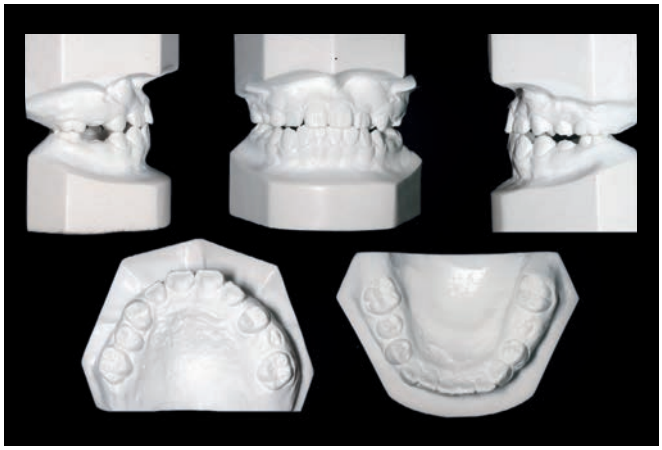


Fig. 5: Pre-treatment dental models (casts)

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	81°	83.5°	2.5°
SNB° (80°)	77°	79°	2°
ANB° (2°)	4°	4.5°	0.5°
SN-MP° (32°)	40.5°	41°	0.5°
FMA° (25°)	33.5°	34°	0.5°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	2.5	3.5	1
U1 To SN° (104°)	98°	107°	9°
L1 To NB mm (4 mm)	6	6.5	0.5
L1 To MP° (90°)	86°	86°	0°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	1	-1	2
E-LINE LL (0 mm)	2	1	1
%FH: Na-ANS-Gn (53%)	56%	57%	1%
Convexity: G-Sn-Pg' (13°)	12.5°	14°	2.5°

Table 1: Cephalometric summary

were missing and second molars were un-erupted. A tendency for an edge-to-edge relationship was noted between the upper and lower lateral incisors (*Fig. 2*). Mesial-in rotation was associated with premature loss of the adjacent deciduous canine. Crowding was 8-9mm in the upper arch. The panoramic radiograph revealed that lateral incisors and first premolars were tipped into the sites of the missing deciduous canines, bilaterally. The unerupted maxillary canines appeared well positioned to erupt when adequate space was provided, so CBCT imaging was not indicated.

Diagnosis

Facial:

- Height: *Excessive lower facial height (56%)*
- Convexity: *WNL (12˚)*
- Lip Protrusion: *Slightly protrusive (1mm/2mm to the E-line)*

Skeletal:

- Sagittal Relationship: *Mandibular retrusion (SNA 81˚, SNB 77˚, ANB 4˚)*
- Mandibular Plane Angle: *Increased (SN-MP 40.5˚, FMA 33.5˚)*

Dental:

- Occlusion: *Class II molar*
- Overjet & Overbite: *WNL*
- Upper incisor: *Retrusive (U1-NA 2.5mm), decreased axial inclination (L1-MP 98˚)*
- Lower incisor: *Protrusive (L1-NB 6mm), decreased axial inclination (L1-MP 86˚)*
- Canines: *UR3 was normally positioned, but blocked-out. The UL3 was high in the alveolar process and at risk of impaction.*

American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*): 25 as shown in the subsequent worksheet.

Treatment Objectives

Maxilla and Mandible

- Allow normal growth expression in sagittal and transverse planes.

Maxillary Dentition

- A-P: *Anterior movement of incisors*
- Vertical: *Allow extrusion consistent with normal growth.*
- Inter-Canine Width: *Increase*
- Inter-Molar Width: *Increase as molars are retracted to create space for canines*

Mandibular Dentition

- A-P: *Retract incisors*
- Vertical: *Maintain*
- Inter-Canine Width: *Maintain*
- Inter-Molar Width: *Maintain*

Facial Esthetics:

- Lips: *Slightly retract the lips to the E-Line consistent with ethnic preference.*

Treatment Plan

Despite an 8mm upper arch deficiency, non-extraction treatment was indicated because the facial profile and growth potential were favorable. A positive indicator for conservative treatment was the optimal intra-alveolar orientation of the blocked-out U3s (*Fig. 3*). Opening adequate space was likely to result in normal eruption. Since the premolars were (*or soon will be*) erupted, a full fixed PSL appliance was indicated. Open coil springs were inserted between the first premolars and lateral incisors bilaterally to provide sufficient space for the maxillary canines. If the canines failed to erupt spontaneously, surgical intervention was indicated to expose the crowns and bond attachments for traction. Bilateral infrazygomatic crest (*IZC*) bone screws (*BSs*) were also a viable option if needed. However, the mandible was retruded (*SNB 77˚*) with a steep mandibular plane (*FMA 33.5˚*), so Class II elastics were risky. However, they were the mechanics of choice if the Class II molar discrepancy does not spontaneously correct when space is opened for the unerupted U3s. Clear retainers were planned to retain both arches.

Treatment Progress

A 0.022" slot Damon Q® passive self-ligating (*PSL*) brackets (*Ormco Corporation, Brea, CA*) were bonded on all upper teeth. A 0.014" CuNiTi archwire was inserted, and compressed coil springs were placed to create space for the maxillary canines. Low-torque brackets were chosen for the four upper incisors to compensate for the expected increase in axial inclination that was associated with space opening. The light labial force of the coil springs was resisted with lip competence to prevent excessive flaring of the incisors. The unerupted U3s had no root interference with adjacent teeth (*Fig. 6*), so there was no need to avoid bonding the upper lateral incisors. Increasing the arch perimeter of the upper arch was the principal objective. During the first 17 months of active treatment, the UL4 was aligned (*Fig. 7*) and the Class II molar relationships were spontaneously corrected to Class I. It was not necessary to use Class II elastics.

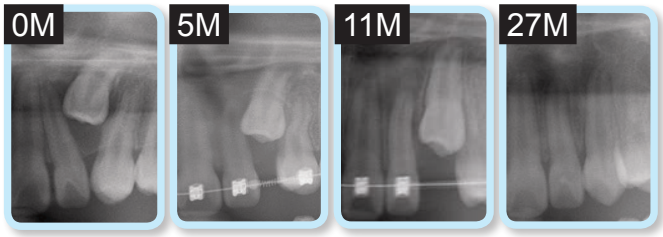


Fig. 6:
A panel of four radiographs shows the recovery of the impacted UL3 from 0-27 months (M). See text for details.

Fig. 7: Treatment progress for the upper arch is shown from 0-24 months (M). See text for details.

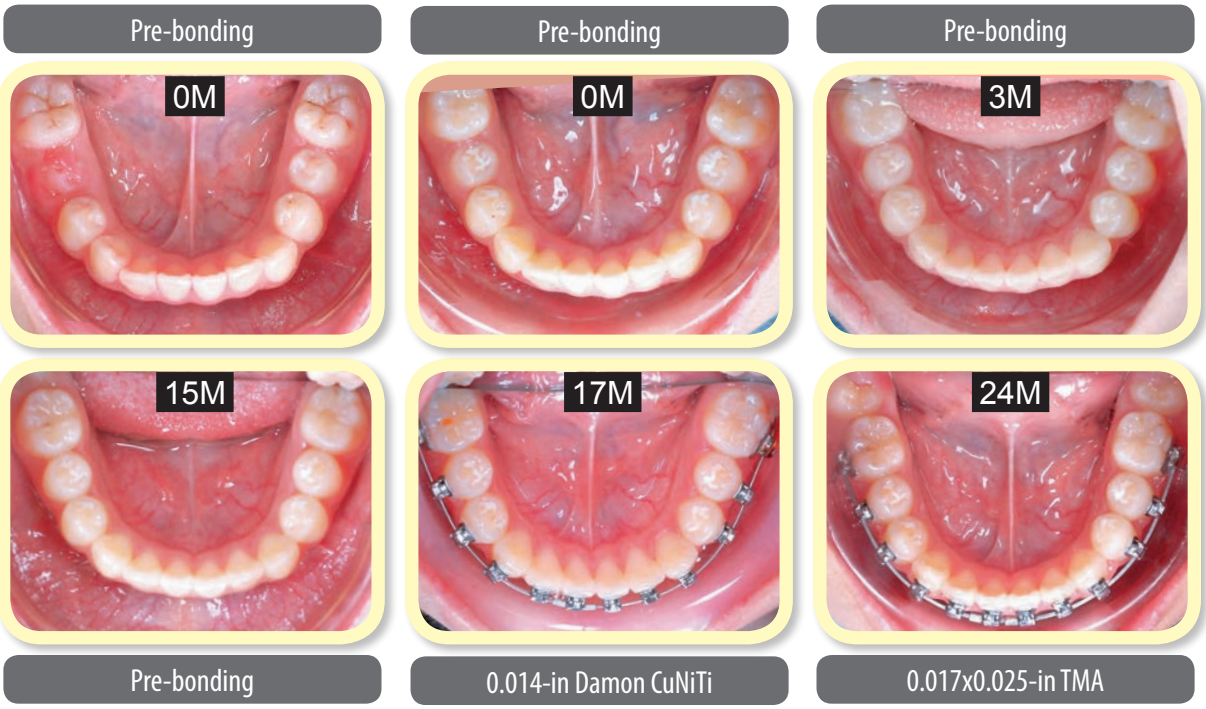


Fig. 8: Treatment progress for the lower arch is shown from 0-24 months (M).

Prior to bonding the lower arch (*17 months into treatment*), space was provided for the maxillary canines to erupt normally (*Fig. 6*). Both canines erupted into keratinized gingiva, coronal to the mucogingival junction, but were tipped buccally, so they were bonded with high-torque brackets. Both arches were leveled and aligned with light, continuous archwires: 0.014" CuNiTi followed by 0.014x0.025" NiTi. Low friction 0.017x0.025" TMA wires were used to refine the final alignment in both arches (*Figs. 7 and 8*).

Over the entire course of treatment, the axial inclinations of incisors, lip competence and labial prominence were carefully monitored. Vertical elastics were used to improve interdigitation and posterior contacts (*Fig. 9*). No bone screws or other temporary anchorage devices were needed to retract either arch. The archwire was sectioned distal to the upper right canine in the last month of treatment, and intermaxillary vertical (*zig-zag*) elastics were used for final finishing of the buccal segments (*Fig. 9*). The fixed appliances were removed in the 27th month of treatment, and clear overlay retainers were delivered.

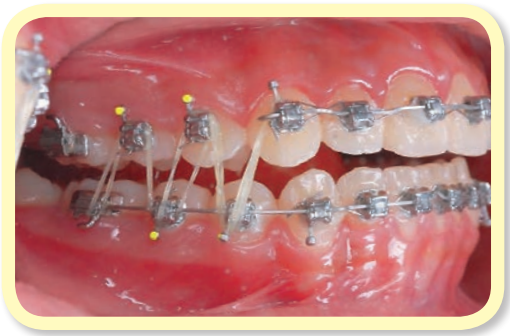


Fig. 9:
Finishing the occlusal contacts in the buccal segments is accomplished with continuous (zig-zag) vertical elastics.

Results Achieved

Maxilla (all three planes):

- A-P: *Increased*
- Vertical: *Increased*
- Transverse: *Increased*

Mandible (all three planes):

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

Maxillary Dentition:

- A-P: *Incisors and molars were protracted.*
- Vertical: *Extruded, consistent with normal growth*
- Inter-Molar Width: *Increased*

Mandibular Dentition:

- A-P: *Molars protracted*
- Vertical: *Incisors extruded*
- Inter-molar/Inter-canine Width: *Maintained*

Facial Esthetics:

- Convexity: *Increased with anterior growth of the maxilla during treatment, but decreased 5 years later due to continuing anterior growth of the mandible*
- Lips: *Both upper and lower lips were slightly retracted to the E-line.*

Final Evaluation of Treatment

This board case report describes the correction of a severe malocclusion with a DI of 25, which was

treated to an acceptable CRE of 18 points. The major residual discrepancy was Class II occlusal relationships in the canine and premolar areas (*7 points*). The post-treatment panoramic (*Fig. 10*) and cephalometric (*Fig. 11*) radiographs reveal near ideal root parallelism for all teeth including the untreated lower second molars. Comparison of the initial (*Fig. 5*) and final casts (*Fig. 12*) documents correction of a full cusp Class II molar relationship. Upper arch perimeter was increased by 8mm and arch width was expanded by 3mm, but there was little dimensional change in the lower arch.

Post-treatment facial and intraoral photographs (*Fig. 13*) show good facial esthetics, and an acceptable smile arc, but growth in the length of the upper lip restricted ideal correction of the upper incisor display. Overall, dentofacial esthetics were improved

Fig.10: Post-treatment panoramic radiograph

Fig.11: Post-treatment lateral cephalometric radiograph

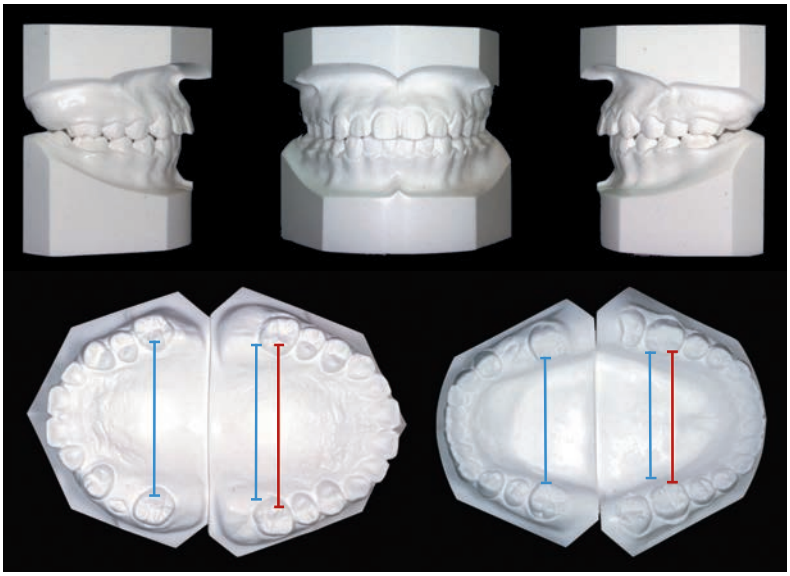


Fig. 12:
The upper three images show buccal and frontal views of the post-treatment dental models (casts). The lower occlusal views are direct comparisons of width at the mesiobuccal cusps for the initial (blue line) to the finish (red line) casts. Expansion was 3mm and 1.5mm for the upper (left) and lower (right) casts.

Fig. 13: Post-treatment facial and intraoral photographs

Fig. 14:
Matched radiographs and intraoral photographs show the initial (upper) and final left buccal occlusion (lower).

compared to the start of treatment, and the midline was maintained (*Fig. 1*). Anterior labial gingiva of the maxillary arch was healthy and well keratinized (*Fig.14*).

At the 5-year follow-up evaluation, anterior maxillary gingival display was improved (*Fig.15*). The upper second molars erupted into a slightly more buccal orientation, particularly on the right side. Overall alignment of the dentition was maintained, but the lower left canine was slightly rotated distal-out. The recovered UL3 was surrounded with keratinized stable gingiva (*Fig.16*), and there were no signs of re-intrusion, root resorption or gingival inflammation.

Fig. 15: Facial and intraoral photographs five years after treatment

The patient was no longer wearing retainers, so the final result was deemed stable. Fig. 17 shows the superimposed cephalometric tracings pre-treatment, post-treatment, and at 5-year follow-up. Overall, the patient had a favorable downward and forward growth pattern, but an unusual increase in anterior growth of the midface resulted in increased facial convexity at the end of the treatment (*15.5°*). Five years later, increased mandibular compared to maxillary growth resulted in correction of facial convexity to 10°. Lip protrusion decreased 1-2mm during treatment, and the lower lip decreased another 1mm at follow-up (*Table 2*).

Fig. 16:
At 5-year follow-up, a left buccal intraoral photograph shows that the attached gingiva surrounding the UL3 compared to adjacent teeth. The periodontium was healthy and sufficient. In particular, note the high-low-high gingival margin relationships of the central incisor, lateral incisor and canine. See text for details.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	f/u
SNA° (82°)	81°	83.5°	86°
SNB° (80°)	77°	79°	81°
ANB° (2°)	4°	4.5°	5°
SN-MP° (32°)	40.5°	41°	38°
FMA° (25°)	33.5°	34°	31°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	2.5	3.5	4
U1 To SN° (104°)	98°	107°	108°
L1 To NB mm (4 mm)	6	6.5	7
L1 To MP° (90°)	86°	86°	90°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	1	-1	-1
E-LINE LL (0 mm)	2	1	0
%FH: Na-ANS-Gn (53%)	56%	57%	57%
Convexity: G-Sn-Pg' (13°)	12.5°	14°	10°

Table 2:
Cephalometric summary with 5-year follow-up (f/u) measurements

Discussion

The treatment for the present patient may appear simple and intuitive, but the clinical success required a series of timely and precise decisions. First, an assessment of the etiology indicated a non-extraction approach. Second, early treatment reversed the etiology to achieve normal eruption. Third, gentle labial force within the limits of lip competence increased arch perimeter and helped correct the Class II molar discrepancy. These important principles were based on a fundamental understanding of maxillary canine development and eruption. In effect, the cause of the malocclusion was reversed in a timely manner, thereby preventing high label eruption and/or impaction of the U3s. Reversing the etiology of a malocclusion is fundamental to achieving a natural result that is stable. A very attractive smile was accomplished with minimal mechanical intervention.

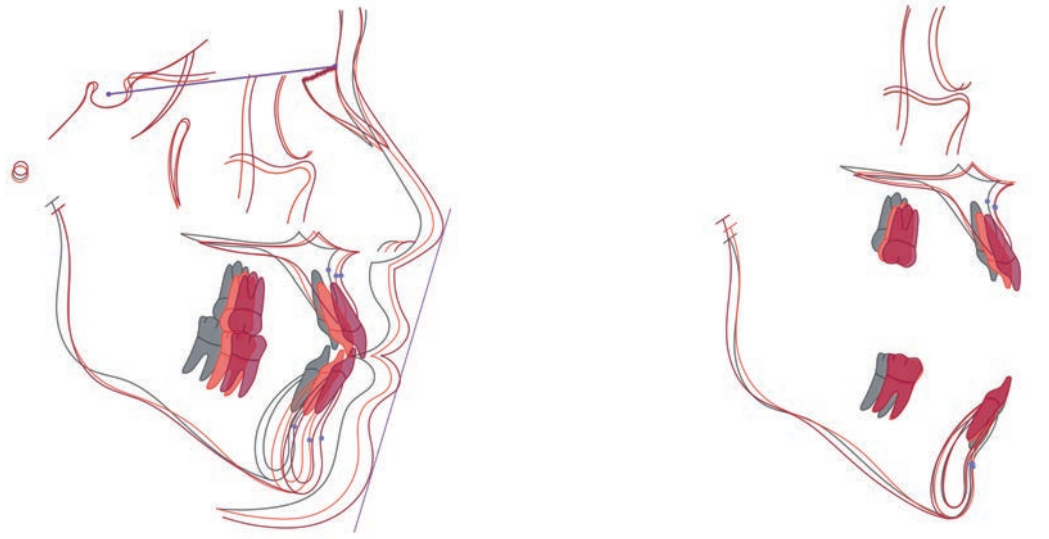


Fig. 17:
Cephalometric tracings before treatment (black), at the finish (red), and 5-years later (purple) are superimposed on the anterior cranial base (left), maxilla (upper right) and mandible (lower right). Note the unusually large component of anterior growth for the mid-face (maxilla) compared to the mandible. See text for details.

Etiology of Maxillary Canine Impaction

In 1993, Kokich and Mathews[13] suggested that the etiology of impacted maxillary canines was unknown. Subsequently (*2015*), Becker and Chaushu[12] classified the etiology into 4 distinct groups: 1) local hard tissue obstruction, 2) local pathology, 3) disturbance of normal incisor development, and 4) hereditary or genetic factors. For the present patient, the most probable etiology was ectopic eruption of the maxillary lateral incisors into the canine space, which resulted in the premature loss of the deciduous canines.[14,15] The buccal segments drifted mesially resulting in full cusp Class II malocclusion. To achieve an optimal result, it was necessary to recover the canine spaces with compressed coil springs to facilitate U3 eruption.[16] Fortunately, as the upper canine spaces were opened, the patient maintained lip competence, so this physiologic force system retracted the upper molars. In addition, strong lower face growth assisted the spontaneous correction of the Class II buccal segments.

Critique: the occlusal result could be improved by flattening the lower curve of Spee, performing interproximal enamel reduction of the lower incisors, and using Class II elastics to complete correction of cuspid and premolar occlusal relationships (*Fig. 13*).

Timing of Non-Extraction Treatment

Chang's Extraction Decision Table[17] was used to assess the necessity for extractions. Two factors favoring extraction were a high mandibular plane angle (*FMA 33.5°*) and >7mm of crowding in the maxillary arch. However, the patient had a normal profile with decreased axial inclination of the maxillary incisors (*98°*). Furthermore, extraction(*s*) to correct impacted canines is best limited to patients with ankylosis, uncontrollable infection, internal or external root resorption, severe root dilaceration, and/or pathology that may compromise the adjacent teeth.[18,19] The patient was only 10 years old at the start of treatment, had competent lips, and considerable anterior growth was expected. Therefore, a non-extraction treatment plan was indicated.

Broadbent[20] described the mechanism of anterior maxillary eruption as the "*ugly duckling*" stage. The concept implied was that the eruptive movement of the canines was guided along the distal aspect of the roots of the lateral incisors.[12] The pre-treatment panoramic radiograph (*Fig. 3*) showed that the U3 roots were not fully developed, so there appeared to be strong eruption potential. The problem was inadequate arch length. Since arch development was required, compressed coil springs were indicated to provide space for U3 eruption.

Open Coil Springs

A classic approach for impacted maxillary canines is space opening, surgical exposure, and light traction force.[21] For the present patient, open coil springs increased the space between the lateral incisors and first premolars to create an unobstructed path of eruption for the canines. The reciprocal force generated by the open coil springs uprighted the mesially tipped buccal segments, rotated the UL4, and flared the upper incisors. To prevent excessive tipping of the incisors, low-torque brackets were chosen.[22] Bonding standard-torque brackets upside-down and applying root torque springs were additional options, if needed.[23] Maintenance of lip competence as incisors flare is the responsibility

of patients and should be emphasized to his or her family.[24]

Conclusions

Careful management of impacted maxillary canines is important both esthetically and functionally. Investigating the cause of the problem is the first step for establishing an optimal treatment plan. Reversing the etiology is usually the best choice for correcting acquired malocclusions. Well planned orthodontic therapy (*with or without surgery*) provides optimal results for both the patient and the clinician. A careful assessment of the etiology is critical for differentiating between potential treatment plans. It is wise to use the least invasive approach that has a reasonable probability of success.

References

1. Kurol J. Early treatment of tooth-eruption disturbances. Am J Orthod Dentofacial Orthop 2002;121:588-91.
2. McDonald F, Yap WL. The surgical exposure and application of direct traction of unerupted teeth. Am J Orthod 1986;89:331-40.
3. Sajnani AK, King NM. Prevalence and characteristics of impacted maxillary canines in southern Chinese children and adolescents. J Investig Clin Dent 2014;5(1):38-44.
4. Zhong YL, Zeng XL, Jia QL, Zhang WL, Chen L. Clinical investigation of impacted maxillary canine. Chinese J Stomatology 2006;41(8):483-5.
5. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. Eur J Orthod 1988;10(4):283-95.
6. Jacoby H. The etiology of maxillary canine impactions. Am J Orthod 1983;84:125-32.
7. Leite HR, Oliveira GS, Brito HH. Labially displaced ectopically erupting maxillary permanent canine: interceptive treatment and long-term results. Am J Orthod Dentofacial Orthop 2005;128:241-51.
8. Williams B. Diagnosis and prevention of maxillary cuspid impaction. Angle Orthod 1981;51:30-40.
9. Kokich VG. Surgical and orthodontic management of impacted maxillary canines. Am J Orthod Dentofacial Orthop 2004;126:278-83.
10. Vanarsdall R, Corn H. Soft tissue management of labially positioned unerupted teeth. Am J Orthod 1977;72:53-64.
11. Vermette M, Kokich V, Kennedy D. Uncovering labially impacted teeth: closed eruption and apically positioned flap techniques. Angle Orthod 1995;65:23-32.
12. Becker A, Chaushu S. Etiology of maxillary canine impaction: A review. Am J Orthod Dentofacial Orthop 2015;148:557-67.
13. Kokich VG, Mathews DP. Surgical and orthodontic management of impacted teeth. Dent Clin North Am 1993;37:181-204.
14. Lindauer SJ, Rubenstein LK, Hang WM, Andersen WC, Isaacson RJ. Canine impaction identified early with panoramic radiographs. J Am Dent Assoc 1992;123:91-92, 95-97.
15. Power SM, Short MB. An investigation into the response of palatally displaced canines to the removal of deciduous canines and an assessment of factors contributing to favorable eruption. Br J Orthod 1993;20:215-23.
16. Fearne J, Lee RT. Favourable spontaneous eruption of severely displaced maxillary canines with associated follicular disturbance. Br J Orthod 1988;15:93-8.
17. Chang C. Advanced damon course no.7: crowding: extraction vs. non-extraction. Taiwan: Newton's A Ltd, 2019.
18. Niagara K et al. Impacted maxillary central incisor, canine, and second molar with 2 supernumerary teeth and an odontoma. Am J Orthod Dentofacial Orthop 2009;135:390-9.
19. Halazonetis DJ. Horizontally impacted maxillary premolar and bilateral canine transposition. Am J Orthod Dentofacial Orthop 2009;135:380-9.
20. Broadbent BH. Ontogenic development of occlusion. Angle Orthod 1941;11:223-41.
21. Chang C, Roberts WE. Beethoven Podcast Encyclopedia in Orthodontics 2012. Taiwan: Newton's A Ltd, 2012.
22. Thomas B: Variable torque for optimal inclination. Clinical Impression 2009;1:1-9.
23. Tseng L, Chang C, Roberts WE. Diagnosis and conservative treatment of skeletal Class III malocclusion with anterior crossbite and asymmetric maxillary crowding. Am J Orthod Dentofacial Orthop 2016;149:555-66.
24. Oliver BM. The influence of lip thickness and strain on upper lip response to incisors reaction. Am J Orthod 1982;82:141-49.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 25

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 = 0

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 = 1

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 7

OCCLUSION

Class I to end on	=	0 pts.	
End on Class II or III	=	2 pts. per side	____ pts.
Full Class II or III	=	4 pts. per side	8 pts.
Beyond Class II or III	=	1 pt. per mm. additional	____ pts.

Total = 8

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP

≥ 38° = 2 pts.

Each degree > 38° 2.5 x 2 pts. = 5

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

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

Total = 7

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)	_____	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 = 2

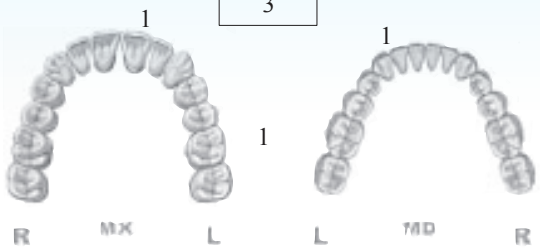
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 18

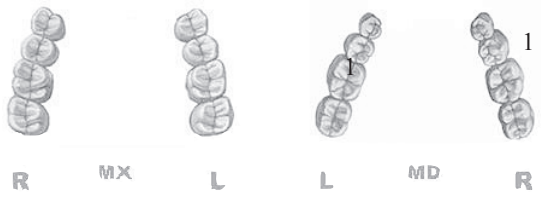
Alignment/Rotations

3



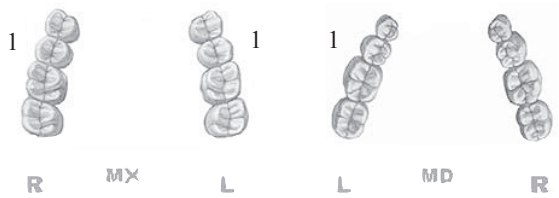
Marginal Ridges

2



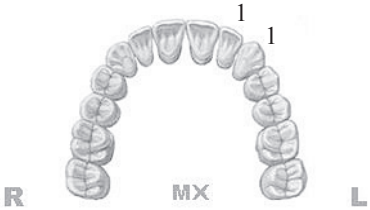
Buccolingual Inclination

3



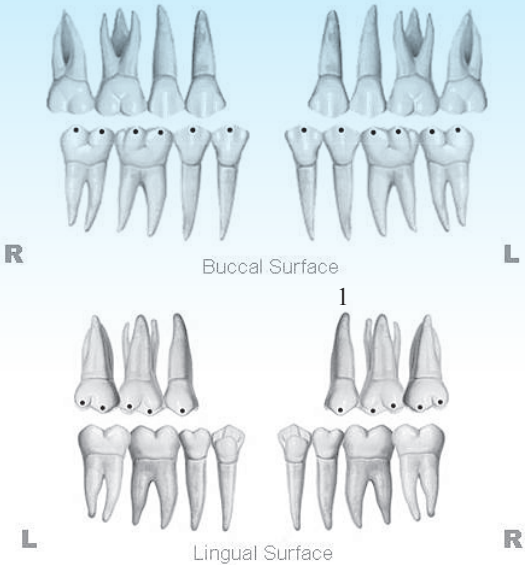
Overjet

2



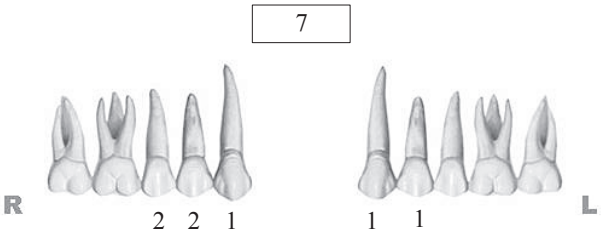
Occlusal Contacts

1



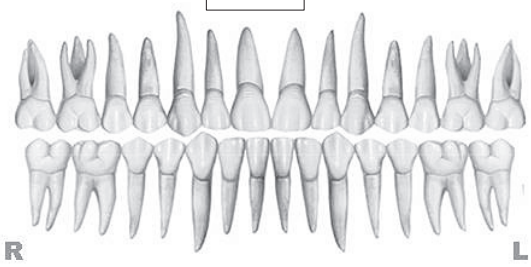
Occlusal Relationships

7



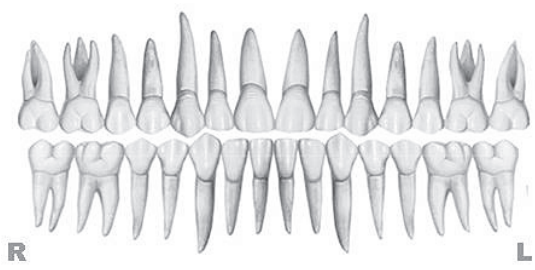
Interproximal Contacts

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: = 3

1. Pink Esthetic Score

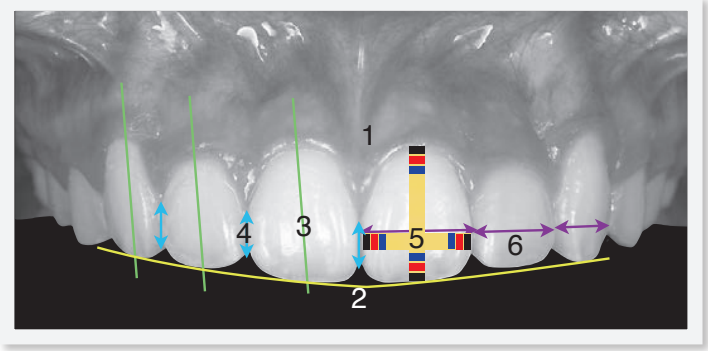
Total = 2

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

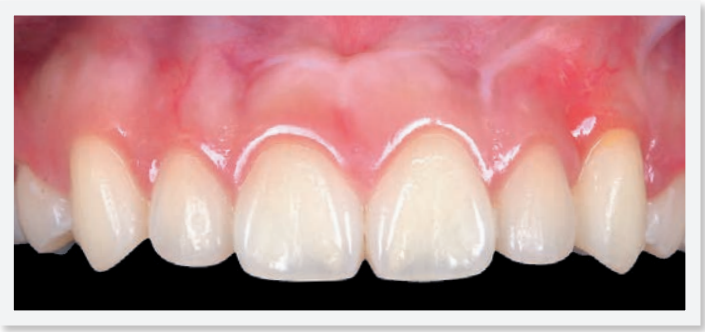
1. M & D Papilla	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	0	(1)	2
4. Level of Gingival Margin	0	(1)	2
5. Root Convexity (Torque)	(0)	1	2
6. Scar Formation	(0)	1	2

2. White Esthetic Score (for Micro-esthetics)

Total = 1



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 Association of 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 Ambassador & Diplomate

國際矯正植牙大使與院士

Ambassadors

Dr. Kenji Ojima◆

Dr. Diego Peydro Herrero◆

Dr. 林詩詠 Joshua Lin*▲

31 pts

Dr. 張銘珍 Ming-Jen Chang*

18 pts

Dr. 曾令怡 Linda Tseng*▲

16 pts

Ambassador（大使）:

- * *One who has published 9+ case reports in JDO.*
- ◆ *Keynote speakers for iAOI annual workshops*
- ▲ *Case report(s) published at least once in referral journals.*
- ● *Referral journals/Research paper - 3 points*
  ABO case report - 2 points
  Clinical tip - 1 point

Diplomates

Dr. 徐玉玲 Lynn Hsu▲

27 pts

Dr. 李雙安 Angle Lee▲

26 pts

Dr. 蘇筌瑋 Bill Su

24 pts

Dr. 葉信吟 Hsin-Yin Yeh▲

20 pts

Dr. 黃育新 Yu-Hsin Huang

16 pts

Dr. 黃祈 Richie Huang

15 pts

Dr. 徐重興 Eric Hsu▲

15 pts

Dr. 邱上珍 Grace Chiu▲

13 pts

Dr. 黃瓊嫥 Sabrina Huang

13 pts

Dr. 曾淑萍 Shu-Ping Tseng

12 pts

Dr. 林曉鈴 Sheau-Ling Lin

10 pts

Dr. 張倩瑜 Charlene Chang

10 pts

Dr. 陳俊宏 Chun-Hung Chen

9 pts

Dr. 林森田 Chris Lin

7 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. 黃荷薰 Ashley Huang

6 pts

Dr. 鄭惠文 Joy Cheng

6 pts

Dr. 張銘津 Ariel Chang

5 pts

Dr. 彭緯綸 Wei-Lun Peng

4 pts

Dr. 呂詩薇 Julie Lu

4 pts

2020 iAOI SYMPOSIUM

SPARK ALIGNERS:
A new paradigm in clear orthodontics

SUN Nov 15

Newton's A
2F, 25, Jianzhong 1st Rd.,
Hsinchu City, Taiwan

Dr. Diego Peydro Herrero

In this one-day course, doctors will learn how to use aligners in any situation to achieve the most demanding goals and results. They will also learn differences between different alinger systems in the market and the best options in each clinical situation.

09:00-10:30 The 3 BASICS in aligner therapy and transversal malocclusions

- How to solve severe transversal problems?
- How to plan the perfect expansion?
- How to select passive and active attachments?

11:00-12:30 Winning protocols for challenging situations

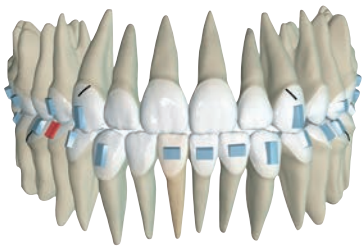
- Protocols to solve severe rotations
- How to avoid cracking aligners?

13:30-15:00 Vertical malocclusions. Introducing aligners and screws

- How to differently plan the perfect intrusion for the upper and lower arch?
- How to solve severe open bite using molar intrusion?
- How to conduct a smile design
- Use of aligners and screws to intrude molars

15:30-17:00 Sagittal malocclusions. Strategies to avoid extraction

- Upper molar distalization protocols
- Lower Molar distalization protocols
- Maximum anchorage using aligners and screws
- Protocols of elastics and sequence of movement



Phone: +886-3-5711377 Registration: iaoi.pro Contact: Michelle Tsai contact@iaoi.pro

2020 iAOI SYMPOSIUM

Workshop
Spark Alingers with Screws

MON **Nov 16** Newton's A
2F, 25, Jianzhong 1st Rd.,
Hsinchu City, Taiwan

Dr. Diego Peydro Herrero
Ormco advisory board and consultant
CEO, Peydro Herrero Odontología Avanzada
CEO, InviOrthoPro and Diego Peydro Academy

Doctors will learn how to use the Spark™ Approver™ 3D Software to properly plan sequences of movements and methods to use TADs in combination with aligners to get the best results.

SPARK™

	By 2020/10/15		After 2020/10/15	
	Member	Non-Member	Member	Non-Member
Lecture	USD 200	USD 250	USD 250	USD 300
Lecture + Workshop	USD 1,000	USD 1,035	USD 1,250	USD 1,285

(iAOI Enrollment Fees USD 35 included)

The fee of lecture+workshop includes consumables.

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 December 1 is subject to 10% of cancellation fees or 30% after.

Phone: +886-3-5711377 Registration: iaoi.pro Contact: Michelle Tsai contact@iaoi.pro

Kerr™

優惠期間自 2020/1/1- 6/25止

贋復指南

From Isolation to Polish

IMPRESSION

01 方案 Take 1 Advanced 泰克印模材系統

Cartridge Wash (Light body) (50mlx24) **x1** 箱(24支裝)

Volume Tray (380mlx2) **x2** 盒

特價NT$20,000 /組

02 方案 Take 1 Advanced 泰克印模材系統

買 *Volume Tray* (380mlx2) **x8** 盒

贈 *Volume Machine* **x1** 台

限量6組

特價NT$65,000 /組

·衛署醫器輸字第021479號

CEMENTATION

處理劑

Silane Primer

特價NT$2,200 /瓶

In/Onlay/Crown

一支會變色的 RESIN CEMENT

UNIQUE COLOR INDICATOR

讓您精確掌握多餘Cement的移除時機！

Maxcem Elite™ Chroma

美生伊立樹脂黏合劑 (5gx2支/盒)

特價NT$12,500/5盒

Optibond Versa **x1**組

歐提邦薇莎自酸蝕黏著劑 (1組/2罐/各6ml)

NX3 Dual Cure **x1**支

廣用型樹脂黏合劑 通用型 (5g/支)

特價NT$4,999/套

Veneer

Optibond Versa **x1**組

歐提邦薇莎自酸蝕黏著劑 (1組/2罐/各6ml)

NX3 Light Cure **x1**支

廣用型樹脂黏合劑 光照型 (5g/支)

特價NT$4,999/套

·衛署醫器輸字第011601、022545、021479、020145號 ·衛部醫器輸字第030574號 ·衛署醫器輸壹字第009056號

your best dental supplier YONG CHIEH 湧傑 客服專線：北區 (02)2778-8315 · 中區 (04)2305-8915 · 南區 (07)226-0030

優惠專區

優惠期間自 2020/1/1- 6/25止

Kerr ENDODONTICS

‘機’不可失

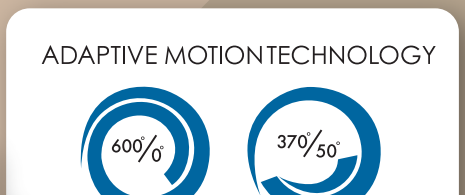
修型 SHAPING

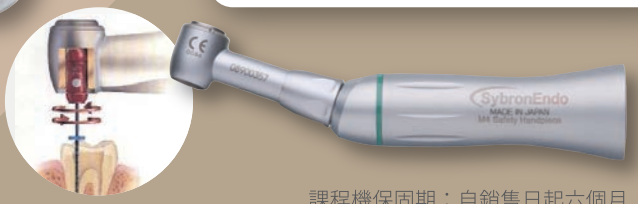
TFA 課程機方案

輕量型多功能旋轉馬達 (課程機) ***x1***台
Elements Motor

根管擴大慢速安全手機 (課程機) ***x1***支
M4 Safety Handpiede

特價 NT$59,900/組 (限量20組)





課程機保固期：自銷售日起六個月

充填 FILLING

無線雙功能根管充填機
Elementsfree

課程機 NT$49,999 (限量4台)

課程機保固期：自銷售日起六個月

DA DENTAL ADVISOR

2017-2019 Dental Advisor 推薦：
便攜、輕量、加熱迅速
的 **Continous Wave Obturation** 根管充填機

・衛署醫器輸壹字第009148號
・衛部醫器輸壹字第013962、016599、016766、017468、019870號

根管治療銼針

TF Adaptive Small 23mm /27mm
TF Adaptive Med / Lrg 23mm / 27mm
K3XF #15 - #40

TFA 或 ***K3XF*** 鎳鈦彈性旋轉器械 ***x20***盒
TFA File 綜合包 或 *K3XF* (號碼任選)

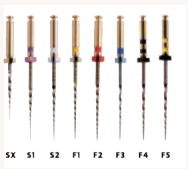
根管探測尋找器械 ***x1***支
Hu-Friedy *DG16* EXDG16 #31柄

特價 NT$24,000/組

EDGEENDO®

EDGETAPER PLATINUM™

EDGEFILE®



Edge Endo 鎳鈦彈性旋轉器械
EdgeTaper PLATINUM 或 *EdgeFile X7*

特價 NT$9,990/10盒

your best dental supplier YONG CHIEH 湧傑 客服專線：北區 (02)2778-8315・中區 (04)2305-8915・南區 (07)226-0030

Non-Extraction Treatment of a Class III/Class I Malocclusion with Anterior Crossbite

Abstract

History: *No contributing medical factors were reported, but ectopic eruption of the maxillary central incisors was probably an etiologic factor for the anterior crossbite.*

Diagnosis and Etiology: *Ectopic eruption of the maxillary central incisors was deemed the proximal cause of this asymmetric malocclusion (Class III right, Class I left) with 1.5mm midline discrepancy and anterior crossbite. There was about a 1mm functional shift (forward and left), and the 3-ring diagnostic sequence indicated conservative management was feasible.*

Treatment: *Correct anterior crossbite with an anterior bite turbo and early light short elastics. Interproximal enamel reduction in the lower arch is needed. Retract the mandibular arch with mandibular buccal shelf (MBS) bone screw anchorage.*

Results: *The anterior crossbite was corrected in 4 months, but lower arch retraction and finishing required 21 months of active treatment. Upper lip protrusion and lower lip retrusion improved the facial profile. The Cast-Radiograph Evaluation (CRE) was 15, and the Pink & White Esthetic Score was 3.*

Conclusions: *Conservative anterior crossbite correction combined with retraction of the entire lower arch produced stable facial and dental outcomes four years after treatment. (J Digital Orthod 2020;58:46-64)*

Key words:
Class III/Class I malocclusion, anterior crossbite, bite turbo, early light short elastics, interproximal reduction, MBS bone screws

Introduction

Asymmetric Class III malocclusion with anterior crossbite is a clinical challenge in adult patients. Complex diagnosis and treatment considerations may contribute to unnecessary invasive treatment such as extractions and/or orthognathic surgery. Differential diagnosis of the skeletal and dentoalveolar aspects of the malocclusion may support an efficient, conservative treatment plan.

In addition to orthodontics, skeletal Class III malocclusion with anterior crossbite may require extractions and/or orthognathic surgery. Some patients may present a pseudo-Class III problem because of an anterior functional shift that results in anterior crossbite in centric occlusion (C_O). If the intermaxillary skeletal relationships, facial profile and bilateral molar classification are acceptable in centric relation (C_R), the anterior crossbite can be effectively managed with conservative fixed appliance treatment.[1-3] However, Class III camouflage treatment may result in labial or lingual tipping of the maxillary and mandibular incisors, respectively. Controlling the axial inclination of the incisors is an important objective for conservative treatment of Class III malocclusion.

Dr. Charlene Chang,
Lecturer, Beethoven Orthodontic Course (Left)

Dr. Angle Lee,
Editor, Journal of Digital Orthodontics (Center left)

Dr. Chris H. Chang,
Founder, Beethoven Orthodontic Center
Publisher, Journal of Digital Orthodontics (Center right)

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

The aim of this case report is to discuss the diagnostic and treatment sequence for conservative management of an asymmetric Class III/Class I malocclusion with an anterior crossbite and a protrusive lower lip.

Diagnosis and Etiology

This 34-year-old female was concerned with poor dentofacial esthetics due to a protrusive lower lip, anterior crossbite, and incisal wear facets. Ectopic eruption of the maxillary central incisors at about age 6 was deemed the probable etiology of the malocclusion. The facial profile was straight (*Fig. 1*). In the frontal plane,

Fig. 1: Pre-treatment facial and intraoral photographs

the maxillary dental midline was coincident with the mid-facial plane, but the mandibular dental midline was shifted 1.5mm to the left. The anterior crossbite involved three maxillary incisors: both centrals and the left lateral incisor. Attrition of the maxillary central incisors was apparent when smiling (*Fig. 2*). There was a slight (*~1.0mm*) C_R to Co functional shift (*anterior and left*), but no signs nor symptoms of temporomandibular joint dysfunction. Maxillary and mandibular arches were square and tapered respectively. The molar relationships were end-on Class III on the right, and Class I on the left (*Fig. 3*). Overjet was -1mm in Co but 0 mm (*edge-to-edge*) in C_R. Overbite was 1-2mm in Co.

The pre-treatment cephalometric analysis in Co revealed a normal SNA (*82°*), but protrusive SNB

Fig. 2:
Incisal attrition due to crossbite in the frontal and lateral views

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

(*83°*). Vertical facial dimensions were increased, FMA (*29°*) and lower facial height (*57%*). Axial inclinations of the maxillary and mandibular incisors was decreased (*Fig. 4, Table 1*). The panoramic radiograph was unremarkable (*Fig. 5*). The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 16 points, as shown in the supplementary Discrepancy Index Worksheet (*Worksheet 1*).

Fig. 4: Pre-treatment cephalometric radiograph

Fig. 5: Pre-treatment panoramic radiograph

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	82°	82°	0°
SNB° (80°)	83°	82.5°	0.5°
ANB° (2°)	-1°	-0.5°	0.5°
SN-MP° (32°)	36°	36°	0°
FMA° (25°)	29°	29°	0°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	4	6	2
U1 To SN° (110°)	105°	110.5°	5.5°
L1 To NB mm (4 mm)	4	3	1
L1 To MP° (90°)	81°	80.5°	0.5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	-3.5	-2	1.5
E-LINE LL (0 mm)	1	0	1
%FH: Na-ANS-Gn (53%)	57%	56.5%	0.5%
Convexity: G-Sn-Pg' (13°)	0.5°	1°	0.5°

Table 1: Cephalometric summary

Treatment Objectives

1. Maintain skeletal dimensions in all three planes.
2. Use a full fixed appliance to level and align both arches.
3. Tip upper incisors anteriorly and retract the lower arch to correct overjet and overbite.
4. Resolve the functional shift to help correct the end-on Class III molar relationship on the right side, and mandibular midline deviation.
5. Protract upper and retract lower lips to improve the facial profile.
6. Reshape incisors and correct soft tissue margins as needed to improve dental esthetics.

Treatment Alternatives

Extraction space can be used to retract the mandibular anterior segment, or the entire mandibular arch can be retracted with skeletal anchorage.[4] The first option was extraction of a mandibular incisor to facilitate crossbite correction, but that approach would complicate correction of both the Class III relationship and midline discrepancy. The second alternative was to extract the mandibular right second molar and close space between the third and first molars to correct the Class III molar relationship. However, asymmetric closure of a 10mm second molar space is challenging, and might result in lower arch asymmetry and an extended treatment time. The third alternative was to extract the mandibular right third molar and place mandibular buccal shelf bone

screws for anchorage to retract the entire lower arch. After a thorough discussion with the patient, the latter option was selected.

Treatment Progress

After the mandibular right third molar was extracted, a 0.022-in Damon Q® (*Ormco, Brea, CA*) fixed appliance was bonded on all permanent teeth. All archwires and auxiliaries were as specified by the same manufacturer. The maxillary archwire sequence was 0.014-in CuNiTi, 0.016-in CuNiTi, 0.014x0.025-in CuNiTi, 0.017x0.025-in TMA and 0.016x0.025-in SS. The corresponding mandibular sequence was 0.014-in CuNiTi, 0.014x0.025-in CuNiTi, and 0.016x0.025-in pre-torque CuNiTi (*Table 2*).

At the start of treatment, the maxillary arch was fitted with low torque brackets on the incisors to prevent excessive labial tipping. An anterior bite turbo was bonded on the incisal edges of the mandibular left lateral incisor and canine (*Fig. 6*). One month later the mandibular arch was bonded with

Fig. 6:
Low-torque brackets were bonded on the upper anterior teeth. An anterior bite turbo was constructed with glass isomer cement on the incisal edges of the lower left lateral incisor and canine.

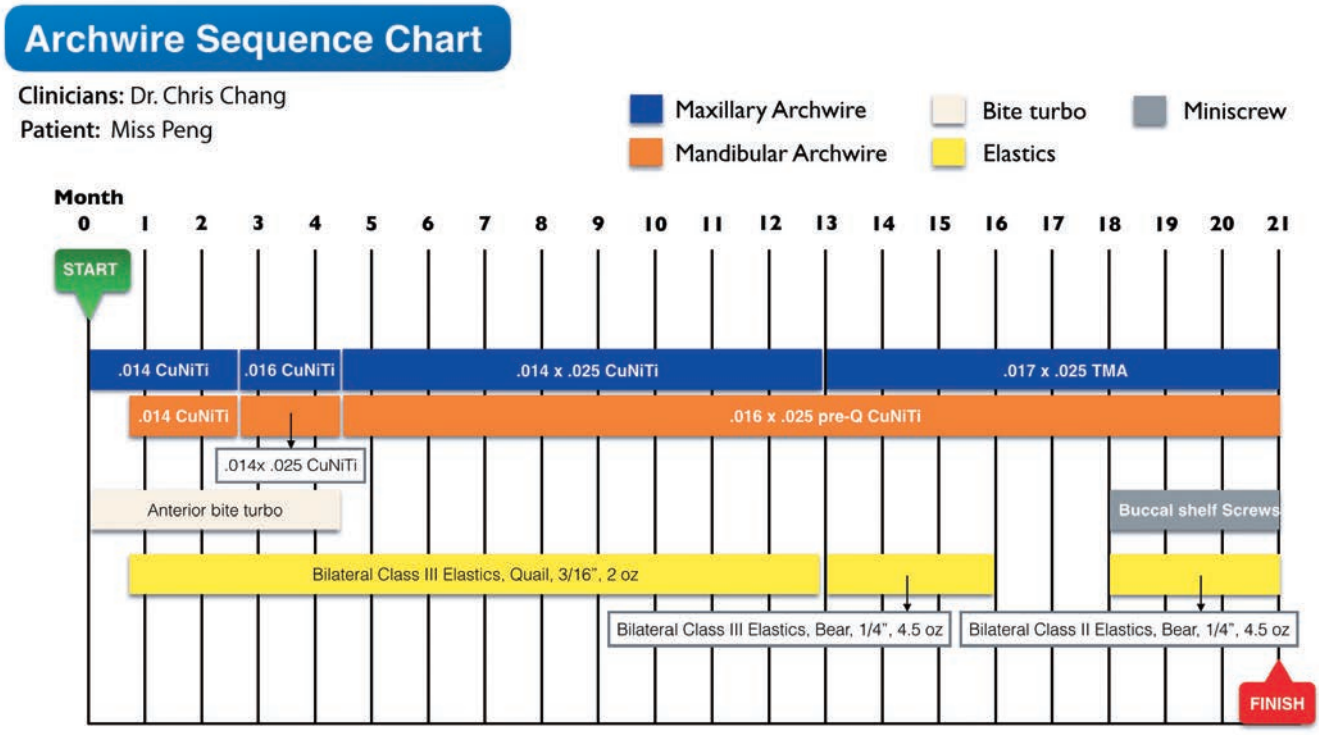


Table 2: Archwire sequence of this case with the timing for using anterior bite turbo, elastics, and miniscrews

standard torque brackets. Bilateral Class III elastics (*Quail, 3/16-in, 2 oz*) were used from the lower first premolars to the upper first molars (*Fig. 7*).

In the fourth month, the anterior crossbite was corrected, the bite turbo was removed, and the maxillary archwire progressed to 0.014x0.025-in CuNiTi. To resist distal tipping of the lower incisors due to Class III elastics, a 0.016x0.025-in pre-torqued (+20°) CuNiTi mandibular archwire was placed (*Fig. 8*). In the ninth month, black triangles between lower incisors were corrected with IPR and space closure (*Fig. 9*).

In the thirteenth month, the maxillary archwire progressed to 0.017x0.025-in TMA, and the upper anterior teeth were ligated with stainless steel to prevent space opening (*Fig. 10*). Class III elastics (*Bear,*

Fig. 9:
In the 9th month of treatment, interproximal space was created in the incisal area with IPR.

Fig. 10:
In the 13th month, upper anterior teeth were stabilized with a figure-8 tie of stainless steel ligature.

Fig. 7: The anterior crossbite is improved with one month (1M) of treatment. See text for details.

Fig. 8:
In the 4th month of treatment (4M), a 0.016x0.025-in pre-torqued (+20°) CuNiTi wire was inserted in the mandibular arch. Early-light short Class III elastics were attached from the lower first premolars to the upper first molars. See text for details.

1/4-in, 4.5 oz) were applied from the mandibular canines to the maxillary first molars.

In the eighteenth month, interproximal reduction was performed between the mandibular incisors. Two miniscrews (*OrthoBoneScrew®, OBS, 2x12mm, iNewton Ltd., Hsinchu City, Taiwan*) were inserted bilaterally in the buccal shelves to retract the mandibular dentition (*Fig. 11*). Class II elastics (*Bear, 1/4-in 4.5 oz*) were used to stabilize the overjet and overbite.

After 21 months of active treatment, all the appliances and OBSs were removed (*Fig. 12*). The

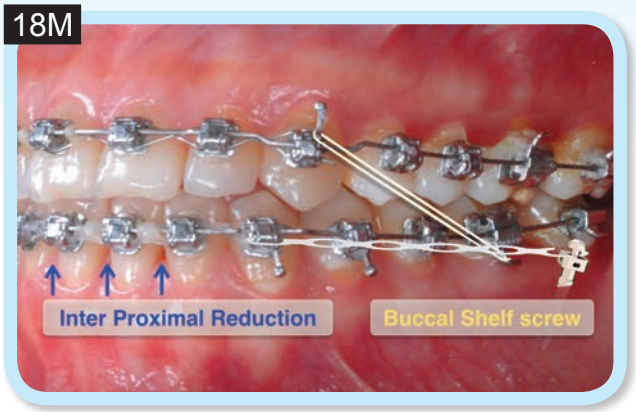


Fig. 11:
In the 18th month, buccal shelf screws were place bilaterally, IPR was performed in the lower incisor area, the lower arch was retracted with a chain of elastics, and Class II elastics retract the upper arch. See text for details.

Fig. 12: Post-treatment facial and intraoral photographs

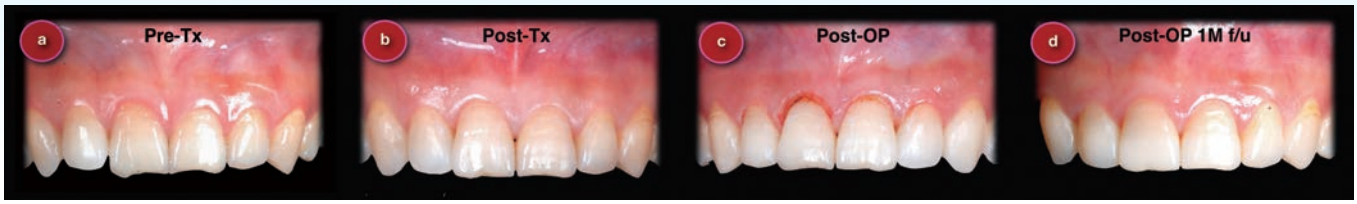


Fig. 13:
Upper anterior esthetics are shown pre-treatment (a), post-treatment after smoothing incisal edges (b), post-operative view after gingiplasty of the right central incisor (c), and one month (1M) post-operative follow-up (d). See text for details.

abraded incisal edges of the maxillary incisors and maxillary canine cusp tips were rounded and polished (*Fig. 13a-b*). Gingivectomy was performed with a diode laser on the maxillary central and lateral incisors as needed (*Fig. 13c-d*).

Fixed lingual retainers were bonded on maxillary incisors and the mandibular anterior segment. Clear overlays were delivered for both arches with instructions for full time wear for the first 6 months and nights only thereafter. Home care and retainer maintenance instructions were provided.

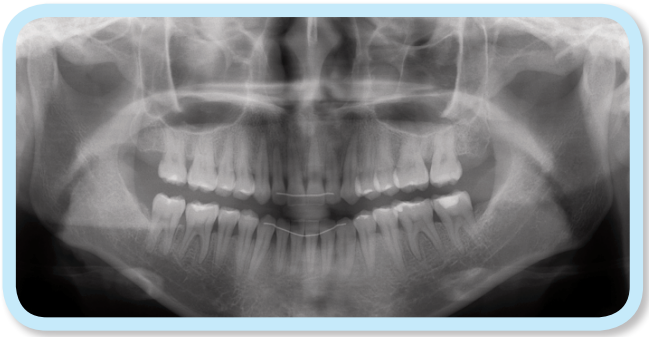


Fig. 15: Post-treatment panoramic radiograph

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

Fig. 16: Post-treatment cephalometric radiograph

Treatment Results

The patient was treated to the desired outcome as documented in Figs. 14-16. The post-treatment facial photographs (*Fig. 12*) document improved facial esthetics in profile associated with more harmonious balance between the upper and lower lips. The anterior crossbite was corrected and buccal relationships were Class I bilaterally. Post-treatment cephalometric analysis (*Table 1*) showed acceptable axial inclination of the upper (*110.5°*) and lower (*80.5°*) incisors. Superimposed cephalometric tracings document that the maxillary incisors were tipped labially and the mandibular arch was retracted (*Fig. 17*). The ABO Cast Radiograph Evaluation (*CRE*) score was 15 points (*Worksheet 2*), and the major residual discrepancy was marginal ridges (*5 points*). Dental esthetics are excellent as documented by the Pink and White dental esthetic index of 3 (*Worksheet 3*). Overall, the patient was well satisfied with the outcomes. Stability of the correction is documented with 4-year follow-up records (*Fig. 18*).

Discussion

Dr. Lin's 3-Ring Diagnosis

Anterior crossbite with asymmetric Class III molar relationship suggests the need for complex, invasive treatment. Differential assessment with Dr. Lin's three-ring diagnosis method is an effective procedure for distinguishing which patients can be managed conservatively from those who require extractions and/or orthognathic surgery. Without a comprehensive diagnosis, most Class III malocclusions may be destined for unnecessary or over-invasive treatments, such as extractions,

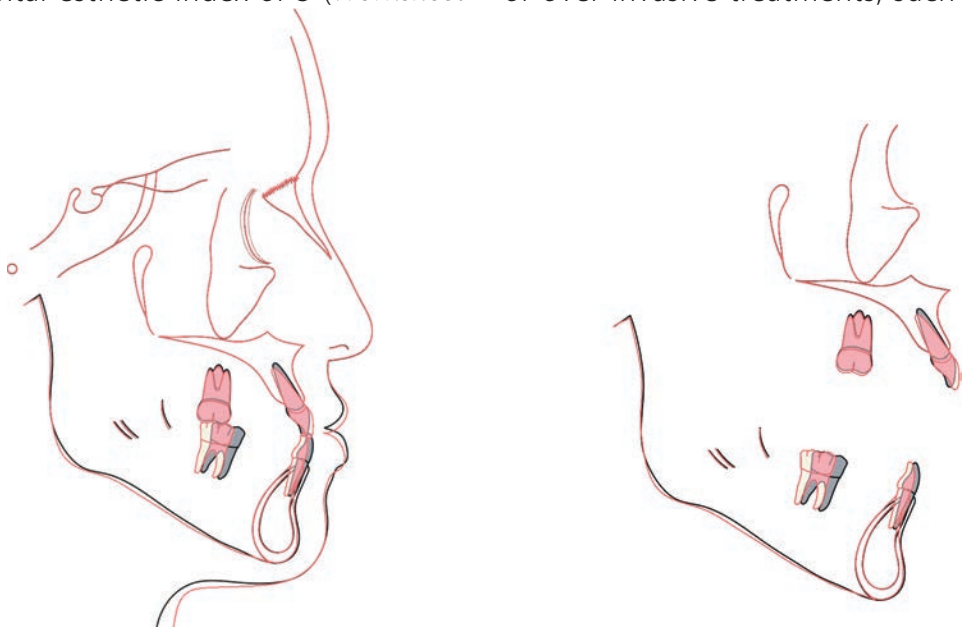


Fig. 17:
Superimposed cephalometric tracings document labial tipping of the upper incisors, increased upper lip protrusion, and retraction of the mandibular dentition after treatment (red). See text for details.

Fig. 18: Facial and intraoral photos 4-years post-treatment

rapid maxillary expansion and face mask (*RME/FM*), or orthognathic surgery. The three-ring diagnosis is an effective method for identifying Class III malocclusions that are likely to respond well to conservative orthodontic therapy (*Fig. 19*):[1-3]

(1) Profile:

Despite a protrusive lower lip, facial profile was orthognathic in both the C_O and C_R positions. This relationship suggests the patient will have a good response to dentoalveolar treatment without extractions or orthognathic surgery.[1-3]

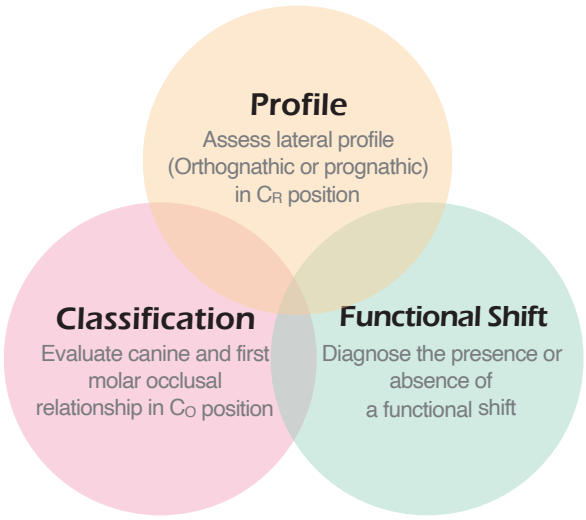


Fig. 19: Dr. Lin's 3-ring diagnosis for Class III malocclusion

(2) Classification:

Buccal relationships were Class III right and Class I left. The anterior crossbite in Co was associated with a small (<*1mm*) anterior and lateral (*left*) Co → CR shift from an edge to edge relationship in CR. Considering the modest intermaxillary skeletal discrepancy (*ANB -1*°) and functional shift, the asymmetric Class III relationship was deemed a dental Class III and not a skeletal malocclusion.

(3) Functional Shift:

The patient's midline discrepancy, interdigitation asymmetry, and anterior crossbite were improved in CR confirming there were both sagittal and frontal components to the functional shift (*Fig. 20*). These data suggest the asymmetric Class III with anterior crossbite was related to occlusal interference, which is a favorable scenario for conservative dentoalveolar treatment.

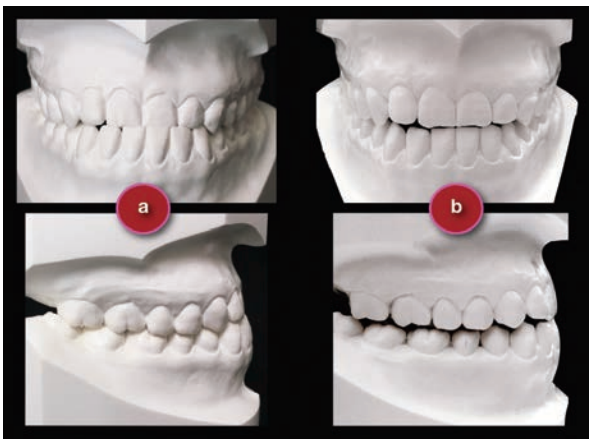


Fig. 20:
Pre-treatment frontal and lateral views of the anterior crossbite (a) are compared to the same casts positioned in a Class I relationship (b). Note the correction of the midline discrepancy and the anterior crossbite when the molar relationship is Class I bilaterally. See text for details.

Four Key Points of Treatment

Conservative treatment was predictable based on three aspects of the planned mechanics: (*1*) proper torque-selection for brackets, (*2*) an anterior bite turbo with light-force Class III elastics, (*3*) IPR in the lower anterior region, and (*4*) lower arch retraction with buccal-shelf bone screws.

(1) Torque Selection & Class III Elastics:

Bracket torque selection (*Table 3*) and/or pretorqued archwires are very important for controlling the axial

Expected Side Effects of Class III Camouflage Treatment		Torque Selection of Damon Q System		
Maxillary Anterior Teeth	**Proclination** (Extraction)	Standard Torque		High Torque
		U1	**U2**	**U3**
		15	6	11
	Proclination (Non-extraction)	Low Torque		Low Torque
		U1	**U2**	**U3**
		2	-5	-9
Mandibular Anterior Teeth	**Retroclination** (Non-extraction)	Standard Torque		Standard Torque
		L1	**L2**	**L3**
		-3	-3	7
	Excessive retroclination (Extraction)	Low Torque Upside-down bonding		High Torque
		L1	**L2**	**L3**
		11	11	13

Table 3:
Torque selection to compensate the side effects in Class III camouflage treatment with Damon Q system

inclination of incisors during camouflage treatment of Class III malocclusion.[5-7] Low-torque brackets were selected for the upper incisors to generate resistance to labial tipping. Standard torque brackets combined with a 0.016 x 0.025-in pre-torqued (+20°) CuNiTi wire were chosen to prevent excessive lingual tipping of the mandibular incisors (*Fig. 21*) during correction of anterior crossbite (*Fig. 22*).

Fig. 21:
Illustration of camouflage treatment mechanics shows incisal crown tipping (yellow arrows) due to Class III elastics. The tipping is resisted in the upper arch with low torque brackets (green curved arrow), and a pre-torqued CuNiTi archwire in the lower arch (red curved arrow). See text for details.

Fig. 22:
The first four months (4M) of anterior crossbite treatment is shown in clockwise order: pre-treatment (Pre-Tx), start (0M), one month (1M), and 4M with Class III elastics shown. See text for details.

(2) Anterior Bite Turbo:

There are numerous methods for modifying occlusion to help correct moderate anterior crossbites. Biting on a wooden tongue blade is a simple approach, but many patients fail to adequately cooperate and the range of the mechanics is limited.[8] Upper removable or lower fixed acrylic bite plates are also common methods, but both require impressions and laboratory procedures which increase the cost and number of appointments.[9,10] A composite-resin inclined plane can be constructed on the lower incisors, but it is a bulky appliance (*3-4mm thick*) that provides about a 45° slope extending from the lingual to the labial surface (*Fig. 23*). This method for single tooth crossbite correction is safe and easy to apply, comfortable, and esthetically acceptable.[11,12]

All of the occlusion modification methods reviewed can be used as auxiliaries with fixed appliances, but a more convenient approach is an anterior bite turbo that unlocks the occlusion to permit tooth movement with archwire action and intermaxillary elastics (*Fig. 22*). The present bite turbo was an

Fig. 23:
A composite-resin inclined plane is shown in another patient that tips the upper left central incisor in a labial direction. The treatment is described in reference 12 of this article.[12]

occlusal prematurity constructed with glass ionomer cement on the incisal edge of the lower left lateral incisor and canine (*Fig. 6*). The bite opening effect (*Fig. 7*) permits the light force Class III elastics and archwire action to correct the anterior crossbite in less than 4 months (*Fig. 22*).

(3) Interproximal Reduction vs. Extractions:

Numerous case reports and reviews support extractions and differential space closure as an effective option for management of adult Class III malocclusions.[13-16] The choice of extraction sites depends on the severity and symmetry of the sagittal discrepancy and crossbite(*s*). Extraction of one mandibular incisor is effective if there is excessive lower incisor mesiodistal arch length (*Bolton discrepancy*) and/or severe lower anterior crowding.[13,14] First or second molar extraction may be preferred when the third molar(*s*) are erupted and healthy.[15,16] Asymmetric buccal segments (*Class III and Class I*) can be managed by differential premolar extractions, i.e. first premolar on one side and second premolar on the other.

If the anterior Bolton excess in the lower arch is less than 2mm, interproximal reduction (*IPR*) of the mandibular incisors is a viable option instead of mandibular incisor extraction.[14,17,18] Mandibular incisal IPR should be limited to about 0.5mm on each surface, and the enamel removed should not exceed 50% of the total enamel thickness. Generally, IPR should focus on the areas of the mandibular teeth with greater enamel thickness: distal surfaces of the lateral incisors and the mesial and distal surfaces of the canines.[18] Furthermore, IPR is useful for eliminating black triangles (*Fig. 24*).

Fig. 24:
A series for frontal photographs shows the treatment sequence to correct lower incisor black triangles (4M) with IPR at nine months (9M). Closure to the IPR generated space produces the final result seen after treatment at twenty-one months (21M).

(4) Skeletal Anchorage:

Extra-alveolar bone screws in the mandibular buccal shelf region (*external oblique ridge area*) offer maximum anchorage for retracting the entire mandibular arch to resolve a variety of Class III malocclusions (*Fig. 25*).[7,19] These temporary anchorage devices have a high success rate (92.8%),

and are effective anchorage for conservative correction of Class III malocclusion.[4,20]

To correct the intermaxillary relationship (*Bolton discrepancy*) of the anterior segments, IPR of the mandibular incisors was performed twice. The initial IPR was combined with Class III elastics and an anterior bite turbo, and the final IPR was in conjunction with buccal shelf OBSs and Class II elastics in the finishing stage (*Table 4*). Collectively, the conservative mechanics and two steps in IPR achieved the desired result in 21 months (*Fig. 26*).

Fig. 25:
A mandibular buccal shelf bone screw is inserted buccal to the roots of the lower molar(s).

Conclusions

(1) A thorough differential diagnosis of adult Class III malocclusion is indicated to determine if conservative fixed appliance treatment is feasible.

(2) Bracket torque selection is an effective technique for controlling the labiolingual inclination of the dentition.

Fig. 26:
A progressive clockwise series of right buccal photographs shows correction of the Class III molar relationship: pre-treatment (Pre-Tx), one month (1M), four months (4M), nine months (9M), sixteen months (16M), and twenty-one months (21M) which is the post-treatment result.

	Management	Function	Treatment Object
Initial stage	**Anterior bite turbo**	vertical stop	correct anterior crossbite
	Interproximal reduction	correct the excessive tooth size of mandibular anteriors	increase the overjet
	Class III elastics	protract upper anteriors and retract the lower anteriors	both above
Finishing stage	**Buccal shelf screw**	supply maximum anchorage to retract lower anteriors, upright lower molars, and retrocline flared upper anteriors	correct Class III canine and molar relationships
	Interproximal reduction	supply space for mandibular anteriors retraction	correct Class III canine relationship
	Class II elastics	retrocline the flared maxillary anteriors	stable the overjet and overbite

Table 4: The management in initial and finishing stage to treat this case

(3) An anterior bite turbo(s) and early light short elastics are simple and rapid treatment for anterior crossbite.

(4) Interproximal reduction of enamel thickness creates space to alleviate crowding, decrease incisal axial inclination, and/or correct a Bolton discrepancy in the anterior segments.

(5) Extra-alveolar OBS anchorage is effective for retraction of the lower arch.

Acknowledgment

Thanks to Dr. Chris Lin, and Dr. Ming-Jen Chang for the instructions of this case. Thanks to Mr. Paul Head for proofreading this article. And special thanks to my family for supporting me on my way studying Orthodontics.

References

1. Lin JJ, Liaw JL, Chang CH, Roberts WE. Class III correction, in orthodontics. Taipei, Taiwan: Yong Chieh Enterprise, Co, Ltd; 2013.
2. Lin JJ. Creative orthodontics: Blending the Damon system & TADs to manage difficult malocclusion. 2nd edition. Taipei, Taiwan: Yong Chieh Enterprise, Co, Ltd; 2010.
3. Lin JJ. The most effective and simplest ways of treating severe Class III, without extraction or surgery. Int J Ortho Implantol 2014;33:4-18.
4. Huang C, Chang CH, Roberts WE. 3D cortical bone anatomy of the mandibular buccal shelf: a CBCT study to define sites for extra-alveolar bone screws to treat Class III malocclusion. Int J Orthod Implantol 2016;41:74-82.
5. Thomas WW. Torque for optimal inclination. Clin Impressions 2009;17:21-27.
6. Tseng LY, Chang CH, Roberts WE. Diagnosis and conservative treatment of skeletal Class III malocclusion with anterior crossbite and asymmetric maxillary crowding. Am J Orthod Dentofacial Orthop 2016;149:555-566.
7. Jing Y, Han XL, Guo YW, Li JY, Bai D. Nonsurgical correction of a Class III malocclusion in an adult by miniscrew-assisted mandibular dentition distalization. Am J Orthod Dentofacial Orthop 2013;143:877-887.
8. Lee BD. Correction of crossbite. Dent Clin North Am 1978;22:647-668.
9. Jacobs SG. Teeth in crossbite: the role of removable appliances. Aust Dent J 1989;34:20-28.
10. Croll TP, Riesenberg RE. Anterior crossbite correction in the primary dentition using fixed inclined plane I. Quintessence Int 1988;1:546-552.
11. Sari S, Gokalp H, Aras S. Correction of anterior dental crossbite with composite as an inclined plane. Int J Paediatr Dent 2001;11:201-208.
12. Arikan V, Sari S. Using Composite resin inclined plane for the repositioning of a laterally luxated primary incisor: a case report. Eur J Den 2011;5:117-120.
13. Wissam D, Julie C, Morris HW. Nonsurgical treatment of an adult with a Class III malocclusion. Am J Orthod Dentofacial Orthop 2007;132:243-251.
14. Kumaresan J, Kumar TS, Kumar S. Skeletal class III camouflage by mandibular incisor extraction: A case report. Asian Pacific Orthodontic Society Trends in Orthodontics 2014;4:40-44.
15. Jiuxiang L, Yan G. Lower second molar extraction in correction of severe skeletal Class III malocclusion. Angle Orthod 2006;76:217-225.
16. Ruellas AC, Baratieri C, Roma MB, Izquierdo Ade M, Boaventura L, Rodrigues CS, Telles V. Angle Class III malocclusion treated with mandibular first molar extractions. Am J Orthod Dentofacial Orthop 2012;142(3):384-392.
17. Kokich VG, Shapiro PA. Lower incisor extraction in orthodontic treatment: Four clinical reports. Angle Orthod 1984;54:139-53.
18. Almeida NV, Silveira GS, Pereira DMT, Mattos CT, Mucha JN. Interproximal wear versus incisors extraction to solve anterior lower crowding: A systematic review. Dental Press J Orthod 2015;20:66-73.
19. Laura P, Aimara AS, Luis THG. Dentoalveolar class III treatment using retromolar miniscrew anchorage. Progress in Orthodontics 2013;14:7-12.
20. Chang CH, Liu SY, Roberts WE. Primary failure rate for 1680 extra-alveolar mandibular buccal shelf mini-screws placed in movable mucosa or attached gingiva. Angle Orthod 2015;85:905-910.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 16

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 = 7

OVERBITE

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

Total = 0

ANTERIOR OPEN BITE

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

Total = 4

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 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 = 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 = 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: Severe enamel wear (anterior attrition)

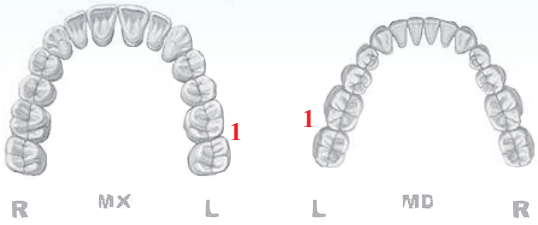
Total = 2

Cast-Radiograph Evaluation

Total Score: 15

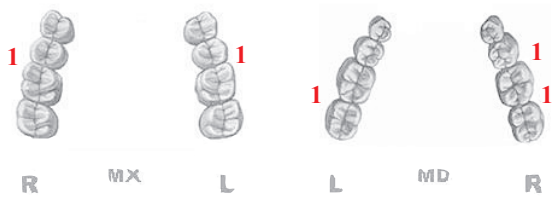
Alignment/Rotations

2



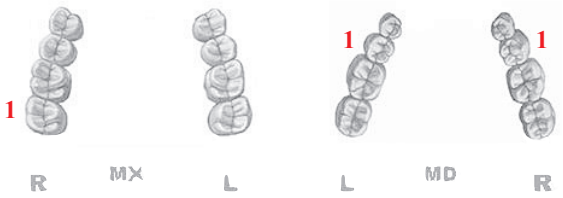
Marginal Ridges

5



Buccolingual Inclination

3

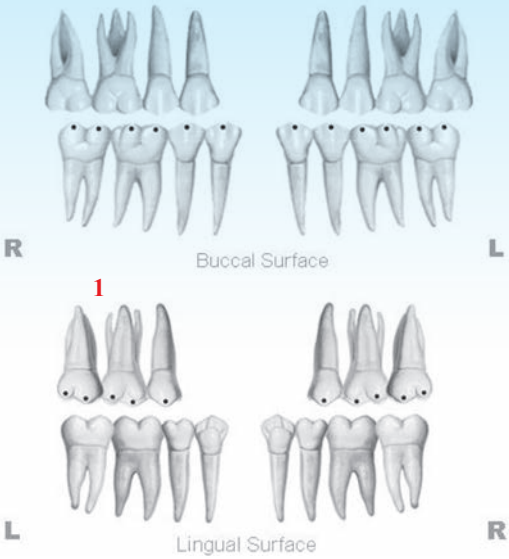


Overjet

2

Occlusal Contacts

2

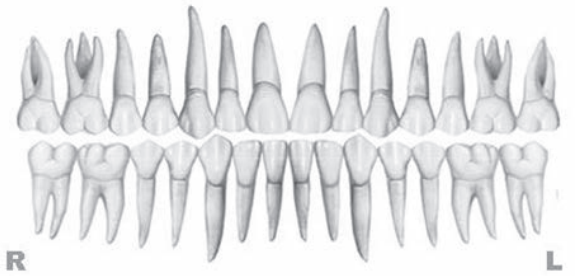


Occlusal Relationships

0

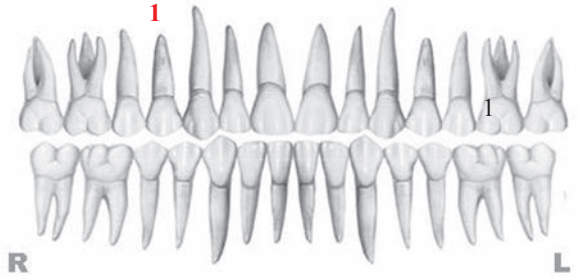
Interproximal Contacts

0



Root Angulation

1



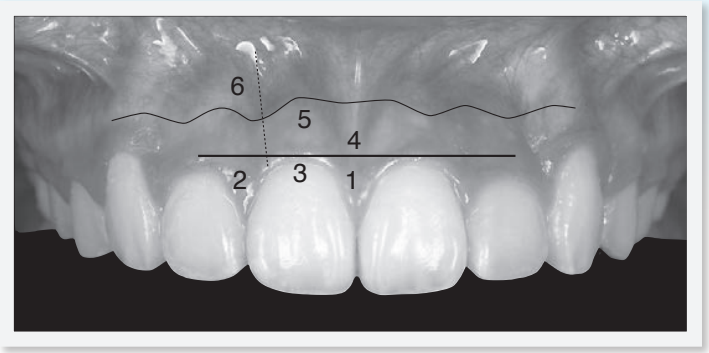
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 3

1. Pink Esthetic Score

Total = 0

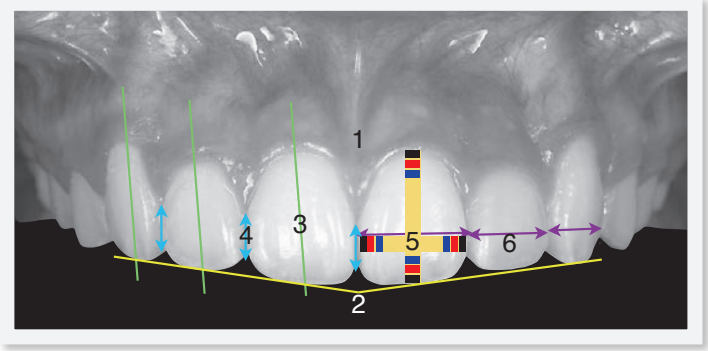


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

1. M & D 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 (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

Hu-Friedy®

How the best perform

2020 獨家代理

特別企劃
即將展開！

貳零貳零 黑潮來臨

Advanced Performance Throughout Your Practice

BLACK LINE

2020 How the best perform

Hu-Friedy 手術器械系列

產品特色：

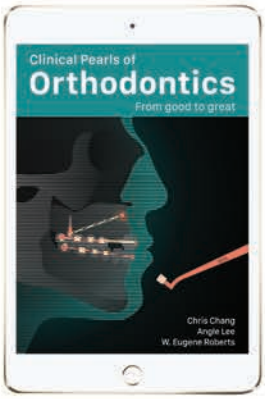
- 特殊黑色塗層，加強與手術部位對比，器械深入組織下時亦可提升能見度。
- 表面消光處理，在手術過程不易產生反光，舒適度大增。

your best dental supplier YONG CHIEH 湧傑 客服專線：北區 (02)2778-8315 · 中區(02)2305-8915 · 南區(07)226-0030

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:

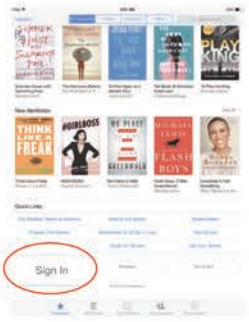
Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg,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

Get it on iBooks

Step-by-step Instructions

1. Launch "iBooks" app on your iPad.

2. Click "Store."

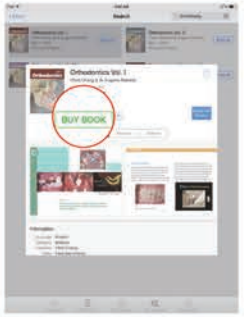


3. "Sign in" with your Apple ID.

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 **inewton.dental@gmail.com** for more information.

+886-3-573-5676

orthobonescrew.com

iNewton

iNewton

BDE

Now available on Google Play!

Free download now
and get complete access of JDO

INSTALL

Beethoven Dental Encyclopedia

iOS / Android

All new design

-Add search by category, more friendly UI

Auto-resumed

-Automatically resume play from last view

My favorite

-Tab and add favorite videos,
support background download

Direct registration

-Register directly and access instantly

Ortho Learning

Damon Master

OBS (TAD)

Finishing

E-Lecture

Implant Forum

Implant Forum

E-Clinic

E-Ortho

E-Pedo

E-Implant

Assistant

1. Now Beethoven video courses will only be available on Apple App Store or Google Play store.
2. A fee of NTD1000 or USD35 is required to upgrade to the iOS or Android version.
3. INewton retains all rights to interpret, amend or terminate this promotion program.

orthobonescrew.com
inewton.dental@gmail.com
+886-3-537-5676

Simplified Removal of an Osseointegrated Implant for Space Closure to Correct Anterior Crossbite

Abstract

***Diagnosis**: A 45-year-old male presented for orthodontic consultation with concerns about a concave facial profile and anterior crossbite. Clinical examination showed facial asymmetry with a cant in the occlusal plane that was associated with mandibular deviation to the right by about 2mm. Cephalometrics revealed a skeletal bimaxillary protrusion (SNA 89°, SNB 89°, ANB 0°). There were multiple missing teeth (UR8, UR7, UR4, UL2 , UL8, LR6, LL6, and LL8), and four endodontically treated teeth (UL5, UL7, LR7, LL6, and LL7). Missing lower first molars were restored with a fixed prosthesis on the right side and an implant-supported prosthesis on the left. A large area of pathology, possibly condensing osteitis, was distal and apical to the root of the LL4.*

***Treatment**: All restorations were replaced by provisional crowns except for the metal crown on the UL7, and the gold crown on the LL8. The pontic restoring the LR6 was cut out with a handpiece. An osseointegrated implant-supported prosthesis (ISP) restoring the LL6 was removed with a sustained counterclockwise torsional load (see text for details). A passive self-ligated, fixed appliance with anterior bite turbos (UR1, UL1) was used to correct the anterior crossbite by retracting the anterior segment with space closure mechanics, supplemented with light force Class III elastics. The edentulous space for the UR4 was opened with a compressed coil spring to receive an ISP. After orthodontic treatment, all provisional crowns were restored with porcelain fused to metal (PFM) prostheses.*

***Results**: After 38 months of treatment, the profile was improved, midlines were coincident, and normal overjet/overbite was achieved. The anterior crossbite was corrected and molar relationships were Class II on the left and Class I on the right. Lower incisors were tipped distally (76.5°), and upper incisors were flared labially (116°). All prostheses were restored as needed. The apparent condensing osteitis apical to the root of the LL4 decreased in size and remained asymptomatic, but endodontic evaluation is indicated. A complex malocclusion with a Discrepancy Index (DI) score of 19 was treated to a Cast Radiograph Evaluation (CRE) of 13.*

***Conclusions**: Osseointegrated implants can be easily removed with a simplified torsional overload procedure to permit optimal orthodontic management of malocclusion. (J Digital Orthod 2020;58:68-90)*

Key words:
Implant removal, anterior crossbite, minimally invasive approach, space closure

Introduction

The osseointegration concept was first described by Dr. Brånemark in 1952 and published by Albrektsson et al. in 1985.[1-3] These researchers referred to the result of their technique as "a direct functional and structural connection between living bone and the surface of a load carrying implant.' There is direct bone anchorage to an implant (*locking the implant into the jaw bone*) which can provide a foundation to support a prosthesis. Therefore, osseointegration is a perfect boundary for an implant surgeon, but a nightmare for an orthodontist. An osseointegrated implant is like an ankylosed tooth. It is almost unmovable, which obstructs tooth alignment and space redistribution. This case report presents a minimally invasive approach of an atraumatic removal of an implant and a treatment of a Class I malocclusion with anterior crossbite.

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

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

Diagnosis and Etiology

A 45-year-old male came for orthodontic consultation. He had a migraine and doubted that it was induced by his malocclusion. External examination indicated protrusive lower lip, asymmetric facial structures (*Fig. 1*) and coincident dental midlines that deviated to the right of facial midline (*Fig. 2*). The asymmetry of the mandible can be observed from the cephalometric and panoramic radiographs (*Figs. 5 and 6*).

Fig. 1: Pre-treatment facial and intraoral photographs

Fig. 2:
Coordinated dental midlines were shifted to the right of the facial midline.

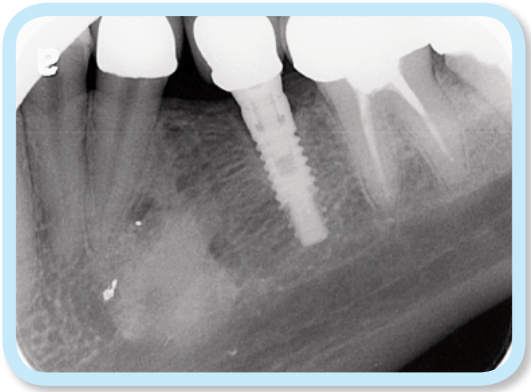


Fig. 3:
An implant was placed 5 years ago to restore a missing LL6. An asymptomatic mass of sclerotic tissue is noted distal to the root of the LL5. See text for details.

Fig. 4: Pre-treatment study models (casts)

Fig. 5: Pre-treatment cephalometric radiograph

Fig. 6:
Pre-treatment panoramic radiograph. Notice the canted occlusal plane and the asymmetry of the mandible.

Intraoral examination revealed an anterior crossbite of five mandibular teeth - from the right canine to the left lateral incisors. An edentulous space presented on the right maxilla (*Fig. 1*) and there was a canted occlusal plane (*Figs. 1 and 7*), which may have resulted from the imbalanced mandibular corpus or early loss of the mandibular permanent first molars. The pre-treatment study cast showed Class I molar relationship on the right, but end-on class III on the

left (*Fig. 4*). The pre-treatment cephalometric analysis showed a 0° ANB angle and a low mandibular plane angle (*Fig. 5, Table 1*). Panorammic radiography (*Figs. 3 and 6*) revealed missing teeth (*UR8, UR7, UR4, UL8 and LR6*), teeth with crowns (*UR6, UL5, UL7, LL8, LL7 and LL5*), and an implant-supported prosthesis LL6.

Fig. 7:
When the bite is opened, no mandibular shift was noted. However, the occlusal plane is canted inferiorly on the right.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	89°	89°	0°
SNB° (80°)	89°	89°	0°
ANB° (2°)	0°	0°	0°
SN-MP° (32°)	29°	29°	0°
FMA° (25°)	22°	22°	0°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	6	6.5	0.5
U1 To SN° (104°)	113°	116°	3°
L1 To NB mm (4 mm)	8	4	4
L1 To MP° (90°)	88°	76.5°	11.5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	-3	-2.5	0.5
E-LINE LL (0 mm)	2.5	-0.5	3
%FH: Na-ANS-Gn (53%)	56%	56%	0
Convexity: G-Sn-Pg' (13°)	-4.5°	-4°	0.5°

Table 1: Cephalometric summary

The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 19 points, as shown in the supplementary Worksheet 1.

Treatment Objectives

1. Remove all prostheses and place provisional crowns as needed.
2. Use full fixed, passive self-ligating (*PSL*) appliance to level and align both arches.
3. Open edentulous space between the UR3 and UR5 with a compressed coil spring.
4. Restore the missing UR4 with an ISP.
5. Remove the LR6 pontic and the LL6 implant.
6. Correct anterior crossbite closing L6 spaces to retract the lower anterior segment.
7. Optimize occlusion with finishing bends and posterior vertical elastics.

Treatment Options

Plan A. Removal of the LL6 implant (*Fig. 8*) was the preferred approach, but the patient was concerned about a difficult surgical procedure. It was explained that bone supporting an osseointegrated implant has a relatively weak layer near the implant surface. Thus, a sustained counterclockwise torsional load

(*reverse torque*) causes bone failure and the implant can be easily removed with minimal trauma.

Plan B. Instead of lower space closure, the anterior crossbite can be treated with interproximal reduction (*IPR*) of the mandibular incisors and space closure to tip the lower incisors lingually. Simultaneous Class III elastics tip the maxillary incisors anteriorly to help correct the anterior crossbite (*Fig. 9*). The drawbacks for this approach are compensated (*tipped*) upper and lower incisors as well as compromised (*more protrusive*) dentofacial esthetics. The patient selected Plan A (*implant removal and space closure*) because he preferred the expected outcomes for that approach.

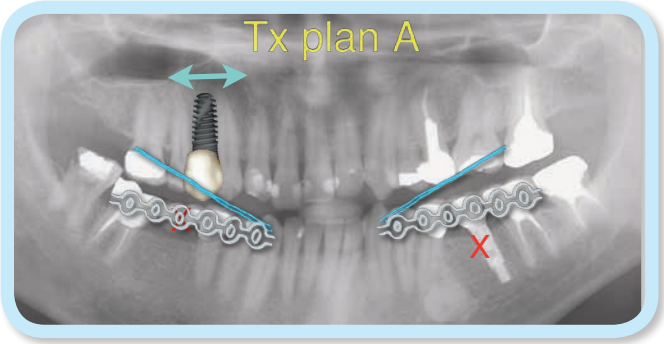


Fig. 8:
Treatment plan A: remove the LL6 osseointegrated implant and LR6 bridge pontic to create space for retraction of the mandibular anterior segment to correct the anterior crossbite. See text for details.

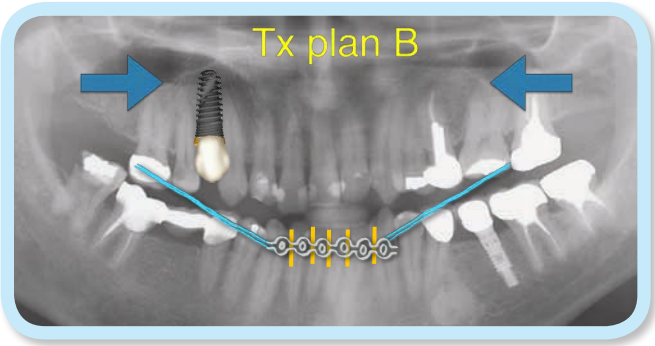


Fig. 9:
Treatment plan B: perform IPR on mandibular incisors and retract them as the maxillary incisors are tipped anteriorly with Class III elastics to correct anterior crossbite. See text for details.

Treatment Progress

Before the start of orthodontics, all prostheses were replaced with new provisional crowns as needed. A PSL fixed appliance was selected (*Damon Q®, Ormco, Brea, CA*). The maxillary arch was bonded at the start of active orthodontic treatment (*0M*) utilizing low torque brackets on the incisors. At the same appointment, an open coil spring was inserted between the UR3 and UR5 to open space for an implant to restore the missing UR4. Bite turbos were constructed as inclined planes on the lingual of the lower central incisors to facilitate anterior crossbite correction (*Fig. 10*). Three months (*3M*) into treatment, the implant-supported prosthesis (*area LL6*) was removed. Failing implants are frequently removed for restorative purposes,[4] but a successful, well integrated 3.5x11mm fixture is a challenge (*Fig. 3*). Two sets of instruments from the original manufacturer (*BioHorizons, Birmingham AL*) were used: implant placement and removal kits (*Fig. 11*). The crown was removed with a tooth extracting forceps (*Fig. 12*), and the abutment was loosened with a screwdriver. After the implant driver was tightly secured to the fixture, the wrench was engaged and held in place with an index finger. The wrench was rotated counterclockwise with a steadily increasing pressure until the supporting bone near the implant surface failed in shear. Once the fixture was loosened, it was easily removed. The torsional load was maintained for a minute or more to allow

Fig. 10: Resin bite turbos were bonded on the lower central incisors to open the bite and assist in anterior crossbite correction.

time for a shear-type fracture in the interfacial bone. A thin layer of bone tissue was on the surface of the recovered implant (*Fig. 12*), which was consistent with an intra-osseous failure, i.e. within the primarily mineralized bone layer.[7] The implant socket (*wound*) was checked 40 minutes later to confirm that there was adequate bleeding and clot formation. Follow-up evaluations of the healing edentulous space was performed from 1-7 days after implant removal. The site was well healed at 7 days (*Fig. 13*), and space closure commenced.

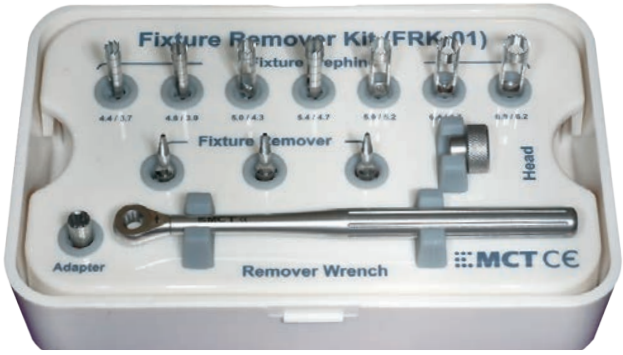


Fig. 11: Implant fixture removal kit

Fig. 12:
Implant removal (extraction) required only 10 minutes, but a sustained mechanical overload in torsion (reverse torque) was required to fracture interfacial bone rather than the implant. See text for details.

One month after the start of upper arch treatment (*3M treatment time*), a full fixed appliance was installed on the lower arch. Low torque brackets were bonded upside down to deliver positive torque to the incisors, high torque brackets were placed on the canines (*Fig. 14*), and the initial wire that was inserted was a 0.014 NiTi. Early light Class III elastics (*Parrot 2 oz.*) from the U6s to the L3s were used for anterior crossbite correction. Three months later (*6M treatment time*), the anterior crossbite was improved to an edge-to-edge relationship (*Fig. 15*), and the anterior bite turbos were removed. In the 10th month (*10M*), lingual buttons were bonded on the lower first premolars, second molars and third molars, respectively. Power chains were applied on both the labial and lingual surfaces of the buccal segments to close space (*Fig. 16*), and reactivated once a month. Class III elastics were changed to Fox (*3.5 oz.*). One month later (*11M treatment time*), a reverse curve of Spee was bent into the lower arch.

The upper dental midline was moved left by the open coil spring (*Fig. 17*). In the 15th month (*15M*), the anterior crossbite was corrected. Class III elastics were changed to Class II elastics on the right side for midline correction. In the next month (*16M into treatment*), the upper archwire was expanded, and a Class II elastic was added from the LR5 via the LR3, and up to the UL1 to reinforce dental midline correction. The bracket that was bonded on the gold crown of the LL8 failed (*Fig. 18*). A pre-operative cone-beam computed tomography (*CBCT*) scan was taken to evaluate the bone volume of the implant site (*Fig. 19*). The bone volume was sufficient to place a 4x9mm implant.

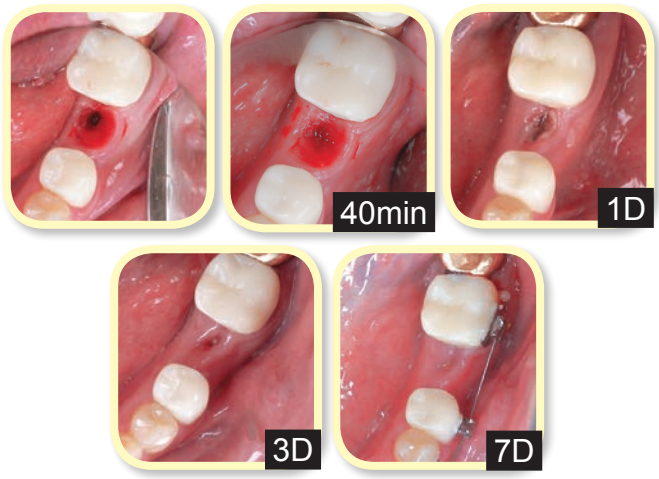


Fig. 13:
Occlusal intraoral photographs show healing of the alveolus at 40 minutes, as well as 1-7 days (D). See text for details.

Fig. 14:
In the third month (3M), low torque brackets were bonded upside down on the lower incisors, and high torque brackets were placed on the canines. Early light Class III elastics (blue lines) were applied. See text for details.

Fig. 15:
By the 6th month (6M) of active treatment, the incisors were edge-to-edge. See text for details.

Fig. 16:
In the 10th month, buttons were bonded on the lingual surfaces of lower first premolars as well as the third and second molars, respectively. Power chains were applied on both buccal and lingual sides to close space. See text for details.

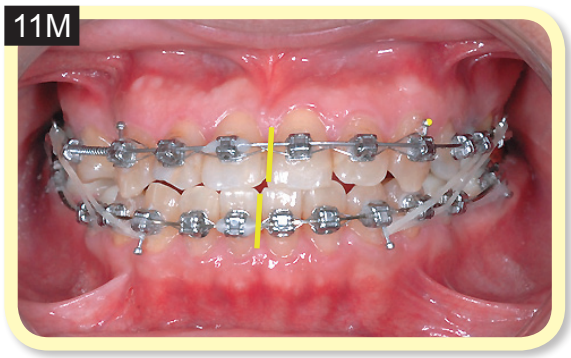


Fig. 17:
At eleven months (11M), the upper dental midline was moved left by the open coil spring. See text for details.

Fig.18:
Bonding a bracket on the LL8 gold crown failed, which compromised the space closure mechanics. See text for details.

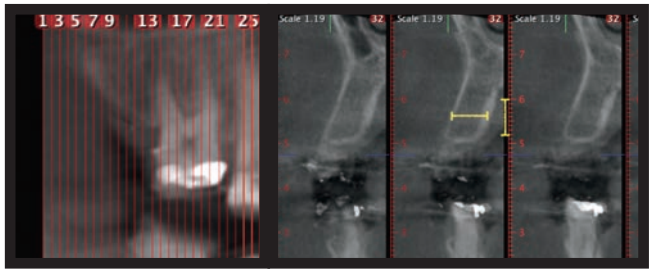


Fig.19:
A pre-operative cone-beam computed tomography (CBCT) scan shows the bone morphology of the UR4 implant site.

Implant Placement Procedure

After 25 months of orthodontic treatment, the UR4 implant was placed. Flap reflection was achieved with crestal and sulcular incisions on the buccal and palatal sides of adjacent teeth. After the first lancer drill, a periapical film was taken, with a surgical guide pin to check the long axis of the osteotomy and its proximity to the adjacent teeth. Following the manufacturer's recommended drilling and expansion procedures, the implant site was surgically developed, step by step according to the 2B-3D rule: 2-mm of buccal bone and 3-mm apical to desired margin of the future crown.[14,15] A 4S x 9mm Astra OsseoSpeed™ (*Dentsply Implants, Mannheim, Germany*) implant fixture was installed. A flared healing abutment (*5.5mm x H4mm*) was screwed

into the implant to form the peri-implant mucosal contour. A post-operative periapical radiograph documented the final position of the implant with its healing abutment (*Fig. 20*).

Orthodontic Finishing

Correction of anterior crossbite usually requires a detailed finishing approach.[13,16] Brackets are rebonded as needed to correct dental axis inclinations. IPR and space closure may be required in either anterior segment, particularly if black triangles are a problem.[16] The current patient required IPR for the upper central incisors to improve crown form, interproximal contacts with adjacent teeth, and overjet (*Fig. 21*).

Implant Prosthesis Fabrication

Eight months after the implant was placed, the healing abutment was removed. A direct abutment width at >2mm of occlusal clearance for PFM crown construction was installed in preparation for the prosthesis fabrication. Before the impression was made, the abutment was torqued twice to 25-30 N-cm with a torque wrench. After the pick-up impression, the abutment was covered with the Tony cap[15] to prevent soft tissue overgrowth.

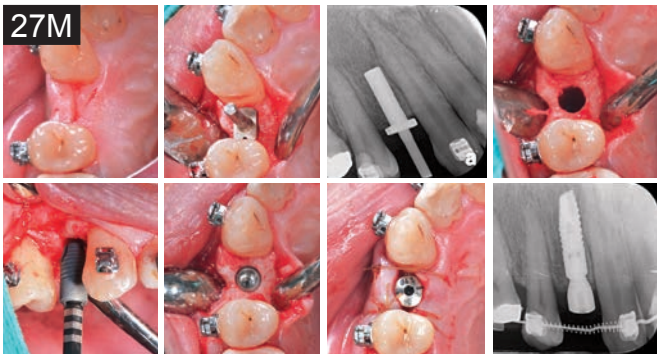


Fig. 20:
The UR4 implants was placed at twenty-seven months (27M) into treatment. A series of intraoral photographs and radiographs document the procedure.

Fig. 22:
The UR4 implant prosthesis fabrication procedure is illustrated with a series of photographs. See text for details.

Fig. 21:
At thirty months (30M) into treatment, space closure is in progress for the lower arch (left), and the UR4 implant is healing (center). The occluded relationship of the jaws is show on the right. See text for details.

All permanent crowns were delivered in the 38th month. Marginal integrity was verified with a dental explorer (*Figs. 22-24*). Clear overlay retainers were delivered for both arches. The patient was instructed to wear the overlays full time for the first month and nights only thereafter.

Fig. 23:
All final prostheses were secured after appropriate tightness of the contact area was confirmed with dental floss.

Treatment Results

The patient was treated to the desired dentofacial result as documented in Figs. 23-28. Negative overjet was corrected and the concave facial profile was improved to an acceptable, straight relationship. The ABO Cast-Radiograph Evaluation (*CRE*) score was 13 points (*Worksheet 2*). The major residual problems were in the occlusal relationships (*7 points*) and overjet (*3 points*). The post-treatment panoramic radiograph revealed the root of the LR5 was mesially inclined (*Fig. 26*). Superimposed tracings (*Fig. 27*) showed that the mandibular incisors were extruded and excessively tipped to the lingual (*from 88° to*

Fig. 24: Post-treatment facial and intraoral photographs

Fig. 25: Post-treatment cephalometric radiograph

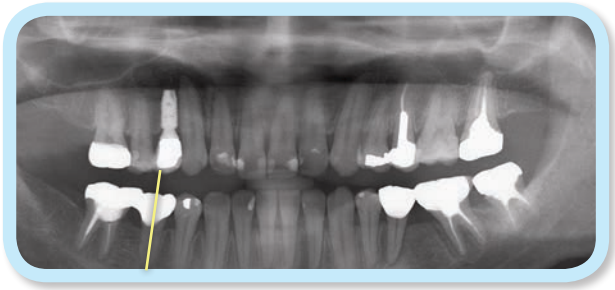


Fig. 26:
Post-treatment panoramic radiograph. The root of tooth LR5 was tilted mesially (yellow line).

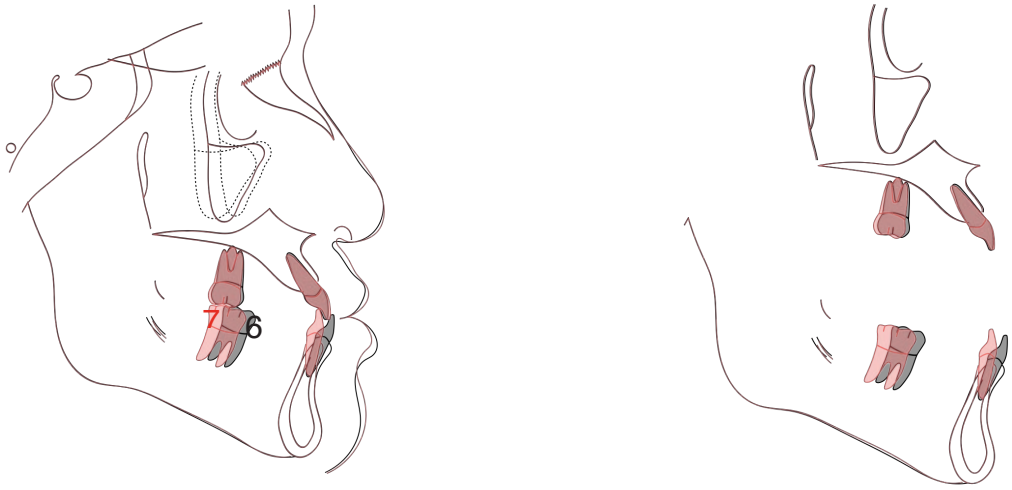


Fig. 27:
Cephalometric tracings before (black) and after (red) treatment are superimposed on the anterior cranial base (left), maxilla (upper right) and mandible (lower right). The lower first molar (6) are substituted by the lower second molar (7) after space closure. See text for details.

76.5°), molars were substituted with the protracted second molars, and the lower lip was retracted. There was little change in the maxilla. The patient was satisfied with the result.

Discussion

There are no reports in the literature for extracting a successful osseointegrated implant for orthodontic purposes. Osseointegration is a term coined by Per-

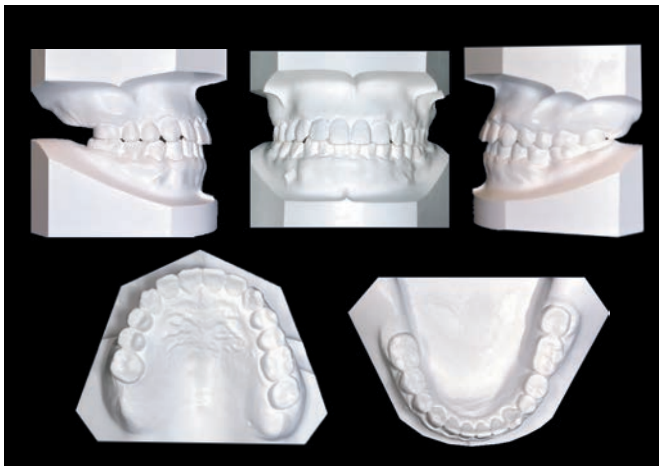


Fig. 28: Post-treatment study models (casts)

Ingvar Brånemark[1-3] that defines the direct structural and functional connection between ordered living bone and the surface of a load-bearing implant, i.e. ankylosis.[7] A well integrated implant can support a prosthesis and/or serve as orthodontic anchorage.[5,6] An osseointegrated implant cannot be moved with an orthodontic load,[5,6] so a well integrated fixture can interfere with tooth movement.[7] The current case report presents a minimally invasive approach for atraumatic removal of an implant as part of a comprehensive treatment plan to correct a severe asymmetric malocclusion with anterior crossbite (*Figs. 1-7*). Careful consideration of the physiology and biomechanics of osseointegration[5-7,11] provided the rationale for a relatively atraumatic extraction procedure (*Fig. 12*) that healed well (*Fig. 13*). The bone healing process, prosthetic procedures, biomechanics, implant failure mechanisms, and soft tissue considerations are relevant to understanding the achievement and maintenance of osseointegration.[17-22]

Bone Healing Process

After implant insertion, the gap between adjacent bone and the implant surface fills with a blood clot and healing begins with intramembranous[18] or de novo[17] bone formation. The healing process is a sequence of platelet activation, blood clot formation, angiogenesis, osteoconduction (*osteogenic cell recruitment and migration*), woven bone formation, compaction of woven bone by lamellar bone, and eventually secondary remodeling of the primary osteons.[7,17-22] The expected sequence is:

1. Wounded bone is covered with a blood clot after implantation. Leukocytes and macrophages are engaged in the wound-cleansing process. Macrophages secrete angiogenic and fibrogenic growth factors.[17]

2. High concentration of fibronectin allows attachment of fibroblasts. Cells migrate into the wound. The coagulum starts to be replaced by granulation tissue, and new angiogenesis is observed.[18-21]

3. Hypoxia attracts macrophages and the stimulated vascular endothelial growth factor (*VEGF*) induces detachment of pericytes from the outer walls of the vessel (*Fig. 29*). The pericytes give rise to the new endothelial progenitor cells.[7-9] These cells then proliferate to form hollow capillary buds (*Fig. 30*) and they arrange themselves to form tubes which are connected to an existing blood vessel. Under VEGF influence, a new vascular loop is created so blood can flow through. The detached pericytes (*osteoprogenitor cells*) migrate forward along the fibrin networks until they reach the bone or implant surface, then differentiate into osteoblasts (*Fig. 31*). The initiation

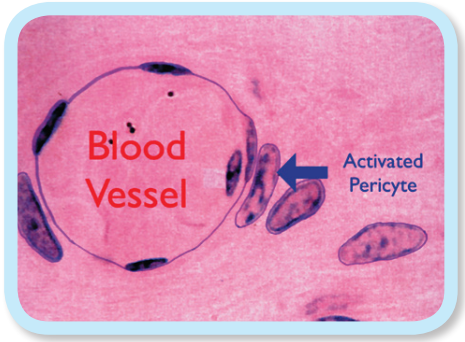


Fig. 29:
Activated pericytes are precursors for osteoblasts. (From Chang et al.[8,9])

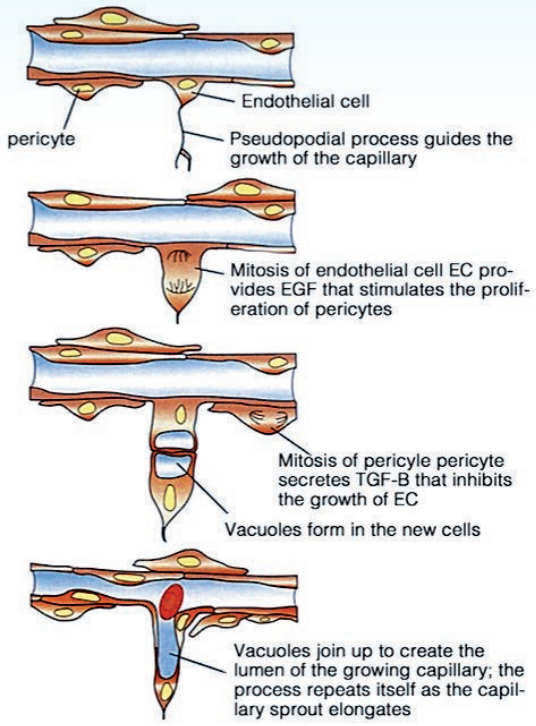


Fig. 30:
Pericytes propagate along the surface of enlarged capillary sprout. (From Chang et al.[8,9])

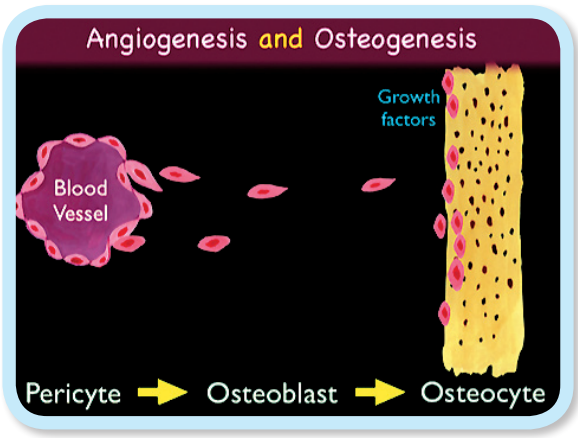


Fig. 31:
Angiogenesis and Osteogenesis: pericytes are stimulated by growth factors to migrate away from blood vessels and differentiate into osteoblasts. Some of the osteoblasts become osteocytes. See text for details.

of platelet activation results in osteogenic cell recruitment and migration to the implant surface (*osteoconduction*).[8,9] Woven (*immature*) bone appears in the mesenchymal tissues.[7]

4. New bone formation begins with the secretion of a collagen matrix by osteoblasts. This matrix is subsequently mineralized by hydroxyapatite.[7] Then nanometer-sized uniaxially oriented hydroxyapatite crystal plates (*foot plates*) are formed within the collagen fibers. Woven bone formation increases, surrounding the implant.[17-21]

5. The immature woven bone is replaced with mature bone via a remodeling process that produces only lamellar bone.[7] The initial woven bone is oriented parallel to the titanium surface in the grooves of the threads. The subsequent lamellar bone forms on the macro-threads, except at the tip of each thread which is a stress riser.[11]

Bone-Implant Interface

The cement line (*Fig. 32*) along the bone interface of an endosseous implant is required to attach new bone. In effect, the surface of a titanium implant is viewed as old bone from a physiologic perspective.[7] Cement lines separate old from new bone at all remodeling sites.[7,24] Osborn and Newesley[20] describe two distinct phenomena for bone formation at the bone/implant interface: distance and contact osteogenesis. In distance osteogenesis, new bone is formed on the surfaces of old bone in the peri-implant site, not directly on the implant itself but on the surface approaching it. In contact

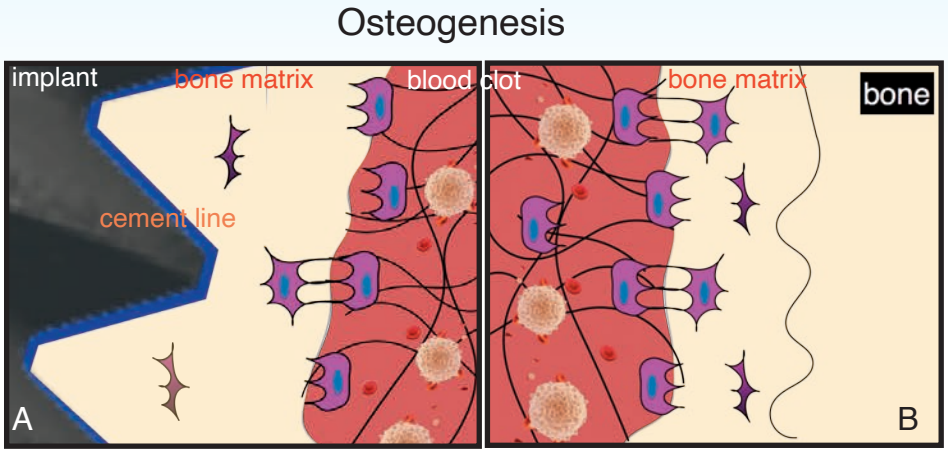


Fig. 32:
Contact osteogenesis (A) and distance osteogenesis (B) are related to implant healing. The drawing is after Davies.[17] See text for details.

osteogenesis, new bone forms first on the implant surface where no bone is present. The implant surface must be colonized by bone cells before bone matrix formation can begin. De novo bone formation, as described by Davies,[17] begins with bone matrix secreted by osteoblasts differentiated from local osteogenic cells.[7-9] The osteogenic cells reach the implant surface via fibrin before initiating extracellular matrix synthesis. The osteoblasts secrete a thin layer of collagen-free organic matrix, cement substance, directly on the implant surface before new bone is attached.[7,19] Two non-collagenous bone proteins, osteopontin and sialoprotein, are present in the initial organic phase. Calcium phosphate nucleation is followed by crystal growth and the initiation of collagen fiber assembly. This collagen compartment of bone will be separated from the underlying substratum by the collagen-free calcified tissue layer (*cement line*).[19] Distance osteogenesis is defined as bone formation approximating the implant surface while contact osteogenesis is bone apposition along the implant surface.[18]

The matrix secreted by osteoblasts is mineralized and becomes bone tissue. The embedded osteoblasts turn into osteocytes or die (*Fig. 32*). Bone matrix mineralizes so bone tissue has no capacity for inherent expansion (*"grow"*).[7] The continued growth of bone away from the implant surface is due to continued recruitment and migration of osteogenic cells,[8,9] processes which are deemed "*osteoconduction.*" The combination of osteoconduction and de novo bone formation results in contact osteogenesis.[12]

The cement line was first described for Haverian systems by von Ebner in 1875.[7,19] It demarcates old from new bone (*Fig. 33*). Cement lines are composed of an afibrillar, collagen-free, but mineralized interfacial matrix is laid down between secondary

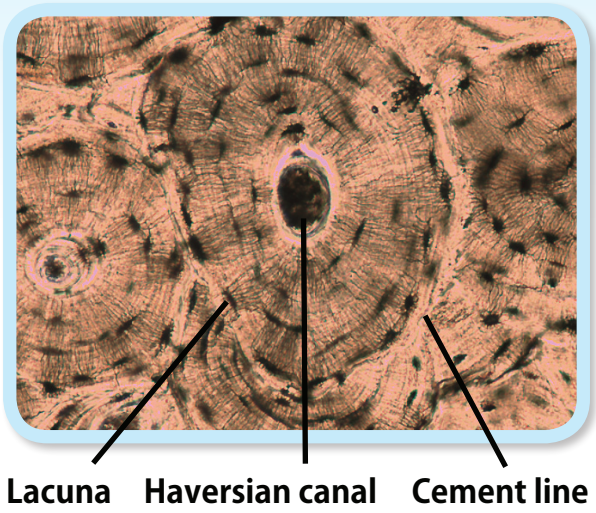


Fig. 33:
Haversian system: an osteon in cortical bone has lacuna that contain osteocytes and a peripheral cement line. See text for details.

osteons and pre-existing bone.[7-24] Although its thickness and appearance vary, this zone forms on the implant surface. More recent high resolution immunocytochemical studies[25] demonstrate that the electron-dense interfacial layer is rich in noncollagenous proteins, such as osteopontin (*OPN*) and bone sialoprotein (*BSP*) which are believed to play roles in cell adhesion and binding of minerals.[22] As reported by Carter and Hayes,[24] mechanical failure of normal bone frequently occurs at cement lines, so they are generally considered a relatively weak area within cortical bone.[25] Assuming the afibrillar mineralized cement line is similar to cortical bone, the strength is about 7.31 MPa for a small hole in the supporting plate. However, a test more relevant to osseointegration failure is a large hole in the supporting plate. Under the latter conditions, the strength of the cement line is about 74 MPa, which approximates the strength of bone lamellae.[25] Mechanical testing of a variety of implanted biomaterials confirms that the toughness of the bone-implant interface is significantly inferior to the intrinsic strength of supporting bone.[29] For natural bone, the shear strength is about 68 MPa and the tensile strength is about 100-105 MPa according to Cowin et al. (*1983*).[26] In 1997, Edwards et al.[27] reported tensile strengths for a bone formed on a smooth hydroxyapatite interface as 0.15 ± 0.11 MPa at 55 days and 0.85 ± 0.55 MPa at 88 days in a rabbit tibial model. These relatively low strengths for bone attachment to a smooth surface suggest that internal strength of a bone and implant interface strength primarily reflects a 3D mechanical interlocking of living and dead materials. In all of the studies reviewed, the strength of interfacial bone is less than the strength of the fully mineralized supporting bone. When an implant is loaded in torsion in the direction to unscrew the fixture (*counterclockwise*), the cement line attaching the bone to the implant may fail. However, it is a very thin (*1-5µm*) layer,[25] so a cement line failure may not result in loosening of an implant because of the overall irregularity of a screw-form implant surface. Furthermore, the thin layer of bone on the recovered implant (*Fig. 12*) suggests the failure was within interfacial bone (*intra-osseous fracture*), not at the cement line. Fragility of the cement line is only part of the unique physiology for bone support of implants. The strength of lamellar bone within 1mm of the implant surface must also be considered.[28-34]

Interfacial Layer of Partially Mineralized Bone

An osseointegrated bone-implant interface has a layer of rapidly remodeling bone within about 1mm of the fixture surface.[28-30] This partially

mineralized bone layer at the interface has less strength compared to the supporting fully mineralized bone.[35] A sustained torsional load in a counterclockwise direction is expected to result in shear failure of interfacial bone, and loosening of the implant with no damage to surrounding tissue. There is a mismatch in the modulus of elasticity at the titanium-bone interface because titanium is about 10x stiffer than cortical bone.[7,30-34] Bending and flexure of dissimilar structures, such as the implant and supporting bone, creates surface shear that drives a high rate of bone remodeling within about 1mm of the implant interface.[7,33,34] The interfacial bone turns over completely several times per year so there is inadequate time for it to undergo secondary mineralization.[7,29-31] Bone strength is directly related to the mineral content.[35] Thus the 1mm layer of primarily mineralized bone at the implant interface has less strength than the metal implant or the fully mineralized bone supporting it.[33,34] In effect, the primarily mineralized bone is a compliant layer between rigid materials (*implant, fully mineralized bone*) which is analogous to the periodontal ligament.[31] The cushioning effect of an intermediate relatively compliant layer may be a requirement for anchoring a rigid material like titanium in living bone.

Fibrous Capsule

When an implant remains stable in relation to supporting bone, osseous integration occurs along the implant surface. Unfavorable mechanical conditions such as micromotion, premature loading, and trauma cause motion between the implant and supporting bone that disrupts the osteogenic reaction, which in turn results in a fibrous encapsulation of scar-like fibrous connective tissue (*Fig. 34*). Szmukler-Moncler[36] concluded that about 100 µm of micromotion disrupts the fibrin network and new vasculature that is critical for a normal bone healing process. The disturbed mesenchymal stem cells divert from the bone pathway and differentiate into fibroblasts that produce a fibrous capsule (*scar tissue*). Prior to osseointegration, fibrous encapsulation of an implant was considered a "*pseudo-periodontium,*" but the biomechanics and physiologic integrity of the supporting tissues was never established. Brånemark et al.[1-3] clearly confirmed that fibrous encapsulation of an implant is an integration failure: subsequently, the entire dental implant field has accepted that standard.

Inflammation

Inflammatory destruction of soft tissues supporting dental implants is termed mucositis and peri-implantitis.[37] Mucositis is a bacteria-induced, reversible inflammatory process affecting peri-

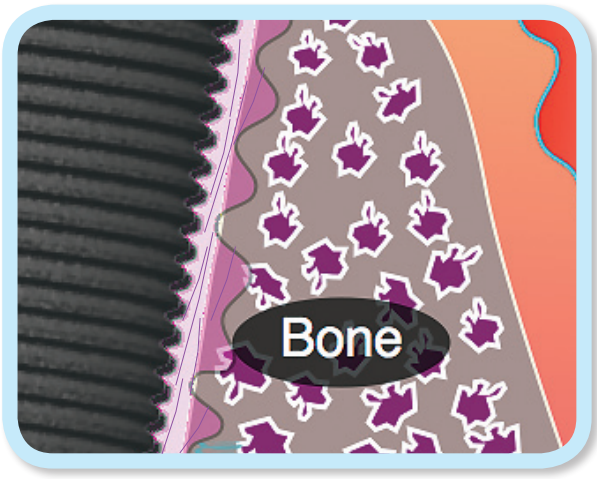


Fig. 34:
Implant Failure: micromotion disrupt the newly formed healing bone tissue and results in fibrous encapsulation. See text for details.

implant soft tissue. The symptoms are reddening, swelling, and bleeding on periodontal probing, that occurs prior to radiographic bone loss. In contrast, peri-implantitis is a progressive, irreversible disease of supporting tissues that is manifested as increased bone resorption, decreased osseointegration, periodontal pockets >5mm, and purulence.[38]

None of the implant failure criteria reviewed (*bone loss, fibrous encapsulation, mucositis or peri-implantitis*) applied to the ISP restoring the LL6 that was removed for orthodontic purposes. The periodontal probing depth was <4mm (*Fig. 35*) and there was no radiographic evidence of bone loss (*Fig. 36*). A radiolucency around the neck of the implant is consistent with a modest cratering of supporting bone, which is normal for functionally loaded implants. Neither crestal bone loss nor implant mobility was evident. The relatively simple torsional overload method for atraumatic implant removal exploits the principles of bone physiology and biomechanics associated with osseointegration.

Fig. 35:
The probing depth was 4mm. There was no soft tissue reddening or swelling.

Fig. 36:
There was a radiolucent shadow (crevice) around the neck of the implant, which is consistent with the slight cratering morphology that is typical of successful ISP in occlusal function. There was no crestal bone loss nor mobility. The LL6 ISP was a healthy implant. See text for details.

Conclusions

There are three features at bone to implant interface: 1) cement line (*osseointegration*), 2) fibrous capsule (*fibrointegration*), and 3) inflammation tissue (*peri-implantitis*). Each of them is an intrinsically weak area. An implant that can be screwed in can therefore be screwed out, as long as it can be firmly secured to the removal instrument. The three keys to the successful outcome of this treatment are: 1) a correct diagnosis and treatment plan, 2) an atraumatic removal of the implant, and 3) an accurate mechanism to retract the mandibular dentition and close space.

Fig. 37 documents the current condition of the patient around 3 years and 7 months post-treatment.

Acknowledgment

Thanks to Mr. Seth T. Pankhurst for proofreading this article.

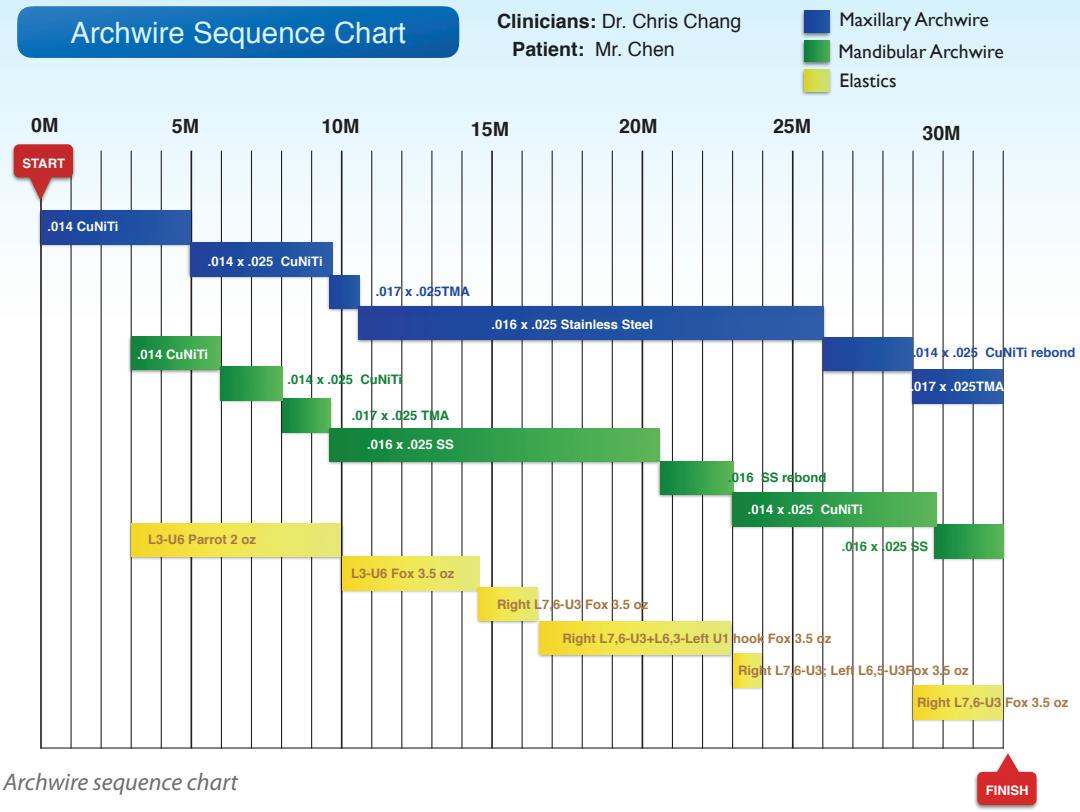


Table 2: Archwire sequence chart

Fig. 37: Facial and intraoral photographs at 3Y7M follow-up

References

1. Brånemark PI, Breine U, Adell R, Hanson BO, Linström J, Ohlsson A. Intraosseous anchorage of dental prosthesis. I. Experimental studies. Scand J Plast Reconstr Surg 1969;3:81-100.
2. Brånemark PI, Hansson BO, Adell R, et al. Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year period. Scand J Plast Reconstr Surg 1977;16:1-132.
3. Brånemark PI, Zarb GA, Albrektsson T. Tissue integrated prostheses: Osseointegration in clinical dentistry. Chicago: Quintessence Publ, Co.; 1985.
4. Roy M, Loutan L, Garavaglia G, Hashim D. Removal of osseointegrated dental implants: a systematic review of explantation techniques. Clin Oral Investig 2020;24(1):47-60.
5. Roberts, WE, Marshall KJ, Mozsary, PG. Rigid endosseous implant utilized as anchorage to protract molars and close an atrophic extraction site. Angle Orthodontist 1990;60(2):135-152.
6. 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.
7. Roberts WE, Sarandeep SH. Bone physiology, metabolism, and biomechanics in orthodontic practice. In: Graber LW, Vanarsdall RL, Vig KWL, Huang GJ (eds). Orthodontics: Current principles and techniques. 6th ed. Oxford: Elsevier Health Sciences 2016:99-152.
8. Chang HN, Garetto LP, Katona TR, Potter RH, Roberts WE. Angiogenic induction and cell migration in an orthopaedically expanded maxillary suture in the rat. Arch Oral Biol 1996;41: 985-94.
9. Chang HN, Garetto LP, Katona TR, Potter RH, Lee CH, Roberts WE. Angiogenesis and osteogenesis in an orthopedically expanded suture. Am J Orthod Dentofacial Orthop 1997;111:382-90.
10. Chiu SC, Chang HN, Roberts WE. Bimaxillary protrusion with an atrophic alveolar defect: Orthodontics, autogenous chin-block graft, soft tissue augmentation, and an implant Am J Orthod Dentofacial Orthop 2015;147:97-113.
11. Chen J, Chen K, Garetto LP, Roberts WE. Mechanical response to functional and therapeutic loading of a retromolar endosseous implant utilized for orthodontic anchorage to mesially translate mandibular molars. Implant Dent 1995:4:246-258.
12. Schneider PM, Silva M. Endemic molar incisor hypomineralization: a pandemic problem that requires monitoring by the entire health care community. Curr Osteoporos Rep 2018;16(3):283-288.
13. Huang A, Lee A, Chang CH, Roberts WE. Class III malocclusion, anterior crossbite and missing mandibular molars: bite turbos and space closure to protract lower second molars. J Digital Orthod 2019;56:48-63.
14. Chang CH. The 2B-3D rule for implant planning, placement and restoration. Int J Orthod Implantol 2012;27:96-101.
15. Chiu G, Chang C, Roberts WE. Interdisciplinary treatment for a compensated Class II partially edentulous malocclusion: Orthodontic creation of a posterior implant site. Am J Orthod Dentofacial Orthop 2018;153(3):422-435.
16. Tseng LL, Chang CH, Roberts WE. Diagnosis and conservative treatment of skeletal Class III malocclusion with anterior crossbite and asymmetric maxillary crowding. Am J Orthod Dentofacial Orthop 2016;149(4):555-66.
17. Davies JE. Understanding peri-implant endosseous healing. Journal of Dental Education 2003;67(8):932-49.
18. Wong M, Eulenberger J, Schenk R, Hunziker E. Effect of surface topology on the osseointegration of implant materials in trabecular bone. J Biomed Mater Res 1995;29(12):1567-75.
19. Davies JE. Mechanisms of endosseous integration. Int J Prosthodont 1998;11:391-401
20. Osborn JF, Newesley H. Dynamic aspects of the implant bone interface. In Dental implants: materials and systems. Heimke G editor Carl Hanser Verlag, München 1980;111-23.
21. Davies JE. In vitro modeling of the bone/implant interface. Anat Rec 1996;245:426-45
22. McKee MD, Nanci A. Osteopontin at mineralized tissue interfaces in bone, teeth, and osseointegrated implants: ultrastructural distribution and implications for mineralized tissue formation, turnover, and repair. Microsc Res Technol 1996;33:141-64.
23. Brunski JB. In vivo bone response to biomechanical loading at the bone/dental implant interface. Adv Dent Res 1999;13:99-119.
24. Carter DR, Hayes WC. Compact bone fatigue damage: a microscopic examination. Clin Orthop 1977;127:265-74.
25. Dong XN, Ahang X, Guo XE. Interfacial strength of cement lines in human cortical bone. Mech Chem Biosyst 2005;2(2):63-8.

26. Cowin SC. The mechanical and stress adaptive properties of bone. Ann Biomed Eng 1983;11(3-4):263-295.
27. Edwards JT, Brunski JB, Higuchi KW. Mechanical and morphologic investigation of the tensile strength of a bone hydroxyapatite interface. J Biomed Mater Res 1997;36:454-468.
28. Garetto LP, Chen J, Parr JA, Roberts WE. Remodeling dynamics of bone supporting rigidly fixed titanium implants: a histomorphometric comparison in four species including humans. Implant Dent 1995;4(4):235-43.
29. Huja SS, Katona TR, Moore BK, Roberts WE. Microhardness and anisotropy of the vital osseous interface and endosseous implant supporting bone. J Orthop Res 1998;16(1):54-60.
30. Yip G, Schneider P, Roberts WE. Micro computed tomography: high resolution imaging of bone and implants in three dimensions. Seminars in Orthodontics 2004;10(2):174-187.
31. Roberts WE. Bone dynamics of osseointegration, ankylosis, and tooth movement. J Inidiana Dental Assoc. 1999;78(3):24-32.
32. Huja SS, Katona TR, Burr DB, Garetto LP, Roberts WE. Microdamage adjacent to endosseous implants. Bone 1999;25(2):217-22.
33. Chen J, Esterle M, Roberts WE. Mechanical response to functional loading around the threads of retromolar endosseous implants utilized for orthodontic anchorage: coordinated histomorphometric and finite element analysis. Int J Oral Maxillofac Implants 1999;14(2):282-9.
34. Chen J, Chen K, Garetto LP, Roberts WE. Mechanical response to functional and therapeutic loading of a retromolar endosseous implant used for orthodontic anchorage to mesially translate mandibular molars. Implant Dent 1995;4(4):246-58.
35. Turner CH. Bone strength: current concepts. Ann N Y Acad Sci 2006;1068:429-46.
36. Szmukler-Moncler S, Salama H, Reingewirtz Y, Dubruille JH. Timing of loading and effect of micromotion on bone-dental implant interface: review of experimental literature. J Biomed Mater Res 1998;43:192-203.
37. Khammissa RAG, Feller L, Meyerov R, Lemmer J. Peri-implant mucositis and peri-implantitis: clinical and histopathological characteristics and treatment. SADJ 2012;67(122):124–126.
38. Wilson V. An insight into peri-implantitis: a systematic literature review. Prim Dent J 2013;2:69–73.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 19

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 = 1+2+2+1+1

Total = 7

OVERBITE

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

Total = 0

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 0

OCCLUSION

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

Total = 4

LINGUAL POSTERIOR X-BITE

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

Identify:

5-year-old implant removal

Total = 8

IMPLANT SITE

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

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

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

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

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

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

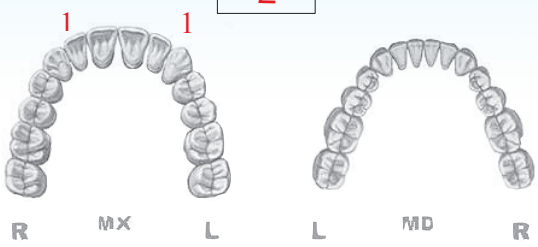
Infection at implant site : None (0 pt), Chronic (1 pt), Acute(2 pts) =_

Cast-Radiograph Evaluation

Total Score: 13

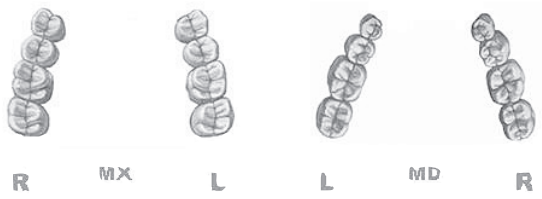
Alignment/Rotations

2



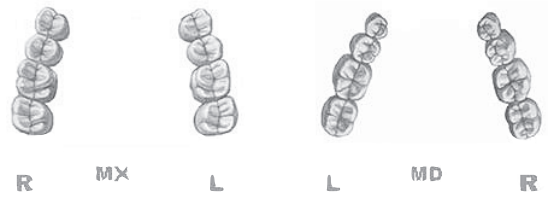
Marginal Ridges

0



Buccolingual Inclination

0

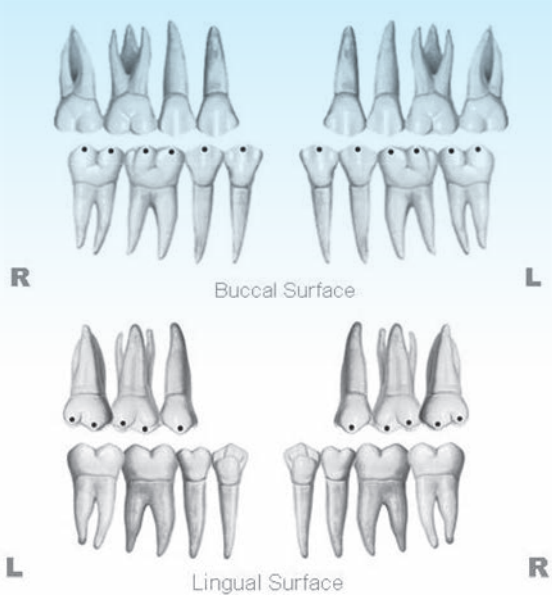


Overjet

3

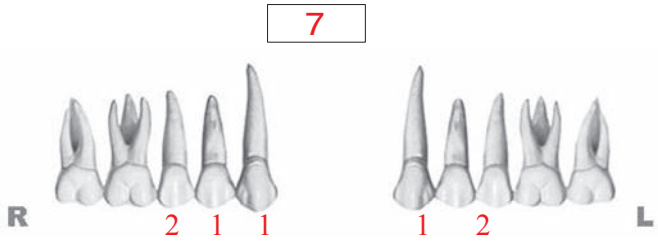
Occlusal Contacts

0



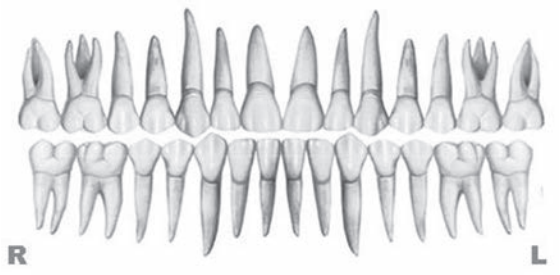
Occlusal Relationships

7



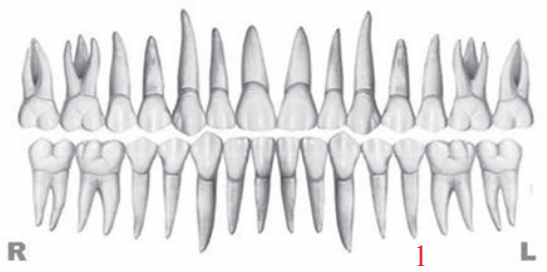
Interproximal Contacts

0



Root Angulation

1



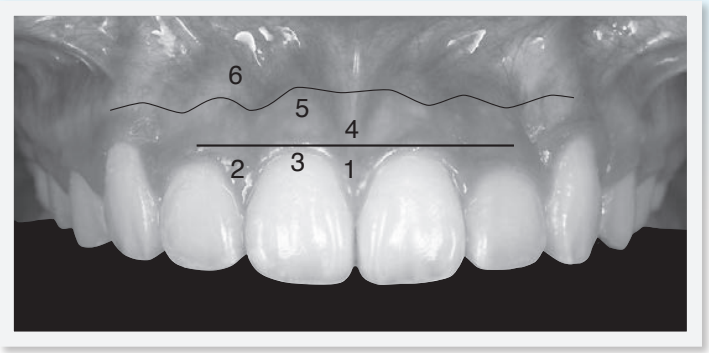
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 5

1. Pink Esthetic Score

Total = 2

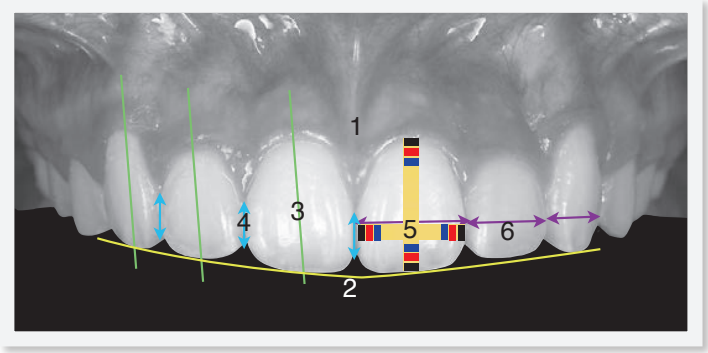


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

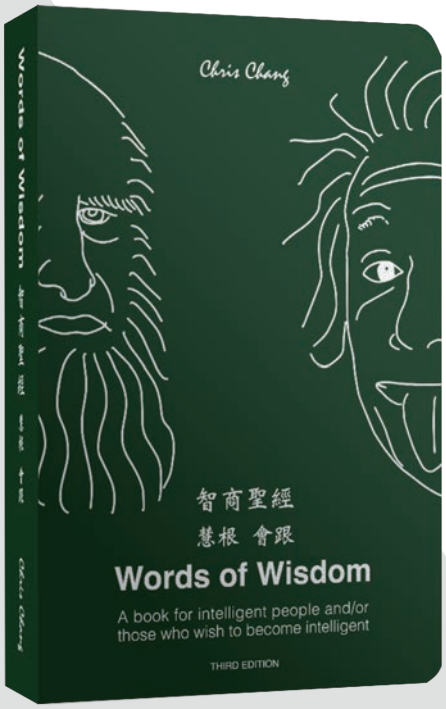


1. Midline	0	1	2
2. Incisor Curve	0	1	2
3. Axial Inclination (5°, 8°, 10°)	0	1	2
4. Contact Area (50%, 40%, 30%)	0	1	2
5. Tooth Proportion (1:0.8)	0	1	2
6. Tooth to Tooth Proportion	0	1	2

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

Newton's A

智商聖經



慧根 會跟

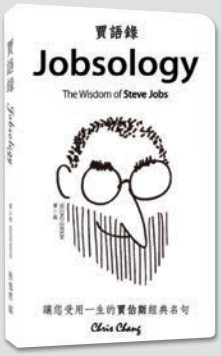
THIRD EDITION

Words of Wisdom

A book for intelligent people and/or those who wish to become intelligent

A classic in your pocket.
Available in Newton's A, Inc.

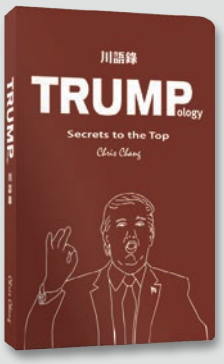
Get it on Apple Books
Chris Chang



Jobsology SECOND EDITION

The Wisdom of Steve Jobs

- *The first collection of Steve Jobs' famous quote, selected by an Apple businessman.*
- *A handy companion for your reading on the go.*



TRUMPology

We owe him (Trump) an open mind and a chance to lead. —Hilary Clinton

- *The other classic created by Dr. Chris Chang,author of the bestseller, Jobsology.*
- *Understand the secrets of Trump's success and improve your English ability simultaneously.*
- *Collected more than 200 famous quotes of the President Trump.*

Now available on Apple Books 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.

2020 一年一度 Damon Master Program in Hsinchu

全新的 2020 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。

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

時間：週四全天（9 am - 5 pm），每月一次。
地點：金牛頓藝術科技（新竹市建中一路 25 號 2 樓）

Module 1: Hands-on - **4/23, 5/7（擇一）**
1. Selecting your ideal first case
2. Bonding position
3. Bonding + BT + Ceph tracing
4. TADs + space closing + hook + spring
5. Finishing bending & fixed retainer

Practice: Clinical photography

Module 2 - **5/21**
1. Four stages of efficient orthodontic treatment
2. Simple and effective anchorage system
3. Extraction vs. Non-extraction analysis
4. Case consultation & discussion

Practice: Ceph tracing;
Filing patient photo records (template)

Module 3 - **6/4**
1. Damon diagnosis & fine-tuning
2. Checklist for finishing
3. Case consultation & discussion

Practice: Editing patient photo records
(use own data); Morph

Module 4 - **7/2**
1. Excellent finishing & case report demo
2. Retention & relapse: case demo
3. Case consultation & discussion
4. Hands-on: Presentation demo

Practice: Demo case report

Module 5 - **8/20**
1. Orthodontic biomechanics & diagnostic analysis
2. Soft & hard tissue diagnostic analysis
3. Children & adult orthodontics and diagnostic analysis
4. Case consultation & discussion

Practice: Case report

Chairside observation - **（TBA）**
Chairside observation & clinic management

Practice: Clinical photography

Computer training (Mac): 1:00 - 2:30 pm

Module 6 - **9/24**
1. Crowding: Extraction vs. Non-extraction
2. Upper impaction
3. Lower impaction
4. Case consultation & discussion

Literature: Interdisciplinary approach

Module 7 - **10/15**
1. Missing teeth: Anterior vs. Posterior
2. Crossbite: Anterior vs. Posterior
3. Case consultation & discussion

Literature: Modfied VISTA

Module 8 - **11/19**
1. Open bite- High angle & Deep bite - Low angle
2. ABO DI, CRE workshop
3. Case consultation & discussion

Literature: Modified 2X4 appliance in ortho treatment

Module 9 - **12/17**
1. Gummy smile and canting
2. Esthetic finishing(transposition)
3. Case consultation & discussion

Literature: Early orthodontic treatment

Module 10 - **2021/1/7**
1. Implant-ortho combined treatment
2. Interdisciplinary treatment-adult complex cases
3. Case consultation & discussion

Literature: Aligner orthdontics

Special lecture: 1:00-2:30 pm

費用含課程視訊、iPad、課程電子書、模型與材料。

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

優惠期間自2020/1/1-6/25止

2020全面回饋

Ormco
Your Practice. Our Priority

戴蒙系統鉅作，愛用好評如潮《常勝軍推薦》Damon Q ×《指標性美力》Damon Clear

買 DAMON

＋ 6|6 7|7 / 6|6 7|7 **Bondable Tube x *10* 人份**

特價 **NT$124,999 /組**

或 DAMON CLEAR / DAMON CLEAR2

(Clear/Clear2 共200顆)

＋ 6|6 7|7 / 6|6 7|7 **Bondable Tube x *10* 人份**

特價 **NT$164,999 /組**

* 以上販售及贈品品項皆不含 SnapLink Tubes, Damon SL, Accent Mini Tubes, A+

贈

.014 Damon Copper Ni-Ti x *20* 條
感溫性鎳鈦合金線 - Level and Align

.014 x .025 Damon Copper Ni-Ti x *20* 條
感溫性鎳鈦合金線 - Begin Torque Control

.016 x .025 Damon SS x *20* 條
不鏽鋼合金線 - Space Closure

.017 x .025 Damon Low-Friction TMA x *20* 條
低摩擦力鈦鉬合金線 - Finishing and Detailing

配件加購專區

Zoo Pack Elastics
動物圈
特價 NT$1,800 /盒

Power Chain
矯正專用彈力鏈
特價 NT$1,500 /卷

Drop-in Hook
DQ插入式掛鉤
特價 NT$1,700 /盒

Sample Kit：
Enlight Syringe x *1* 支 + Ortho Solo x *1* 瓶
光照含氟矯正專用黏著劑+多功能光照基底劑
特價 NT$2,500 /組

SDC Stripping Kit
(Aligner配合使用)
特價 NT$29,999 /組
SWISS dentacare

*限與訂單同時加購，訂單成立後恕無法再行追加。

・衛署醫器輸壹字第010513號 ・衛署醫器輸字第022355號 ・衛部醫器輸字第027158號 ・衛署醫器輸壹字第006857號 ・衛署醫器輸壹字第009520號
・衛署醫器輸壹字第010432號 ・衛署醫器輸壹字第000808號 ・衛署醫器輸字第010924號 ・衛署醫器輸壹字第001360號

your best dental supplier YONG CHIEH 湧傑 客服專線：北區 (02)2778-8315 ・ 中區(02)2305-8915 ・ 南區(07)226-0030

Mechanics and Clinical Significance for Mini-Screws in Four-Bicuspid Extraction Aligner Cases

Abstract

When treating extraction cases with clear aligner therapy, root paralleling during space closure has been inconsistently. Even the G6 (Align Technology, Inc., San Jose, CA, USA) solution does not guarantee highly predictable tooth movement. Anchorage loss and unwanted side effects are still encountered. The aim of the present article is to propose a mini-screw gold standard of care for patients who demand inconspicuous aligner therapy involving extraction of four first premolars. (J Digital Orthod 2020;58:94-98)

Despite the fact that Invisalign® G6 has been launched to improve the management in patients requiring extraction of four first premolars,[1,2] the actual clinical outcome may be less than satisfactory in some circumstances. Dai et al.[3] have reported the differences between predicted and achieved tooth movement (*DPATM*) of maxillary first molars and central incisors in first premolar extraction cases treated with Invisalign®. To be more specific, first molars on average tipped mesially by 5.3˚ and moved mesially 3.16mm even if they were specified to be stable. Because of posterior anchorage loss, the central incisors were tipped lingually, retracted less, and extruded more compared to predictions.[3] The consequence was similar to the torque play between rectangular archwires and bracket slots, a phenomenon referred to as the bowing effect. Fig. 1 demonstrates the difference between one of our cases and Dai et al.'s[3] study results. This

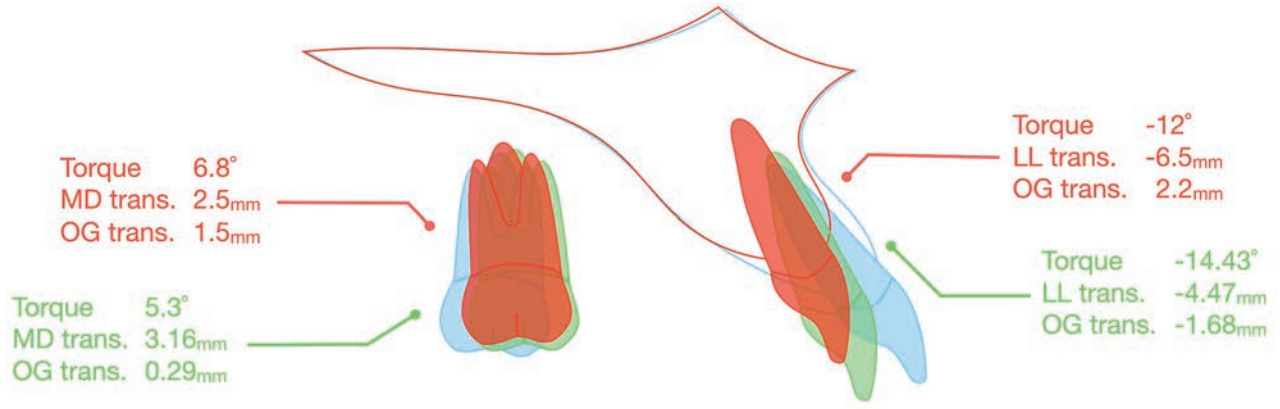


Fig. 1:
A comparison of maxillary superimposed tracings of pre- and post-treatment (blue and orange, respectively) records a bimaxillary protrusion case that underwent four bicuspid extractions and clear aligner therapy. Dai et al.'s[3] study results (green) tested G6 performance in extraction cases.

Dr. Lexie Y. Lin,
Resident, Beethoven Orthodontic Center (Left)

Dr. Chris H. Chang,
Founder, Beethoven Orthodontic Center
Publisher, Journal of Digital Orthodontics (Center)

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

patient presented with bimaxillary protrusion, gummy smile tendency, and mild crowding in both arches. A treatment approach involving extraction of the four first premolars, followed by Invisalign® treatment in conjunction with OrthoBoneScrew® (*OBS*) (*iNewton, Ltd., Hsinchu, Taiwan*) anchorage system, was chosen (*Fig. 2*).

The post-treatment results show excessive mesial tipping of the first molar, rather than the expected and vertical movement (*intrusion*) that was expected due to the inherent intrusive mechanics of mini-screws.[5] Initial crowding may explain the tilting molar, since it had been found to have an inverse correlation with

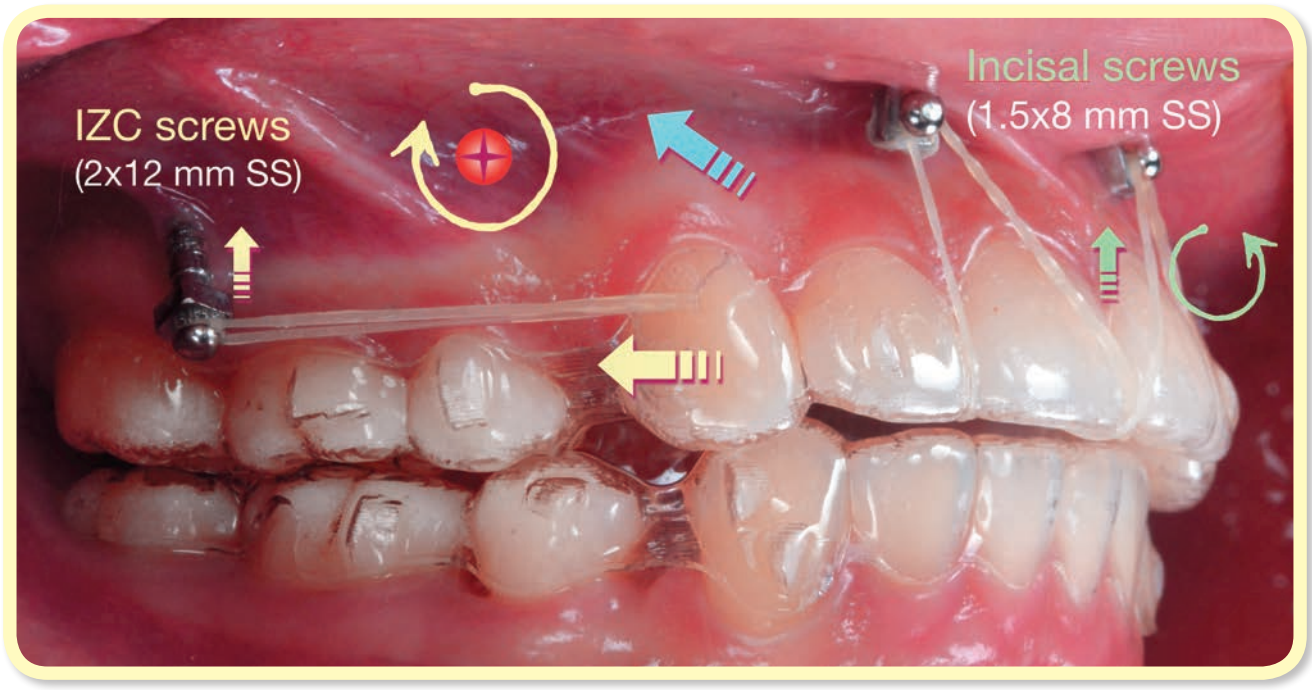


Fig. 2:
The force system is diagrammed for the IZC and incisal mini-screws. Based on the presumed center of resistance (C_R, red circle with a cross) for the maxillary arch, the elastics from the IZC screws to the cuspid precision cut has distal and vertical components (yellow arrows) that produce a clockwise moment around the C_R (curved yellow arrow). The incisal screws anchor an intrusive force (green arrow) that create a counterclockwise moment (curved green arrow) tending to flare the maxillary incisors. The presumed resultant for overall applied loads is the blue arrow.

DPATM relative to anchorage loss.[3,6] As for the central incisor, the amount of retraction and intrusion was obvious, because it was a good use of the extraction spaces, but also prevented posterior open bite. Posterior open bite can be a common side effect in aligner treatment if there is premature contact in the anteriors.[7] Furthermore, the angulation of the central incisor was better controlled in this case with the help of the mini-screws.

Fig. 2 demonstrates the proper mini-screw positioning and mechanics plan for aligners. Two 2mm x 12mm stainless steel (SS) mini-screws were installed bilaterally in the infra-zygomatic crest (*IZC*) extra-alveolar (*E-A*) area, and two 1.5mm x 8mm SS mini-screws were inserted in the maxillary anterior inter-radicular region. These mini-screws were placed when the tenth aligner was delivered. 3.5oz elastics (*Chipmunk and Fox, Ormco, Glendora, CA*) were specified to activate the aligners (*Fig. 3*).

This four-mini-screw setup appears to be similar to the strategy for gummy smile in fixed appliances.[8] However, the IZC and incisal mini-screws serve different purposes. The aligners themselves can provide advantages with regard to the efficiency in mild-to-moderate cases,[9] but cannot offer an ideal force system for all types of tooth movement. When treating extraction cases, root paralleling during space closure after extraction has been found to be challenging.[10] Even the G6 protocol along with SmartStage®[2] does not guarantee highly predictable

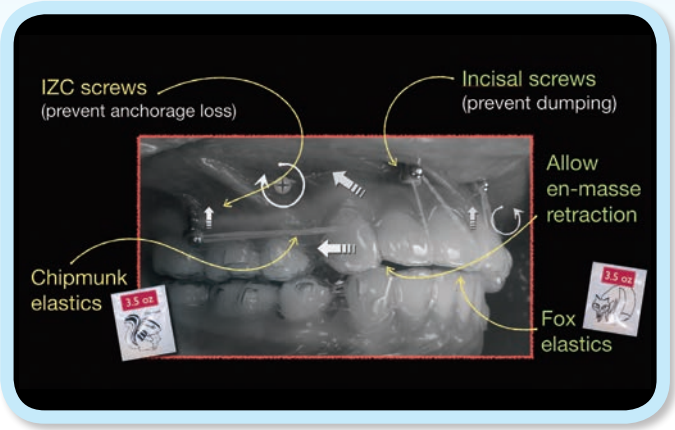


Fig. 3:
The illustration of the combined use of application with clear aligner therapy, mini-screws and elastics. The incisal screws and IZC screws served different purposes for preventing unwanted movements .

tooth movement. Anchorage loss and unwanted side effects are still encountered.

Thus, prevention is better than cure. On the one hand, the IZC E-A mini-screws literally maximize the posterior anchorage, allowing practitioners to design simultaneous retraction from canine to canine. On the other hand, the incisal mini-screws aim to compensate the anterior dumping tendency, minimizing the side effect and encouraging bodily movement during retraction. Furthermore, the presumed resultant for all applied loads is likely to impact the entire maxillary arch with backward and upward movement. This mechano-therapy can change the occlusal plane, leading to counterclockwise rotation of the chin point. Thus, the OBS anchorage[11] system is of the utmost importance in expressing the full potential of aligners.

Mini-screws are a stable anchorage system that can withstand approximately 400g of orthodontic force,[12] which is more than adequate for clear aligner therapy. The failure rates for IZC E-A screws and incisal screws to support fixed appliances are 6.3%[13] and 7.2%,[14] respectively, and failure may be less frequent with aligners because the force applied is lower and intermittent. Further studies on this issue are expected.

With regard to the envelope of discrepancy,[15] Invisalign® has its own tooth movement assessment overview which provides guidance for programming substantial tooth movement into the ClinCheck® (*Align Technology, Inc., San Jose, CA, USA*) treatment plan, along with the skills that may be needed for the treatment (*Fig. 4*).[16]

Fixed appliances and clear aligners are simply tools. When and how to use them properly is left to the practitioners' discretion. In the meantime, mini-screws have the ability to expand the envelope of discrepancy for both appliances.

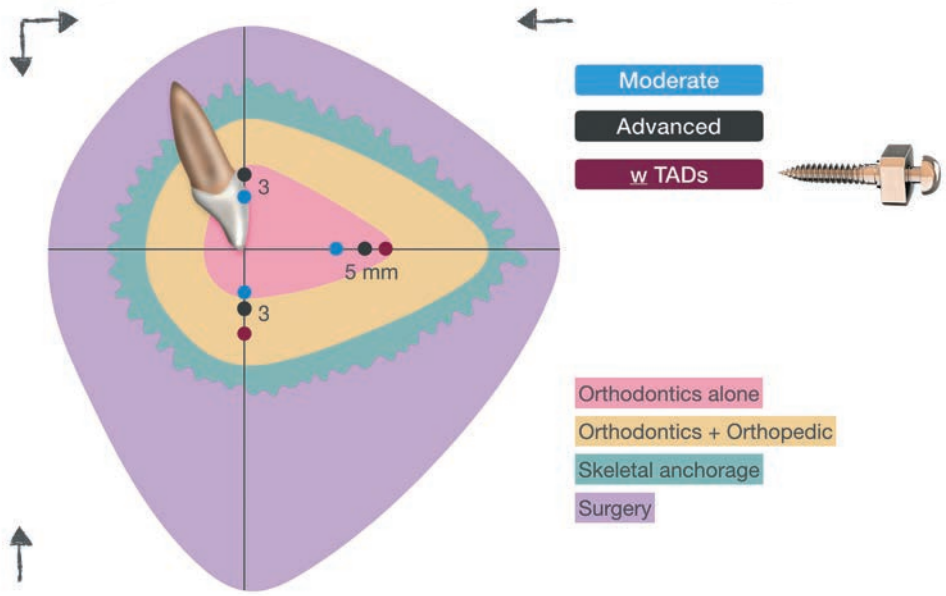


Fig. 4:

The anteroposterior and vertical millimetric range of treatment possibilities in orthodontics can be expressed as an envelope of discrepancy. The different colored zones describe the range of potential tooth movement with fixed appliances. The arrows indicate the direction of movement in the diagram. The reason the green zone is shown in "fuzzy" fashion is that there is only sufficiently reliable data to make estimates at this point.[15] The blue dots indicate moderate treatment with variable predictability in clear aligner therapy, while black dots indicate more complex treatment with less predictability which often requires additional orthodontic techniques as they are more challenging to achieve with the use of aligners alone. Very close monitoring is recommended.[16] The burgundy dots are estimated points, representing the expansion of the envelope of discrepancy for aligners.

Conclusions

Without mini-screws, it is hard to deliver ideal mechanics for patients who demand inconspicuous aligner therapy for treatment involving extraction of four first premolars. This article explains the characteristics of mechanism, and emphasizes the clinical significance of mini-screws in conjunction with Invisalign®. Further studies will result in robust clinical recommendations.

References

1. Align Technology I. Invisalign G6. Available from: http://www.invisalign-g6.com/en-XA.
2. Chang MJ, Chen CH, Chang CY, Lin J, Chang CH, Roberts WE. Introduction to Invisalign® Smart technology: attachment design, and re-call checks. J Digital Orthod 2019;54:80–95.
3. Dai FF, Xu TM, Shu G. Comparison of achieved and predicted tooth movement of maxillary first molars and central incisors: First premolar extraction treatment with Invisalign. Angle Orthod 2019;89:679–687.
4. Archambault A, Lacoursiere R, Badawi H, Major P, Carey J, Flores-Mir C. Torque expression in stainless steel orthodontic brackets: a systematic review. Angle Orthod 2010;80:201–210.
5. Lee JS, Kim JK, Park YC. Biomechanical considerations with temporary anchorage devices. In: Graber LW, Vanarsdall RL, Vig KW, Huang GJ. Orthodontics: current principles and techniques. 6th ed. St. Louis: Mosby; 2017. p. 511–568.
6. Geron S, Shpack N, Davidovitch M, Kandos S, Davidovitch M, Vardimon AD. Anchorage loss—a multifactorial response. Angle Orthod 2003;73:730–737.
7. Lagravère MO, Flores-Mir C. The treatment effects of Invisalign orthodontic aligners: a systematic review. J Am Dent Assoc 2005;136:1724–1729.
8. Wang A, Chang CH, Roberts WE. Conservative management of skeletal Class II malocclusion with gummy smile, deep bite, and a palatally impacted maxillary canine. Int J Orthod Implantol 2017;48:24–46.
9. Zheng M, Liu R, Ni Z, Yu Z. Efficiency, effectiveness and treatment stability of clear aligners: a systematic review and meta-analysis. Orthod Craniofac Res 2017;20(3):127–133.
10. Phan X, Ling PH. Clinical limitations of Invisalign. J Can Dent Assoc 2007;73:263–266.
11. Chang CH, Lin JS, Yeh H. Extra-alveolar bone screws for conservative correction of severe malocclusion without extractions or orthognathic surgery. Curr Osteoporos Rep 2018;16:387–394.
12. Liou JW, Pai CJ, Lin CY. Do miniscrews remain stationary under orthodontic forces? Am J Orthod Dentofacial Orthop 2004;126:42–47.
13. Hsu E, Lin JS, Yeh H, Chang CH, Roberts WE. Comparison of the failure rate for infrazygomatic bone screws placed in movable mucosa or attached gingiva. Int J Orthod Implantol 2017;47:96–106.
14. Chang CH, Huang C, Lee WH, Roberts WE. Failure rates for SS and Ti-alloy incisal anchorage screws: single-center, double-blind, randomized clinical trial. J Digital Orthod 2018;52:70–79.
15. Nguyen T, Proffit W. The decision-making process in orthodontics. In: Graber LW, Vanarsdall RL, Vig KW, Huang GJ. Orthodontics: current principles and techniques. 6th ed. St. Louis: Mosby; 2017. p. 208–244.
16. Align Technology. Invisalign® tooth movement assessment overview. 2011. Available from: https://s3.amazonaws.com/learn-invisalign/docs/us/ToothAssessment.pdf.

2020 Keynote Workshop

講師 —— 金牛頓工程師

技巧班 7/23 (四)

強化你的 Keynote 簡報力

無論是 Keynote 新手或是略有經驗的使用者，在一天的簡報課程中，將精選介紹 Keynote 的重要工具，幫助你設計合適的動畫，分享設計資料視覺化的秘訣，並搭配 Mac 內建常用的影音工具來編修圖片和影像剪輯，金牛頓的教學團隊將教你如何使用 Keynote 創造出動人的專業簡報。

講師 —— 張慧男醫師

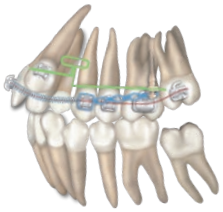
大師班 8/27 (四)

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、主講的一天課程，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且知識性豐富的專業演講。

- 名額有限，以繳費順序為依據。
- 舊生享特惠優惠價，限額4名。

- 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。



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

Dental Clinic Established 1996
Beethoven

Simplified. Insights. Effective.
Maximize orthodontic learning value

2020

Beethoven International Damon Master Program

Dr. Chris Chang
DDS, PhD. ABO certified, Angle Midwest
Beethoven Orthodontic Center, Taiwan

Beethoven International Damon Master Program, led by the world-renowned Dr. Chris Chang, is a 10-module course tailored for clinicians who desire to master the Damon System's treatment protocols with the combined use of mini-screws. The versatile course structure, including on-site lectures and hands-on workshops, as well as live webinars, allows participants to receive maximum learning value without interruptions to their busy practice schedule. Sign up now to experience Dr. Chris Chang's renowned effective teaching style!

1. Hands-on workshop

The course covers practices on a typodont and computer training on Mac. You learn best when you can have real hands-on experiences.

2. Chairside learning

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

3. Free course videos

Participants will be offered recorded course videos free of charge. You can learn in efficient way by reviewing the videos anywhere on an iPad.

- Fees include tuition, ABO Gauge, and workshop supplies, 3 nights of hotel (twin occupancy), e-handouts (iBooks), course videos (iPad format).
- Mac laptop installed with the latest OS and Keynote software is advised, but not required, for the Keynote workshop. No PC.

Course Schedule **Time:** 9AM-5PM (GMT +8)

Module 1 June 11 Thu (Webinar)

1. Selecting your ideal first case
2. Bonding position
3. Four stages of efficient orthodontic treatment

Module 2 July 16 Thu (Webinar)

1. Simple and effective anchorage system
2. Extraction analysis
3. Non-extraction analysis

Module 3 Aug 6 Thu (Webinar)

1. Damon diagnosis & fine-tuning
2. Model & Ceph tracing demonstration
3. OBS model demonstration

Module 4 Sep 17 Thu (Webinar)

1. Excellent finishing & case report demo
2. Retention & relapse: case demo

Module 5 Oct 29 Thu (Webinar)

1. Orthodontic biomechanics & diagnostic analysis
2. Soft & hard tissue diagnostic analysis
3. Children & adult orthodontics and diagnostic analysis

Module 6 Nov 26 Thu (Webinar)

1. Crowding: Extraction vs. Non-extraction
2. Upper impaction
3. Lower impaction

Module 7 Dec 31 Thu (Webinar)

1. Missing teeth: Anterior vs. Posterior
2. Crossbite: Anterior vs. Posterior
3. Open bite- High angle

2021

Module 8 Jan 14 Thu (Webinar)

1. Deep bite- Low angle
2. Gummy smile and canting
3. Esthetic finishing (transposition)

Module 9 Mar 11 Thu (Webinar)

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

Module 10 Apr 15-17 Thu-Sat

1. Model practice (Damon & OBS)
2. ABO DI, CRE workshop
3. Chair side observation
4. Clinic management
5. Keynote workshop: Photo taking and editing (template), Ceph tracing

Workshop in Taiwan (Newton's A & Beethoven Orthodontic Center)
Location: 2F, 25, Jianzhong First Rd., Hsinchu, Taiwan



+886-3-5735676 #201 michelle@newtonsa.com.tw Michelle Tsai

Feedback from the World

Hi Chris, thank you for participating in the meeting. Based on the poll, you are the lecturer that the attendees enjoyed the most. Congratulations - that is really quite an accomplishment!

Dr. Greg J. Huang,
2020 AAO Mid-Winter Meeting

Chris, you are such a pleasure. It is fun for an old worn out man like me to be around enthusiasm. You personify enthusiasm. I am in awe of all the enthusiasm you share with others. You make our specialty better. I am proud of you and I thank you for all you do for so many. You and Shu-Fen travel the world for our specialty - with a smile that you freely give to others. You are special.

Dr. James Vaden,
2020 AAO Mid-Winter Meeting

Dr. Chris Chang is one of the creators and "fathers" of the sophisticated system of anchorage using extra-alveolar screws in orthodontics. He has definitely modified the way we think today in the resolution of orthodontic problems in a rational and simple way. The phrase "It is easy. Believe me!" as he presented had never been so true. Orthodontics will never be the same after the introduction of this type of skeletal anchorage. It is a great honor for me to meet that living legend, Dr. Chang. Thank you.

Dr. Fatih Kahraman,
TWO-DAY LECTURES ORGANIZED BY MEDIKODENTAL, TURKEY

Dear Dr. Chris Chang, I feel that words are not enough to express the gratitude I feel for what you have done for me. Thank you for the invaluable knowledge and experience that you share. For the precious time I had a chance to spend with you and your family, for the incredible hospitality and care. You are an amazing person in the best sense of the word. It was truly unforgettable time! To be honest, before I couldn't even dream about it!

Thanks to madam Shu Fen Kao, Dr. Joshua Lin and dearest Dr. Kim Lin for their precious time they dedicated to me. Thank you to Michelle and thanks to all the amazing people who made it possible.

Dr. Ivan Vengerenko,
2019 DAMON MASTER PROGRAM

胡璐璐 医师
精修班视讯旁听

不能出门，去不了台湾，也没有关系。网络飞架南北，天堑变通途。感谢高老师张老师给我们创造条件学习、充实自己。

林琳 医师
精修班视讯旁听

张老师台湾精修班今天早上九点开始。高老师考虑到我们国内的疫情，特地升级设备开放了五十个旁听名额给正畸班的学员，并在一周前把学习相关的论文也发给了我们。张老师说，你们不能上班就做你们在家可以做的事情，在家也要好好充实自己，不要被环境所影响。

潘超 医师
精修班视讯旁听

今天远程参加了台湾张慧男老师的精修课，收获颇丰：以前觉得 3D level arm 的圈圈是随意弯的只是增加弓丝弹性，今天才学习到这上面也要考虑到胡克定律的，隐适美关闭大空间之前用片段弓 5 个月可以节省太多时间，还有好几个点……总之一个充实又有收获的上午太开心，太感激老师们。

2020 Implant Forum

本課表僅供參考，植牙論壇保留課程變動之權利

均可單堂報名

	日期（週五）	專題演講 9:00 - 10:30		植牙案例報告 10:45 - 12:00（30 分鐘 / 人）
1	3/13	陳明時 醫師（台灣假牙牙醫學會長、美國俄亥俄州立大學牙醫學院助理教授、美國加州州立大學舊金山牙醫學院副教授、台北醫學大學假牙研究所臨床教授） 主題：如何在自然牙根或者人工牙根建立穩定又平衡的咬合		
2	4/24	陳禮凡 醫師（長庚紀念醫院牙周病科兼任臨床指導主治醫師、美國波士頓塔夫茲大學牙周病專科醫師及牙周病碩士、美國牙周病專科醫學會專科醫師、中華民國植牙醫學會秘書長及專科醫師、禮凡牙醫診所院長） 主題：Advanced surgical techniques in implant dentistry	蕭浩宜 醫師（美國南加州大學植牙研究所進修、新綠牙醫診所院長）	張慧男 醫師（美國印第安那普渡大學齒顎矯正研究所博士）
3	5/22	吳尚霖 醫師（臺大醫院補綴科兼任主治醫師、耕莘醫院湖口仁慈分院主治醫師、尚霖牙醫診所負責人） 黃冠傑 技師（富緻牙體技術所牙技師、臺北科技大學經營管理EMBA、中臺科技大學牙體技術科學士） 主題：DTX Studio™ 數位化軟體應用 & 手術導板設計與生產		
4	6/12	胡剛碩 主任（新光醫院一般牙科主任、臺灣牙周病醫學會學術副主委、中華民國家庭牙醫學會學術副主委、台北市牙醫師公會學術委員） 主題：如何治療及避免植體周圍炎		
5	7/24	蘇筌瑋 醫師（高雄醫學大學牙周病學碩士、國際矯正植牙學會理事長） 主題：垂直前庭切線骨膜下隧道法 **下午另有 Hands-on 課程，可參考隔頁（費用另計）**		
6	8/28	謝清堯 醫師（台大牙醫系學士、台大臨床牙醫研究所補綴碩士、台大補綴科總醫師、台大補綴科兼任主治醫師） 主題：數位牙科的整合與應用		
7	9/25	林森田 醫師（中山醫學大學學士、國際矯正植牙學會院士、美國南加州大學植牙研究所進修） 翁蔚任 醫師（中華民國植牙醫學會專科醫師、中華民國家庭牙醫學會專科醫師、高雄醫學大學牙醫學士） 主題：From A to Z：完成你的第一個全口重建案例		
8	10/16	柯秋賢 醫師（竹北柯牙醫院長、高雄醫學大學牙醫學士、牙醫學研究所碩士、亞洲齒列再生研究會會員、中華植體美學醫師學專科醫師） 主題：Case report using the X-Guide dynamic navigation: From single tooth replacement to full mouth rehabilitation	黃育新 醫師（國際矯正植牙學會院士、台北醫學大學牙醫學系學士、台灣植牙醫學會專科醫師）	張慧男 醫師（美國印第安那普渡大學齒顎矯正研究所博士）
9	11/27	邱上珍 醫師（美國明尼蘇達大學牙周病學碩士、美國牙周病學會院士） 題目：Osseodensification and Densah Bur 的臨床運用 **下午另有 Hands-on 課程，可參考隔頁（費用另計）**		
10	12/18	黃怡豪 醫師（美國密西根大學牙周病專科認證、美國天普大學口腔生物學碩士、台灣大學附設醫院牙周病科兼任主治醫師、台北市牙科植體學學會副理事長） 主題：即拔即種與前牙美學究極		

地點：新竹市建中一路25號2樓（金牛頓藝術科技）

時間：每月一次、星期五上午 9:00-12:00

報名專線：03-5735676 #203

clinton@newtonsa.com.tw 陳建名

2020/07/24 (五)

蘇筌瑋 醫師

主題：垂直前庭切線骨膜下隧道法

課程時間：09:00～16:00

Modified VISTA: Crosslink between ortho., perio. and implant

Dr. Homa Zadeh 在 2011 年發表 VISTA，更簡單有效率的處理牙齦萎縮的問題，張慧男醫師跟著 Dr. Homa 老師學習後更改良為 modified VISTA 並廣泛應用在矯正與科技合作的案例，同時將成果發表在期刊與美國矯正年會中得到國際的肯定，我們利用案例一步步解析如何應用 VISTA 來處理各類的問題。

課程人數僅限 20 人，報名請趁早喔！

報名資訊

聯絡人: 3a Amy

連絡電話: 03-2209722#20 (8:30-17:30)

官方LINE ID: @3aonline

匯款資訊

ATM轉帳

玉山銀行 (808)-南桃園分行

帳號: 0842940022756

戶名: 三業股份有限公司

2020/11/27 (五)

邱上珍 醫師

主題：Osseodensification and Densah Bur 的臨床運用

課程時間：11/27 09:00～16:00

2014 年 Dr. Huwais 發明 Densah® Bur，應用 Osseodensification 自體骨緻密術的觀念，經由特殊設計的 Bur，在鑽骨的同時，利用反向切削與水壓動力，保留骨屑，並將骨屑往兩側的骨小樑間隙推擠，使植體周圍的骨質更加緻密；同時也利用骨頭本身的彈性體特性，使切削下的骨屑在骨頭回彈時，填入植體螺紋間隙，增加植體和骨頭的接觸面積比例，幫助癒合。此外，Densah® Bur 也可運用在齒脊擴張與上顎竇增高術，是您臨床有利的幫手。

2019 年 10 月，Dr. Huwais 本人來台灣授課，講師邱上珍醫師參與其中。這次課程邱醫師將清楚闡釋 Dr. Huwais 上課的重點，並分享她個人的使用經驗。下午的 Hand-on 課程，將讓您實際體驗 Densah® Bur 的魅力，並了解操作的細節。有興趣的醫師千萬不要錯過！

課程人數僅限 20 人，報名請趁早喔！

報名資訊

聯絡人: 3a Amy

連絡電話: 03-2209722#20 (8:30-17:30)

官方LINE ID: @3aonline

匯款資訊

ATM轉帳

玉山銀行(808)-南桃園分行

帳號: 0842940022756

戶名: 三業股份有限公司

"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

New Release!

Dr. Chris Chang's lecture organized by Medikodental in Istanbul, Turkey in January 2020. The lecture reached over 300 attendees, the largest in record over the years!