Long Term Follow Up and Management of a Severe Class III Open Bite Case
Dr. John Lin

Molar Retraction in All Four Quadrants to Correct a Class III, Crowded Malocclusion in a Patient with a Flat Profile
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Implant-Orthodontic Combined Treatment: Congenital Missing Teeth with a Unilateral Crossbite
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Orthodontic and Implant Treatment for Severe Crowding Complicated by Missing Molars
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The 2B-3D rule for implant planning, placement and restoration
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IJOI

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2012 International Beethoven Damon and OBS Workshop; Drs. Chris Chang (center left), John Lin (center right) and participants from Malaysia, Thailand and Colombia.

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《僅供牙科專業人士參閱》

2012~2013 熱愛學矯正

張慧男 博士

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

學會開始做矯正需多久?

39小時讓您入門矯正。本課程採高效學習法及高效矯正簡報法 - Keynote，在舒適、輕鬆的環境下，學會簡單有效的矯正方法，教室與診間結合，讓您現學現用，立即熟悉各種習得的技巧，而不需太多課後複習。全程以 In-Office Training 方式，用病例帶動分析、診斷，治療計畫與療程技巧，每一步驟皆以圖片及影片教學，讓您很難錯失任何環節，更沒有聽不清楚或無法理解的可能。為提高課後自我學習及臨床印證之效率，另備有教學電子檔，供學員家中研習。我們的終極目標是：用最短時間、最輕鬆的方式，讓每位學員 - *熱愛矯正學、熱愛學矯正。*

Damon矯正課程

【課程】9:00 - 12:00
【實習】另外安排

使用最新一代矯正器 Damon Q 進行課程，歡迎舊生報名參加。

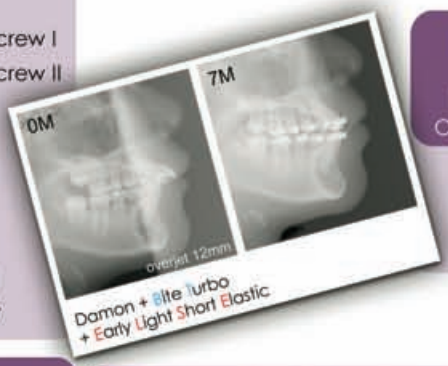
	台北 (二)	高雄 (四)	*請注意！課程日期調整。 LECTURE	LAB
1	額滿 10/2	NEW 10/11	理想入門病例+Damon Q黏著	Bonding (Damon Q) + BT
2	10/9	11/22	快速矯正療程四部曲	Ceph + Photo
3	10/23	12/13	簡捷有效的錨定系統	Damon + OrthoBoneScrew I
4	11/27	1/10/13'	不拔牙與拔牙分析	Damon + OrthoBoneScrew II
5	12/11	3/7	Damon 診斷流程及微調	Finish Bending
6	1/8/13'	3/28	完工檢測及報告示範	Fixed Retainer (FR)
7	3/5	4/11	維持及復發；病例示範	Presentation Demo
8	3/12	4/18	矯正力學及診斷分析 (1)	DDX + Case Reports I
9	3/26	5/16	軟硬組織及診斷分析 (2)	DDX + Case Reports II
10	4/9	5/30	兒童矯正及診斷分析 (3)	DDX + Case Reports III
11	4/23	6/6	成人矯正及診斷分析 (4)	DDX + Case Reports IV

矯正植體課程

【課程】9:00 - 12:00
【實習】13:30 - 20:00

矯正植體的操作時機、植法與實習、個案討論、臨床跟診及實作示範。

新竹(五) 9/21 (含午、晚餐)



International workshop

Keynote & managment
OrthoBoneScrew & Damon

A班 6/12-14
B班 11/13-15

矯正進階課程

【新竹】9:00 - 12:00
【高雄】14:00 - 17:00

以病例討論為主軸，培養學員如何正確診斷及快速排除臨床疑點，課程中亦訓練每位學員善用 Keynote。

	新竹 (四)	高雄 (四)	*請注意！課程日期調整。 Paper Reviews	Topics & Case Demo
1	7/5	NEW 10/11	Bracket Placement	Crowding: Ext. vs. Non-ext.
2	7/26	11/22	Impacted Canines	Upper Impacted Teeth
3	9/27	12/13	Canine Substitution	Lower Impacted Teeth
4	11/1	1/10/13'	Missing 2nd Premolar	Missing: Ant. vs. Post.
5	12/20	3/7	DI Workshop	Crossbite: Ant. vs. Post.
6	1/3/13'	3/28	CRE Workshop	Open Bite High Angle
7	2/21	4/11	Excellence in Finishing (occlusion)	Deep Bite Low Angle
8	3/21	4/18	Excellence in Finishing (esthetics & perio)	Gummy Smile & Canting
9	4/25	5/16	Ortho-Perio-Restore Connection	Esthetic Finishing (Transposition)
10	5/9	5/30	Adjunct to Perio	Implant-Ortho
11	5/23	6/6	Unhappy Patient	IDT - Adult Complex

助理訓練課程

【課程】10:00 - 14:30
【實習】15:00 - 20:00

每梯次共兩堂課程與技術操作，內含照相技術、Morph 與公關衛教之電腦資料處理；另安排一次診所見習。

新竹(五) 10/5、12 (含午、晚餐)

矯正精修課程

【課程】9:00 - 12:00

協助每位學員了解由古典到現代之文獻，進而應用於實際病例；並藉由DI及CRE讓精緻完工（Excellent Finishing）變成易達到的目標。

新竹 (二) 精修IV 5/22 6/19 7/10 8/14 9/18 10/16 11/20 12/18 1/15/13' 3/19 4/16

課程資訊

上課地點

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恆毅資訊中心 畢卡索廳
/ 台北市復興北路99號12樓
(捷運南京東路站旁)

【新竹】
金牛頓藝術科技公司
/ 新竹市建中一路25號2樓

【台中】
中國文化大學台中教育中心
/ 台中市西屯區中港路二段128之2號3樓

【高雄】
國立科學工藝博物館-南館
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*每次上課請依最新一期IJOI 公告為主

Invitation to the first iAOI annual conference

With great pleasure I'd like to invite you all to attend the first International iAOI Symposium on December 9th, 2012 in Taipei Taiwan. This year's theme will be: "*Management of soft and hard tissue complications*". Every clinician has encountered clinical situations when unexpected complications occur. I have invited two internationally renowned experts and my mentors in implant dentistry, Dr. Thomas Han from UCLA and Dr. KB Park from South Korea, who will critically examine the cause, therapeutic technique and protocol in the treatment of soft and hard tissue complications. My mentor in Orthodontics, Dr. John Lin, and myself will each give a lecture on the ortho-implant connection. In addition, six iAOI diplomate candidates are invited to present their ortho-implant combined cases and share their lessons learned in this brand new field. This series of explorative inquiries of orthodontic and implant combined treatment is sure to provide inspirations to your clinical practice. I urge your active participation in one of this year's most exciting educational events. Be there!

我非常高興能邀請您來參與12月9日即將在台北舉行的首屆國際矯正植牙學會年會。今年的主題為：「處理軟組織與硬組織的臨床併發症」。每位醫療專業人士，不論是新手上路或是資深專家，都曾遇到過意料之外的臨床併發症。兩位國際級的植牙專家也是我在植牙界的老師，來自美國UCLA 的 Dr. Thomas Han 和南韓的 Dr. KB Park 將針對軟組織和硬組織常見的併發症成因、治療方式以及標準處理步驟進行深入探討。我和我矯正界的老師 - 林錦榮老師也將針對矯正與植牙的連結各提出一場專題演講。此外，六位國內新興的講師，也是首屆學會院士候選人也各將提出一個結合矯正與植牙治療的臨床案例報告，與大家分享他們在這個嶄新領域裡的收穫。我相信透過這一系列探索性的提問和整理，將會對您的臨床工作帶來新的刺激與啓發。請您千萬不要錯過這一場今年最精采的牙科盛會！

Chris Chang DDS, PhD, Publisher


Examiner
Dr. W. Eugene Roberts


Examiner
Dr. Tom Pitts


Examiner
Dr. John J. J. Lin


Consultant
Dr. Frederick J. Regennitter


Consultant
Dr. Tucker Haltom


Consultant
Dr. J. Michael Steffen


Consultant
Dr. Larry White


Examiner
Dr. Kwang Bum Park


Examiner
Dr. Homa Zadeh


Examiner
Dr. Fernando Rojas-Vizcaya


Consultant
Dr. Baldwin W. Marchack


Consultant
Dr. Stephen Wallace


Consultant
Dr. Mark Y. K. Ou


Guest Editor
Dr. Rungsi Thavarungkul

iAOI

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Dr. Chris Chang, *Publisher*

Long Term Follow Up and Management of a Severe Class III Open Bite Case

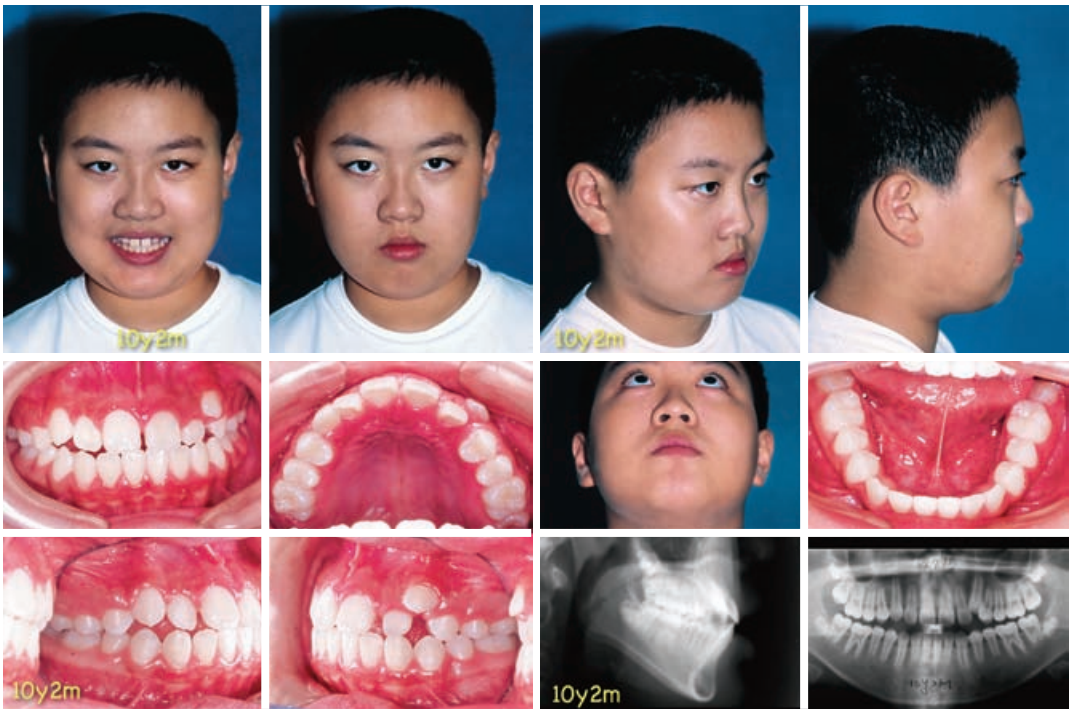
(A) Introduction

The patient presented with seemingly simple Class III asymmetry with a labially block out left upper canine. The initial treatment plan indicated traditional edgewise orthodontic appliances for better alignment. The patient would then stay in long term follow up until the active growth period was completed and be ready for second stage correction of the asymmetric malocclusion.

However, during the first phase of alignment of the ectopic upper canine, an open bite developed unexpectedly, and worsened progressively. Surgical correction was planned while the mandibular growth remained in close monitoring. The use of buccal shelf mini-screws to correct Class III open bite was attempted and the orthognathic surgery was avoided. Overall, the patient was treated and stayed in follow up over 14 years.

A new modality of the treatment of Class III open bite, and the concepts of etiology and myofunctional therapy of Class III open bite are discussed below.

(B) Case report

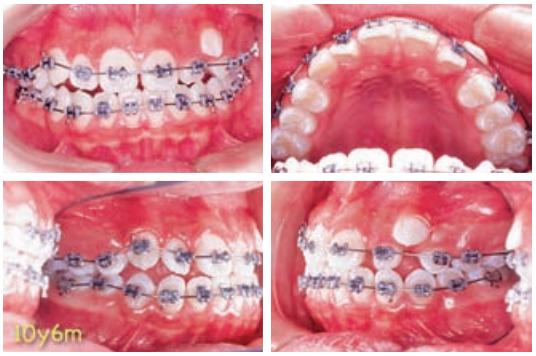


Dr. John Jin-Jong Lin
MS, Marquette University
Chief Consultant of IJOI
President of TAO (2000~2002)
Author of *Creative Orthodontics*

■ *10y2m:*

Diagnosis: *This is a Class III subdivision malocclusion case with right side molars in a Class III relationship and Class I relationships for the left side molars. The upper midline was deviated to the left side due to the upper lateral incisor shifting to the left as a result of the labially block out left upper canine. Originally the upper midline should be more to the right, indicating the lower dental midline deviated to the left, and coinciding with the left deviated chin point.*

Prognosis: *After space creation for the left upper canine, the upper dentition was well aligned. Reevaluation and re-treatment were indicated when active growth was completed. The asymmetrical skeletal and dental relationship tended to worsen with growth.*



■ *10y6m:*

Beginning of traditional edgewise orthodontic treatment.

■ *11y4m:*

The upper canines were in good alignment.
The lower dental midline, compared to the upper dental midline, was still slightly deviated to the left.

■ *11y7m:*

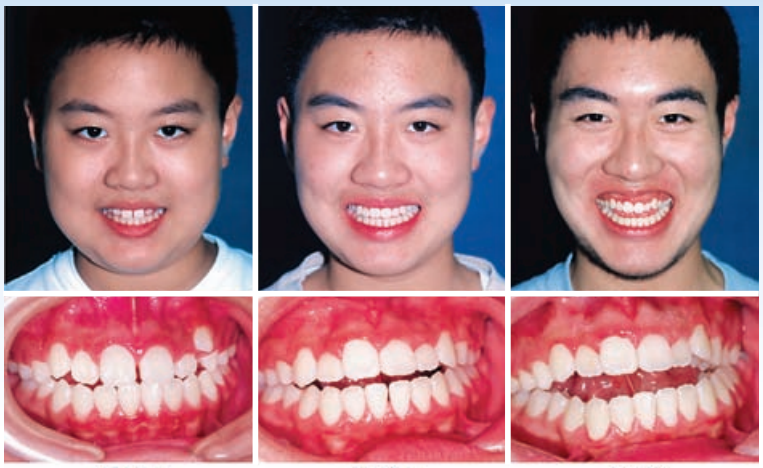
After 13 months of orthodontic treatment, the ectopic left upper canine was aligned, but the anterior open bite was gradually developed. The edgewise orthodontic treatment was then stopped. The patient remained in follow-up for future re-evaluation. The author explained to the parents and patient about possible future surgical corrections.

11y10m :

After debonding, the patient was found with an anterior open bite, and the lower dental midline was deviated to the left. Only the left side second premolars and the posterior molars were in occlusal contact.

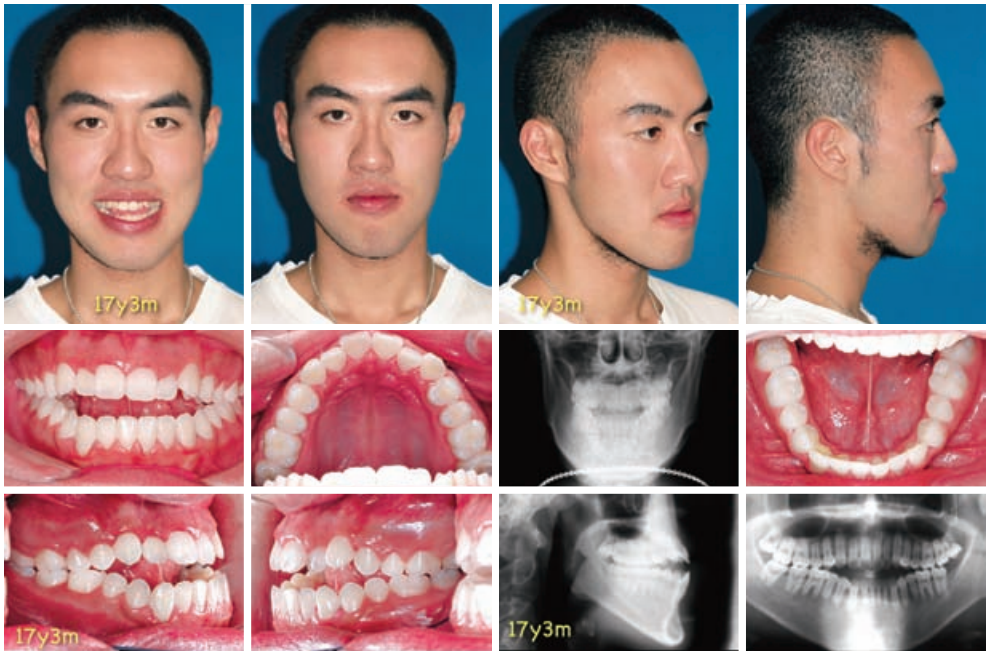
14y5m:

The anterior open bite worsened and only the posterior molars were in occlusal contact. In addition, the lower midline was further deviated to the left, coinciding with the left deviated mandible.



10y2m - 11y10m - 14y5m :

Comparing the smiles before and right after treatment, it seemed that either the patient developed a gummy smile or his smile became bigger.



17y3m:

The anterior open bite, Class III malocclusion, and the left deviated lower dental midline as well as the left deviated chin point all became more severe.

17y6m: Bonding for pre-surgical orthodontic treatment.

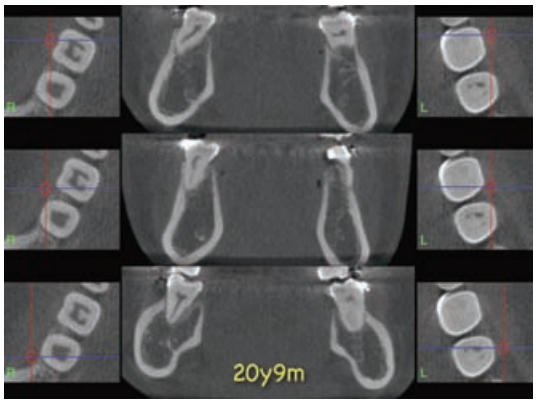
Mimicry of Crown Lengthening

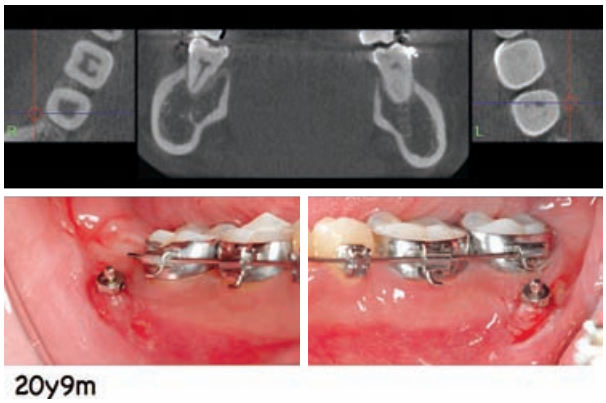
Projected outcome photo of crown lengthening by Photoshop

20y5m:

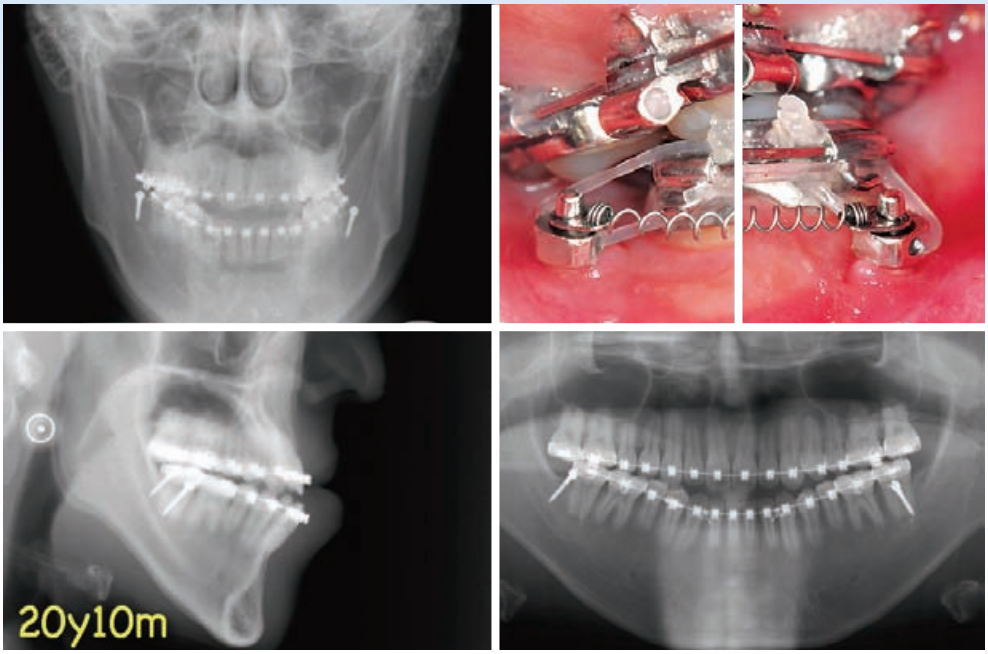
The patient was ready for surgical corrections of the severe Class III open bite and deviated lower dental midline. After consultation with the oral surgeon, maxillary Le Fort I surgical impaction, mandibular setback surgery and advancement genioplasty were planned.

- The projected satisfactory outcome of crown lengthening indicated that the gummy smile could be resolved without the Le Fort I surgery. Instead, the severe Class III open bite could be corrected by buccal shelf mini-screws.
- Before surgical placement of the buccal shelf mini-screws, computed tomogram (*CT*) was taken to determine the placement sites of the buccal screws.



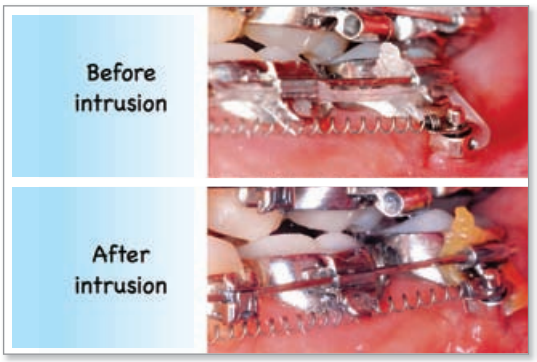


- The CT revealed that the thickest slope of buccal shelf was over the distobuccal corner of the right lower 2nd molar, and the buccal side of the left lower 2nd molar.
- Two stainless steel buccal shelf mini-screws (*2x12mm*) were placed with an apically positioned flap around

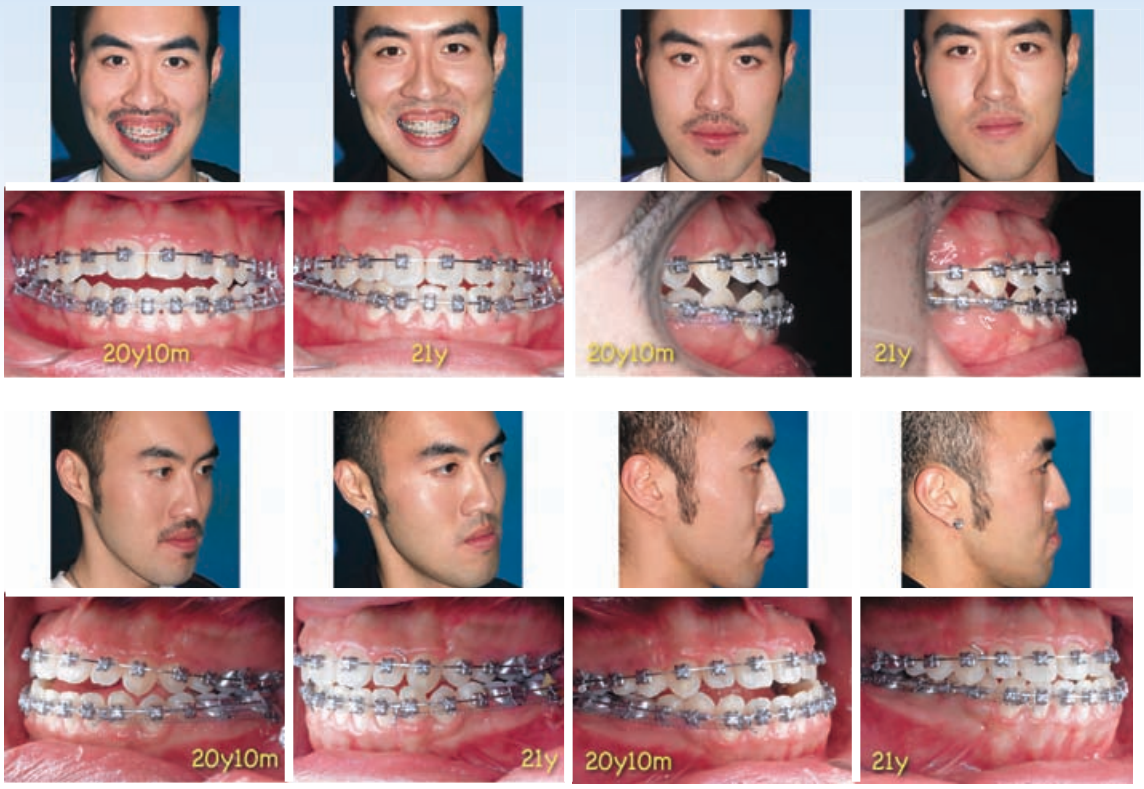


the screws. This flap could secure the mucosa apically. As such, irritation could then be prevented and the denuded periosteum would become attached gingiva after healing.

- Lateral cephalogram showed the open bite.
- PA cephalogram showed the buccal shelf mini-screws were almost parallel with the molar roots.
- This extra-radicular placement of the screws made the distalization of the whole lower dentition possible.
- The panorex showed that the screws were placed over the buccal side of the lower left 2nd molar and over the distobuccal side of lower right 2nd molar.

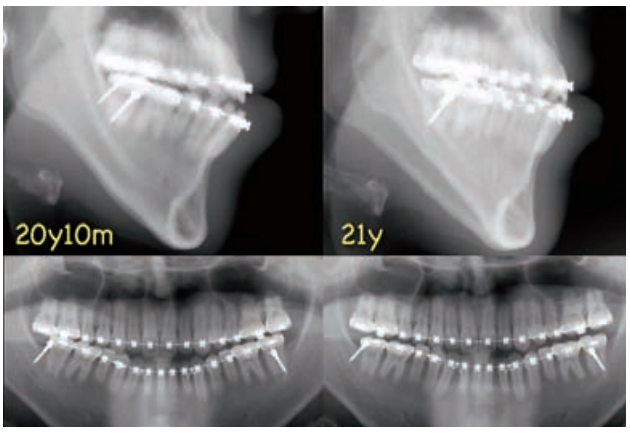


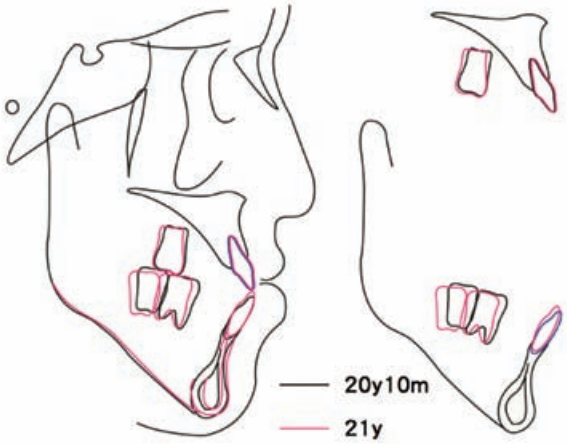
- Closed coil springs were used to retract the whole lower dentition distally (*16oz on the right side and, 12oz on the left side*) for the correction of the lower midline deviation. Square elastic threads (*0.26" x 0.26", Rocky Mountain, Co.*) were tied from the buccal tube of lower second molars to the holes of the platform of the stainless steel screws to intrude the lower molars, and solve the anterior open bite. No lingual holding arch was used in the lower dentition.



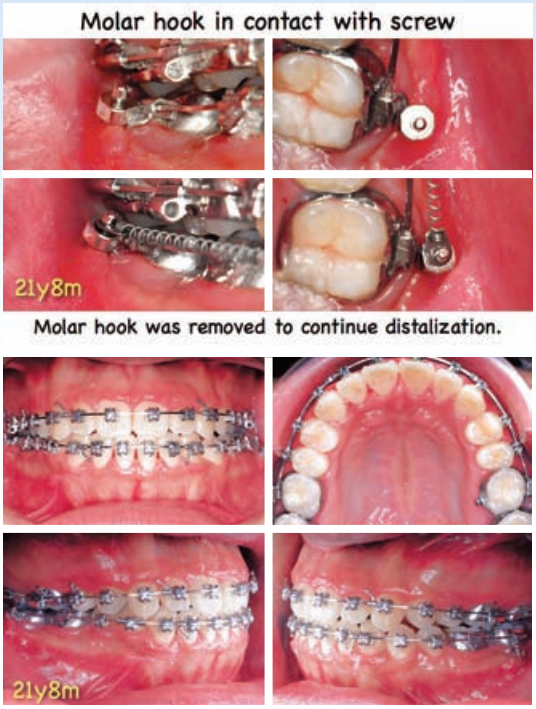
20y10m - 21y:
Results of 2 months of intrusion of molars and retraction of the whole lower dentition.

The Class III malocclusion was much improved and the open bite was closed to an edge to edge relationship in just only two months as the result of lower molar distalization and intrusion of lower molars.





The cephalometric superimposition indicated true intrusion of the lower molars and mild autorotation of the mandible. These changes turned the previously slightly retrognathic mandible orthognathic. The counter-clockwise rotation of the occlusal plane facilitated the correction of the Class III malocclusion[1].



21y8m:

The 2nd molar hook was in contact with the screw which prevented further retraction of the whole lower dentition. It was later ground off to continue retraction of the whole lower arch.

21y11m:

Results of the crown lengthening procedure of the upper anterior teeth performed by the periodontist.

22y5m:

Overcorrection to a deeper overbite was planned to prevent relapse of the open bite. However, the treatment had to be terminated even though the overbite was just about 1mm due to the patient's impending military service. No significant changes was observed in the post treatment profile. The mandible remained deviated to the left, and the gummy smile was corrected with the crown lengthening surgery. The overjet was 2mm and overbite was 1mm. The canines and molars were in a Class I relationship on bilateral buccal occlusion. The left side remained in a slightly open contact over left first bicuspid region.

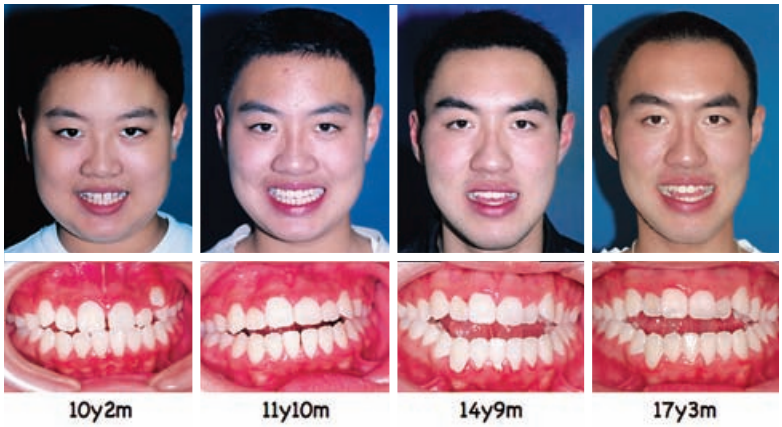
24y:

In the 1-year-and-7-month follow up visit, the overjet was found to relapse to 0.5mm, while the overbite, despite no overcorrection was performed, remained to be 1mm. No obvious bite opening was observed. The right buccal occlusion stayed in a solid Class I relationship while the left side settled better. Mild open contact over the left upper canines and first premolar region were found. The mandibular dentition relapsed horizontally and moved forward while the vertical overbite was well maintained.

(C) Case Summary

(1) Stage one treatment (Before growth completed).

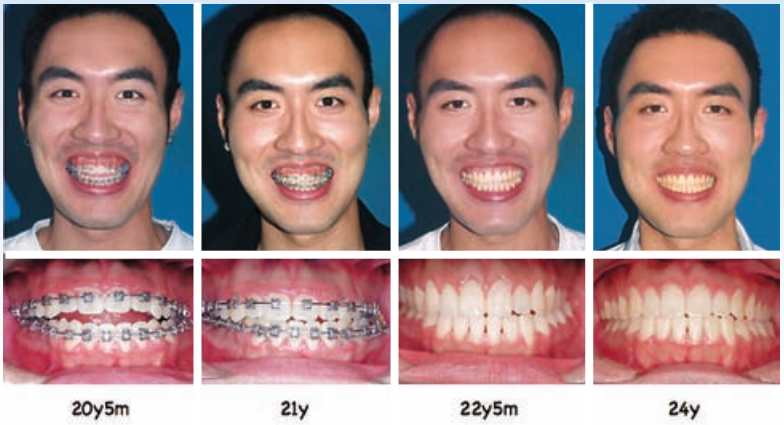
This Class III subdivision case appeared to be one with an easily treatable upper ectopic canine. After 13 months of traditional edgewise treatment, the bite opening continued worsening. Therefore, the treatment was temporary suspended.



The patient was in follow up throughout the growing period. Photographic records indicated that the bite, as well as the deviated dental midline and chin point, deteriorated progressively. At the age of 17 years and 3 months, the patient was ready for the second stage pre-surgical orthodontic treatment.

(2) Stage two treatment (Post major growth period)

The second stage orthodontic treatment was planned to prepare for subsequent surgical correction. After re-evaluation, the use of buccal mini-screws was applied to correct the open bite malocclusion. Meanwhile, the gummy smile was corrected by the crown lengthening procedure, instead of the Le Fort I surgery. 1 year


20y5m
21y
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20y5m
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20y5m
21y
22y5m
24y

and 7 months after the treatment, the occlusion slightly relapsed but the overbite was well maintained. No open bite relapse was found despite neither tongue guard nor any myofunctional therapy was instructed.

(D) What can we learn from this case?

(1) The original orthognathic profile, and shallow overbite Class III malocclusion gave little indication that this would evolve into a severe Class III open bite case. So far there is no precise indicators with predictability of Class III growth. Luckily such cases with severe Class III open bite growth, as in the present case, are uncommon.

(2) It was advised to stop the early stage of Class III treatment when the bite kept opening during the treatment. Efforts to resist the vertical growth of the mandible would be difficult and futile, and the patient would have to wear braces for a prolonged duration, leading to a series of periodontal problems and caries. Luckily the 2nd stage treatment was delayed until the major mandibular growth stopped. The new method of using buccal mini-screws to correct severe Class III open bite became available and surgeries were avoided.

(3) This patient presented initially as a typical severe Class III subdivision case. Indeed, the dentition and chin point deviated progressively to the left with growth as expected.

(4) The recent advancement of the temporary anchorage devices (*TADs*) can solve many traditionally surgical Class III cases, as long as patients can accept the profile. Many difficult Class III can be treated with conventional orthodontics with the aids of TADs.[1]

(5) Projected images of treatment results, utilizing digitally (*ie. Photoshop*) modified visuals, is an effective tool for patient consultation, as in this present case for predicting future treatment results of crown lengthening.

(6) Although inter-radicular placement of the buccal shelf mini-screw is technically less challenging than the extra-radicular placement, the screw may come in contact with the roots, causing screw loosening. Besides, the amount of distalization is limited with this method.[2]

(7) There are some Class III open bite cases with a little retrognathic mandible instead of prognathic mandible, as in the present case. Intrusion of molars and auto-rotation of the mandible are advantageous for open bite closure and profile improvement. 2mm x 12mm stainless steel miniscrews with holes on the platform makes the intrusion of lower molars a very easy procedure. This type of buccal shelf mini-screws is critical to the successful treatment of this open bite case.

(8) The author suspects that the tongue habit or breathing problem are not the main etiologies of this type of severe Class III open bite cases. Hence, no muscle training, ie swallowing exercise, or the use of tongue guard or chewing gum exercise were instructed to the patient.[3] The author had two other similar cases in the past. So far the one and half years of follow up records all indicate satisfactory stable results with no open bite relapse.

REFERENCES

1. Lin JJ. Creative Orthodontics: Blending the Damon system & TADs to manage difficult malocclusions. 2nd edition. 2010, Yong Chieh Enterprise Co, Ltd., Taiwan.
2. Nakamura A, Teratani T, Itoh H, Sugawara J, Ishikawa H. Photoelastic Stress Analysis of Mandibular Molars Moved Distally with the Skeletal Anchorage System. Am J Orthod Dentofacial Orthop. 2007;132:624-9.
3. Kondo E. Muscle Wins! - Muscle and respiration oriented orthodontic treatment and long term occlusal stability - Ishiyaku publishers, Inc. 2007.

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The authors would like to acknowledge Dr. Nancy Nie-Shiuh Chang for performing the crown lengthening surgery and placing the buccal shelf mini-screws in this case; Dr. Liao You-Cheng for precise ceph tracing; and Ms. Tzu-Han Huang for English editing.

Dear Dr. Chris Chang:

Hi! I am Brian S. Lee, an Korean American practicing orthodontic treatments in South Korea.

Currently, I almost treat all of my patients with Damon system occasionally with the help of TADs.

Recently, I had found from the internet and 'Youtube' about Taiwan Damon study group (*the beethoven dental group*). I had read some of the articles that were published on the International Journal of Orthodontics and Implantology (*IJOI*). Most of them were very clear and easy to understand what the authors were trying to say. To tell the truth, the articles written by the American clinicians in the Clinical Impressions (*CI*) were broad and sometimes vague to grasp what they were trying to say.

From the articles I had the sense that these Taiwanese orthodontists know what they are doing to their patients in order to give a better facial esthetics. That is the treatment I sincerely want to provide to my patients.

Recently, I have signed up to become a member on the iAOI website and get more information about the orthodontic philosophy suggested by Taiwanese clinicians.

Through the research, I have seen the book "*Orthodontics*" by Chris Chang, W. Eugene Roberts (*2012*). I want to ask you if it is possible to buy this book. I currently don't know where to purchase this textbook. Please let me know if you have some of them in stock. If you have them, I will buy it by credit cards.

Thank you for your time and patience. Have a good one.

Sincerely,

Brian

D.D.S in Chonnam National University at Gwangju (South Korea)
M.S.D in Seoul National University at Seoul (South Korea)
Ph.D in Tohoku University at Sendai (Japan)

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視訊課程三選一

SIMPLE WITHIN COMPLEXITY

Just Elastics, Bite Turbo
in the Damon System!!

OCTOBER 21, 2012

Speaker Introduction 講師介紹

Dr. Jean-René Van Becelaere

- 1945 : Born in Lille, FRANCE
- August 1964 to 1968 : Dental School in Lille
- July 1968 : Emigration to CANADA
- 1968 to 1971 : Resuming Dental studies to get equivalence in the University of Montreal
- 1971 : Obtained DDS
- August 1971 : Starts right away Orthodontic specialty; Trained in the Segmented Arch Technique of Dr. Charles BURSTONE.
- March 1973 : Interrupted specialty to comply with French military obligation.
- July 1974 : Resumed the whole Orthodontic course program (2 years) .
- 1976 : Specialty in Orthodontics completed; Certificate in Orthodontics; in full time practice since then.

您想知道這些困難之病例如何單純只用Damon System治療成功嗎?

All the cases, non-extraction, no TADS, no RPE, no Headgear.

CII

CIII

Severe CII

Severe Open Bite

Severe Perio

Deep Bite

Great 強力推薦 Recommendation

林錦榮/中華民國齒顎矯正學會顧問

今年初筆者應 Ormco 公司之邀，於 Phoenix 舉辦之Damon Forum 擔任講師；於開會期間，一位華裔女醫師主動向筆者強力推薦她的矯正校友 JR, 當時 JR 正熱心地與一位約旦醫師分享病例，瞄了一下JR 於筆電螢幕上之資料，即被其完整且漂亮之記錄所吸引。後來抽空與 JR 交談，他慷慨分享其治療精華後，筆者深深被他精彩之病例所吸引，乃邀他到國內演講。

以 JR 近七十歲之高齡，他仍然認真地像海綿般地努力吸收各矯正名家之精華，並將之應用於臨床。早在 2008 年之 Damon forum 中，筆者發現 Damon 具有神奇似 MEAW (Multiloop Edgewise Arch Wire) 之效果，於治療 Class III 有極佳之效果，實質上廣義的MEAW 效果可延伸到嚴重 Class II 或 open bite 之治療。

JR 應筆者之請求，已寄給筆者其即將講之精彩病例內容，包含詳細治療步驟，病例詳細治療過程印成筆記，發送給參與之聽眾，加上JR當天之詳細說明，相信將會使國內 Damon 使用者更堅信 Damon 之神奇 MEAW effect, 且更有信心只利用 straight wire 與 elastics 即可輕鬆治療大部份異常咬合之 Damon system。

請仔細看看文宣所印製 JR 之病例，如果這是您的病例，可能用目前之 bracket system 輕鬆治療成功嗎? 請把握此一難得之好機會，向使用 Damon system 已出神入化之 JR 學習。

賴向華/中華民國家庭牙醫學會理事長

如果您曾經看過Dr.Jean Rene 治療過的各種困難的臨床病例，其效率及治療後之穩定度，一定會讓您讚嘆不已。這個暑假，誠意的邀請您一同分享這場學術饗宴。

Lecture 演講資訊 Information

Organizer: 社團法人中華民國家庭牙醫學會

Co-organizer: 湧傑企業股份有限公司

Date: 2012/10/21 星期日 9:00am ~ 5:00pm

Venue: 台大醫院 兒醫大樓 B1講堂

Speaker: Dr. Jean- René Van Becelaere

10/7前 會員2000元 非會員3000元
學生會員1000元

10/8後 會員3000元 非會員4000元
學生會員1500元

Registration: 請先電話報名(02)2778-8315 #123 李's
郵政劃撥帳號：17471807
戶名：湧傑企業股份有限公司

Certification: 參加者發給繼續教育學分

Time	Content
09:00-10:20	Highly clinically illustrated course on bonding and Torque
10:20-10:40	Coffee Break
10:40-12:00	Early interception: setting our goals (crowding , cross-bite , Class II &III)
12:00-13:00	Lunch
13:00-14:40	Light elastics and bite turbo , illustrated with cases , open and deep bite , Class I, II & III
14:40-15:00	Coffee Break
15:00-16:30	Clinical cases and Retention : Lingual wires : direct and indirect – Essix retainers –Post Phase 1 retainers, Damon Splint prepared directly in the mouth .
16:30-17:00	Q&A

Molar Retraction in All Four Quadrants to Correct a Class III, Crowded Malocclusion in a Patient with a Flat Profile

HISTORY AND ETIOLOGY

A 26 year old male patient presented for consultation with a chief complaint of dental protrusion. He asked for extraction treatment to reduce the perceived protrusion. However clinical examination revealed a relatively retrusive maxilla and straight profile, with no sign of dental protrusion. Apparently the maxillary incisor prominence, due to severe crowding, led to his mistaken impression of "*protrusion*" (*Figs. 1-3*). The preliminary diagnosis was a mild skeletal Class III relationship, with dental compensation, that resulted in flaring of the upper incisors and lingual tipping of the lower incisors. Based on the examination and history, the etiology of the malocclusion appeared to be primarily genetic.

Although the arch length discrepancy was 8mm in the lower arch and 7mm in the upper arch, a nonextraction treatment approach with temporary anchorage devices (*TADs*) was indicated to avoid a concave profile in the midfacial region after extraction treatment. The patient was skeptical about the nonextraction treatment plan but later agreed to it on the condition of conducting a re-evaluation in 8 to 10 months.

The patient was treated to an optimal result as documented in Figs. 4-6. The cephalometric and panoramic radiographs document the pre-treatment condition and the post-treatment results (*Figs. 7-8*). The cephalometric tracings before and

Fig. 1: Pretreatment facial photographs

Fig. 2: Pretreatment intraoral photographs

Fig. 3: Pretreatment study models

Johnny JL Liaw, Director, Beauty Forever Dental Clinic (left)
W. Eugene Robert, Consultant,
International Journal of Orthodontics & Implantology (right)

Fig. 4: Posttreatment facial photographs

Fig. 5: Posttreatment intraoral photographs

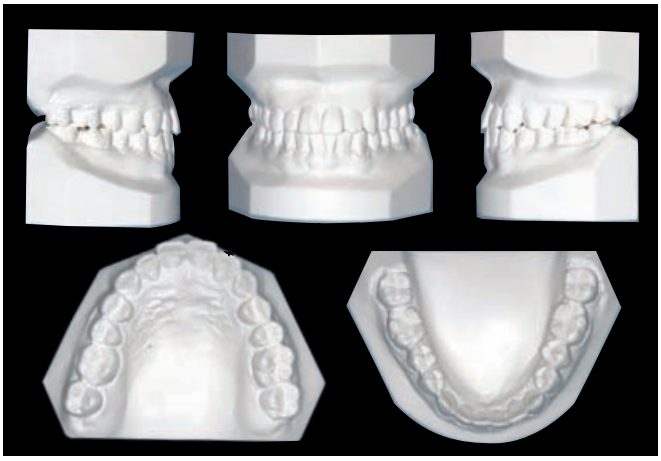


Fig. 6: Posttreatment study models

after treatment are superimposed in Fig.9, and the summary of cephalometric measurements is provided in Table 1.

DIAGNOSIS

Skeletal:

- Skeletal Class III (*SNA 79°, SNB 83°, ANB -4°*)
- Low mandibular plane angle (*SN-MP 29°, FMA 20°*)
- Facial asymmetry: no significant asymmetry was noted

Dental:

- Bilateral molar Class III relationship
- Class III canine relationship on the right side
- Class I canine relationship on the left side
- Both upper lateral incisors were locked-in palatally and were in crossbite with the lower incisors
- The OJ was 0.5mm, and the OB was 0.5mm
- 7mm space deficiency in the upper arch
- 8mm space deficiency in the lower arch
- Upper dental midline was shifted to the right by 2mm
- Lower dental midline was coincident with facial midline
- Upper left third molar was present.
- Archforms: symmetrical ovoid in the maxilla; narrow, tapering shape in the mandible

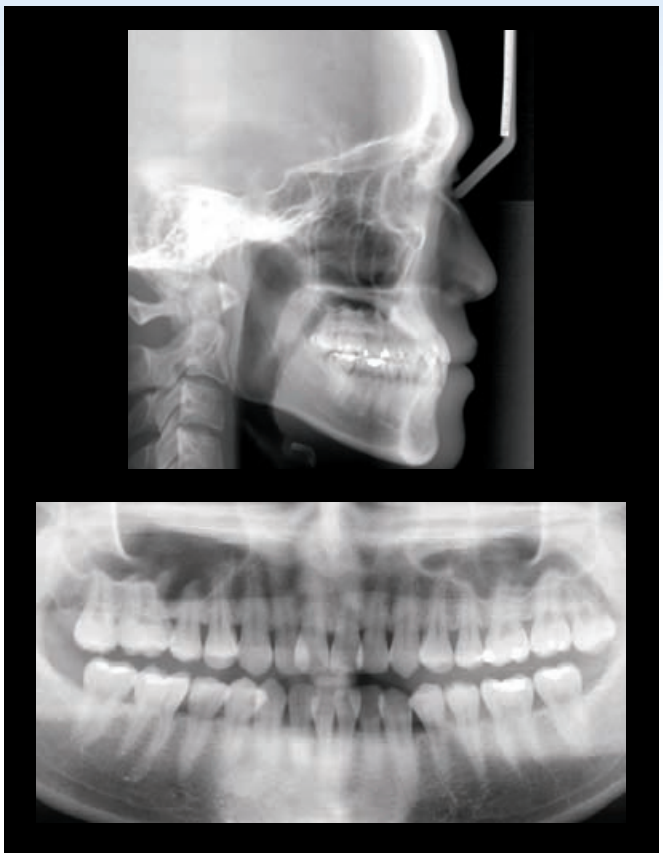


Fig. 7: Pretreatment pano and ceph radiographs

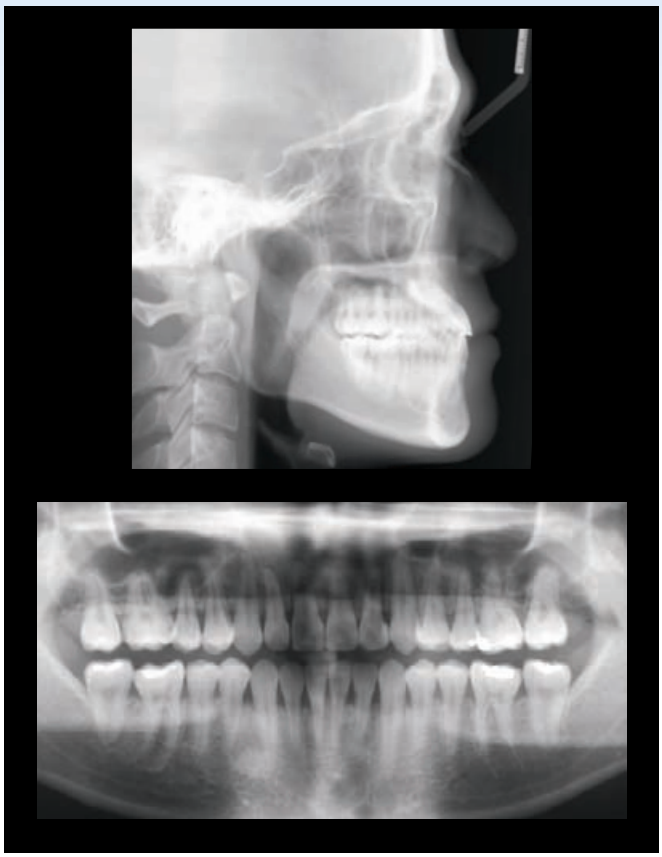


Fig. 8: Posttreatment pano and ceph radiographs

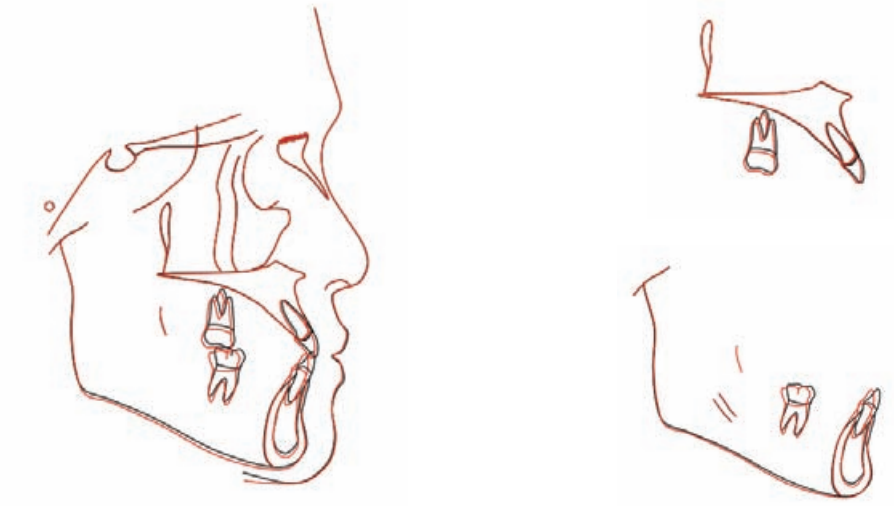


Fig. 9: Superimposed tracings

Fig. 10:

A bite turbo was bonded on the lingual surface of lower right lateral incisor to avoid the bracket loosening of upper right lateral incisor.

Fig. 11:

Two upper posterior miniscrews were installed on the day of upper initial bonding. Elastic chains were attached from the miniscrews to upper canines for the distal movement of the buccal segment.

Facial:

- Straight profile
- Midface deficiency
- Prominent chin

Maxilla (*all three planes*):

- A – P: Maintain
- Vertical: Maintain
- Transverse: Maintain

Mandible (*all three planes*):

- A – P: Maintain
- Vertical: Open slightly
- Transverse: Maintain

Maxillary Dentition:

- A – P: Slight retraction to upright originally flared upper incisors
- Vertical: Slight increase
- Transverse: Maintain

Mandibular Dentition:

- A – P: Total arch retraction
- Vertical: Intrusion of incisors
- Transverse: Maintain

Facial Esthetics:

- Maintain

The ABO Discrepancy Index (*DI*) was 25 as shown in the subsequent worksheet.

Fig. 12:

Two segment of NiTi open coil springs were inserted on .016 x .022" NiTi archwire between bilateral upper central incisors and upper canines to create space for aligning the locked-in upper lateral incisors. A second .016 NiTi archwire was used to align and intrude bilateral upper lateral incisors.

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla (*all three planes*):

- A – P: Maintain
- Vertical: Maintain
- Transverse: Maintain

Mandible (*all three planes*):

- A – P: Maintain
- Vertical: Open slightly
- Transverse: Maintain

Maxillary Dentition:

- A – P: Slight retraction to upright originally flared upper incisors
- Vertical: Slight increase
- Transverse: Maintain

Mandibular Dentition:

- A – P: Total arch retraction
- Vertical: Intrusion of incisors
- Transverse: Maintain

Facial Esthetics:

- Maintain

TREATMENT PLAN

Nonextraction treatment was pursued with extra-alveolar bone screw anchorage, lateral to the molars in all four quadrants. The skeletal anchorage was used for retraction of all posterior segments to alleviate maxillary arch crowding and retract the entire mandibular dentition. A bite turbo on the lingual surface of the lower right lateral incisor (*Fig. 10*) was used to facilitate correction of anterior crossbite. Besides the TADs for canine distalization, open coil springs were also used to create space for the locked-in upper lateral incisors. A segment

Fig. 13: Upper arch was well aligned after three months treatment. Lower arch was initially bonded at this time.

Fig. 14: Class III elastics from the upper posterior miniscrews were used to distalize lower canines.

Fig. 15:

Class III elastics were discontinued two months later, because the lower canines were not distalized efficiently. Two miniscrews were inserted on both buccal shelves of mandible for further canine distalization.

Fig. 16: Both arches were well aligned into .016 x .022" NiTi archwires after 11 months treatment.

Fig. 17: Further adjustment in arch form and occlusal detailing were done on .016 x .022" archwires.

Fig. 18: IPR was performed for reducing the black triangles.

of .016 NiTi archwire was introduced to align and intrude the upper lateral incisors for the correction of anterior crossbite.

APPLIANCES AND TREATMENT PROGRESS

A modified Alexander prescription was used. The slot size of the anterior teeth (*canine to canine*) were .018", and .022" for the posterior teeth. The initial archwire for the upper arch was .016" thermal (*Copper*) NiTi archwire. A bite turbo was bonded at the lingual surface of lower right lateral incisor to avoid bracket interference while correcting the cross-bite (*Fig. 10*). Two miniscrews (*OrthoBoneScrew, Newton's A, Inc. 2x12mm*) were installed in the upper posterior area (*zygomatic crest*) on the same day as the initial bracket bonding (*Fig. 11*). Bilateral elastic chains were attached from the miniscrews to the maxillary canines for retraction to crearte space for the anterior tooth alignment. One month later, a dual-archwire force system was introduced. The .016 x .022" NiTi archwire engaged the brackets on all the maxillary teeth, and a "*piggy-back*" 016 NiTi archwire, with two segments of NiTi open coil springs, was inserted to create space for the blocked-out lateral incisors (*Fig. 12*).

Once space was opened, both upper lateral incisors were fully engaged on a .016 Thermal NiTi archwire, and retraction of the upper canines continued, utilizing TAD anchorage (*Fig. 13*). At the same appointment, brackets were bonded on the lower arch, but the patient declined having two additional miniscrews placed. Therefore, Class III elastics (*Ram, 5/16", 4.5 oz*) were prescribed to retract the lower canines to alleviate lower anterior crowding (*Fig. 14*). However, the Class III elastics were not very efficient, so two months later two additional miniscrews (*OrthoBoneScrew, Newton's A, Inc. 2x12mm*) were installed on the bilateral buccal shelves to retract the lower canines (*Fig. 15*). The alignment of both arches improved rapidly with four quadrants of miniscrew anchorage. After 11 months of active treatment, both arches were well aligned with .016 x .022" NiTi archwires (*Fig. 16*). Adjustment of the archform and detailing of the occlusion was performed with .016 x .022" SS archwires (*Fig. 17*). Interproximal reduction (*IPR*) was performed in the anterior segments of both arches to reduce the black triangles (*Fig. 18*). Following space closure and final detailing, appliances were removed after 20 months of active treatment.

RESULTS ACHIEVED

Maxilla (*all three planes*):

- A – P: Maintain
- Vertical: Maintain
- Transverse: Maintain

Mandible (*all three planes*):

- A – P: Slight retraction with modest clockwise rotation of the mandible
- Vertical: Opened slightly as the mandible rotated posteriorly
- Transverse: Maintain

Maxillary Dentition:

- A – P: Maintain
- Vertical: Slight extrusion of the molars
- Transverse: Maintain

Mandibular Dentition:

- A – P: Retraction of the entire arch
- Vertical: Maintain
- Transverse: Maintain

Facial Esthetics:

- Maintain

RETENTION

Upper and lower clear retainers were delivered, and the patient was instructed to wear them full time for the first 6 months and nights time only thereafter. In addition, the patient was instructed in proper home hygiene and maintenance of the retainers.

FINAL EVALUATION OF TREATMENT

The Cast-Radiograph Evaluation score was 23 points, with most of the points reflecting problems in marginal ridge alignment. The discrepancies in marginal ridges resulted from the distal forces on both arches, which retracted the buccal segments, resulting in distal tipping of posterior teeth. Cephalometric superimpositions demonstrated total arch retraction of the lower dentition, so that the upper incisors could be uprighted to correct the patient's perception that the maxillary arch was "*protrusive.*" Overall, this challenging skeletal and dental malocclusion was treated to an appropriate facial and dental result with no iatrogenic problems.

DISCUSSION

Tweed[1] reported that Angle used the E-arch to expand a crowding dentition to achieve a nonextraction correction of crowded malocclusions. This approach contrasted with Case who advocated extractions to avoid excessive dental arch expansion.[1] The dominant treatment option for crowding in the first half of the 20th century was Angle's nonextraction treatment. Tweed conducted follow up studies of of his patients and found some relapses, so he retreated these cases with premolar extraction to avoid over-expansion of the arches and excessive mandibular incisor protrusion. Overall, the corrections were much more stable. Tweed later published his findings to explain the importance of Frankfort-mandibular incisor angle (*FMIA*) in orthodontic diagnosis and treatment planning.[2,3] In that study he closely analyzed the cephalograms of winners from a beauty pageant. He found out that the FH plane, the long axis of the lower incisors, and the mandibular plane angle formed a triangle, which is commonly known as the "*Tweed triangle.*" He concluded the

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	79°	79°	0°
SNB°	83°	81°	2°
ANB°	-4°	-2°	2°
SN-MP°	29°	29°	0°
FMA°	25°	27°	2°
DENTAL ANALYSIS			
U1 TO NA mm	2 mm	3 mm	1 mm
U1 TO SN°	118°	112°	6°
L1 TO NB mm	2 mm	0 mm	2 mm
L1 TO MP°	89°	83°	6°
FACIAL ANALYSIS			
E-LINE UL	-3 mm	-5 mm	2 mm
E-LINE LL	-1 mm	-2 mm	1 mm

■ Table. Cephalometric summary

FMIA of these "*good looking ladies*" was above 65 degrees. Hence, Tweed set his treatment goal to achieve an FMIA above 65 degrees. He removed four bicuspids to make room for incisor retraction, and to achieve balance for lower face esthetics. However, following the "*rule of numbers*" blindly may lead to a dished in face in some cases. So consideration of the profile is important when reviewing the numbers on cephalometric analyses.

Considering the profile of this patient (*Fig. 1*), extraction treatment may result in unacceptable midface deficiency ("*dishedin*").[4,5] Hence, a nonextraction treatment plan was indicated. However, the marked crowding in each arch precluded conventional non-extraction treatment because it would produce excessive expansion of the arch and/or proclination of incisors. Such compromises may predispose the patient to relapse. The rationale for the nonextraction modality in the current patient was to alleviate anterior crowding by distal movement (*retraction*) of the entire dentition. Such an approach can avoid flaring of the incisors and over-expansion of the intercanine width.[6] In effect, the corrected dentition can be aligned over the apical base of bone. Three-year post-treatment records of the present patient show satisfactory stability (*Figs 19, 20*).

One of the major limiting factors for total arch distalization is the posterior limit of the alveolar process. The distal boundaries are formed by the maxillary tuberosity, and the mandibular accending ramus with its over-lying soft tissue. For maxillary dental arch retraction, Sugawara suggested that the average amount of upper molar distalization is 3.78mm at the crown level and 3.2mm at the root level.[7] However, attempts to translate mandibular molars distally have been less successful: 3.5mm at crown level and 1.8mms at root apex level.[8] Thus, there is more of a tendency for mandibular molars to tip rather than be translated distally. Root distal bends in the mandibular archwire or repositioning of molar brackets for a root distal moment may be indicated for patients undergoing retraction of the entire mandibular arch.

Because of the limitations in the average amount of molar retraction that can be achieved with TAD anchorage, clinicians should inform patients that a re-evaluation will be conducted at 8 to 10 months after the start of the treatment to decide on the final treatment plan. If the initial nonextraction treatment is unsatisfactory, the treatment plan can be modified into an extraction approach. Furthermore, there may be complaints of discomfort as periodontal tissue builds-up distal to the terminal molars, and periodontal surgery may be necessary to reduce the amount of gingival tissue in the direction of tooth movement.

Fig.19: Three years posttreatment facial photographs

Fig. 20: Three years posttreatment intraoral photographs

CONCLUSION

Total arch distalization with TADs provides a valuable treatment option for patients with severe crowding and a straight profile. By increasing the arch circumference, crowded teeth can be aligned over the apical base of bone, and this nonextraction approach helps avoid the dished-in midface that commonly occurs with extraction treatment.

ACKNOWLEDGMENT

Thanks to Ms. Tzu Han Huang for proofreading this article.

REFERENCES

1. Sabri R. Treatment of a severe arch-length deficiency with anteroposterior and transverse expansion: long-term stability. Am J Orthod Dentofacial Orthop 2012;137(3): 401-11.
2. Erdinc AE, Nanda RS, Dandajena TC. Profile changes of patients treated with and without premolar extractions. Am J Orthod Dentofacial Orthop 2007;132(3):324-31.
3. Konstantonis D. The impact of extraction vs nonextraction treatment on soft tissue changes in Class I borderline malocclusions. Angle Orthod 2012;82(2):209-17.
4. Kyung SH, Lee JY, Shin JW, Hong C, Dietz V, Gianelly AA .Distalization of the entire maxillary arch in an adult. Am J Orthod Dentofacial Orthop 2009;135(4 Suppl):S123-32.
5. Kook YA, Kim SH. Treatment of Class III relapse due to late mandibular growth using miniscrew anchorage. J Clin Orthod 2008;42(7):400-11.
6. Paik CH, Nagasaka S, Hirashita A. Class III nonextraction treatment with miniscrew anchorage. J Clin Orthod 2006;40 (8):480-4.
7. Weisner SM. Treatment of a skeletal Class III malocclusion

with mandibular asymmetry using a single miniscrew. J Clin Orthod 2009;43(5):335-41.

8. Yamada K, Kuroda S, Deguchi T, Takano-Yamamoto T, Yamashiro T. Distal movement of maxillary molars using miniscrew anchorage in the buccal interradicular region. Angle Orthod 2009;79(1):78-84.
9. Yanagita T, Kuroda S, Takano-Yamamoto T, Yamashiro T .Class III malocclusion with complex problems of lateral open bite and severe crowding successfully treated with miniscrew anchorage and lingual orthodontic brackets. Am J Orthod Dentofacial Orthop 2011;139(5):679-89.
10. Jung MH, Kim TW. Biomechanical considerations in treatment with miniscrew anchorage. Part 1: the sagittal plane. J Clin Orthod 2008; 42(2): 79-83.
11. Jeon JM, Yu HS, Baik HS, Lee JS. En-masse distalization with miniscrew anchorage in Class II nonextraction treatment. J Clin Orthod 2006;40(8):472-6.
12. Gracco A, Luca L, Siciliani G. Molar distalization with skeletal anchorage. Aust Orthod J 2007;23(2):147-52.
13. Sugawara J, Kanzaki R, Takahashi I, Nagasaka H, Nanda R. Distal movement of maxillary molars in nongrowing patients with the skeletal anchorage system. Am J Orthod Dentofacial Orthop 2006;129(6):723-33.
14. Sugawara J, Daimaruya T, Umemori M, Nagasaka H, Takahashi I, Kawamura H, Mitani H. Distal movement of mandibular molars in adult patients with the skeletal anchorage system. Am J Orthod Dentofacial Orthop 2004;125 (2):130-8.

ABO 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 = 6

OVERBITE

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

Total = 0

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 7

OCCLUSION

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

Total = 4

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 2

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° 2 x 1 pt. = 2

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 = 6

OTHER (See Instructions)

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

Identify:

Total = 0

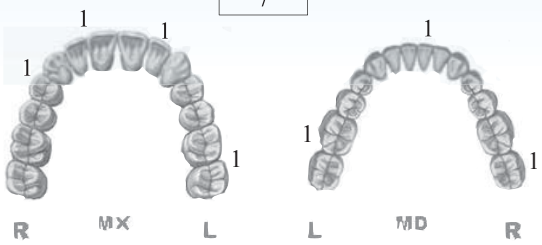
Cast-Radiograph Evaluation

Case # 2 **Patient**

Total Score: 23

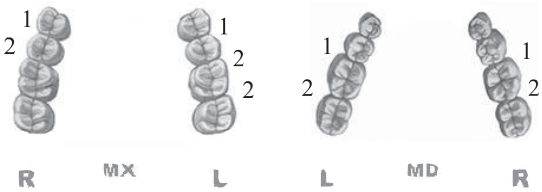
Alignment/Rotations

7



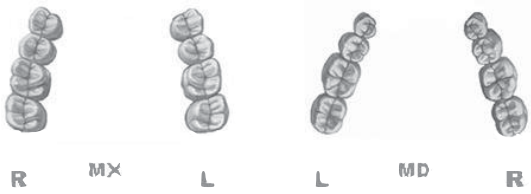
Marginal Ridges

10



Buccolingual Inclination

0

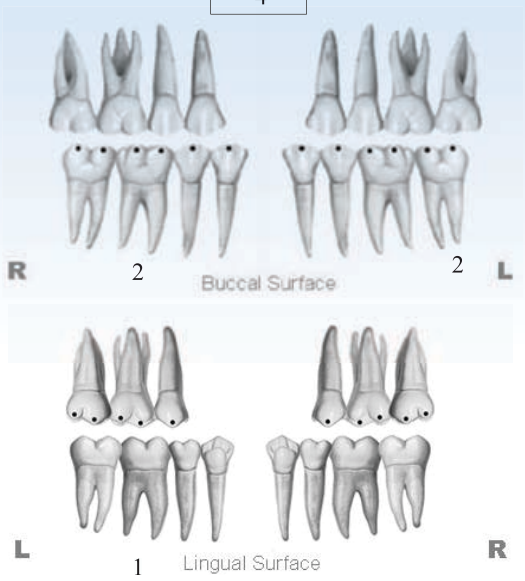


Overjet

0

Occlusal Contacts

4

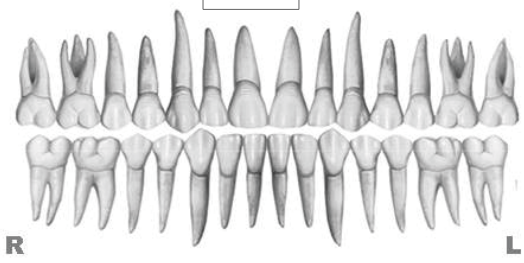


Occlusal Relationships

1

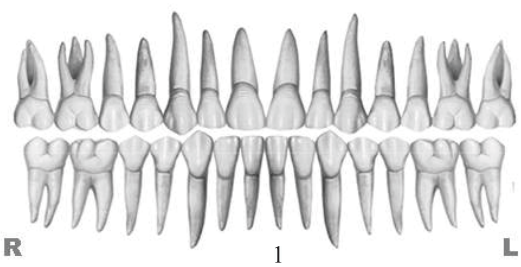
Interproximal Contacts

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.

Orthodontic and Implant Treatment for Severe Crowding Complicated by Missing Molars

HISTORY AND ETIOLOGY

A 33-year-old female was referred by her dentist for orthodontic consultation to evaluate her Class II Division 2, mutilated dentition (*Fig. 1*). Bilateral miniscrews were evident in the infrazygomatic crest areas, that had been placed by her dentist, prior to the decision to send the patient for specialty evaluation. The patient's chief concern was an irregular dentition, with two missing teeth in the lower left posterior area (*Figs. 1-2*). No other contributing medical or dental history was reported.

Following 3 years and 11 months of orthodontic treatment, the crowding was relieved and the edentulous space was reduced from 14 to 8mm. As documented in Figs. 3-4, the patient was treated to an acceptable result and the residual space was restored with a single implant-supported prosthesis. Radiographic documentation of the pretreatment condition and the posttreatment result is provided in Figs. 5-6, respectively. Cephalometric data is presented in Table 1, and Fig. 7 shows the superimposed cephalometric tracings.

Fig. 1: Pretreatment intraoral photographs

Fig. 2: Pretreatment study models

DIAGNOSIS

Skeletal:

Skeletal Class II (*SNA 79°, SNB 74°, ANB 5°*)

High mandibular plane angle (*SN-MP 38°, FMA 31°*)

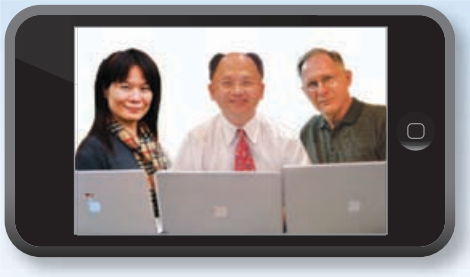
Dental:

Class II molar relationship, 2mm on the right side, no first molar interocclusal relationship on the left side

OJ 1mm; OB 6mm

Upper midline was shifted 4mm to the left of the facial midline

Teeth #10 and #29 blocked-in



Dr. Shu Ping Tseng, Lecturer, Beethoven Orthodontic Course (left)
Dr. Chris Chang, Director, Beethoven Orthodontic Center (middle)
Dr. Eugene W. Roberts, Consultant, News and Trends in Orthodontics (right)

Fig. 3: Posttreatment intraoral photographs

Fig. 4: Posttreatment study models

Teeth #19 and 20 missing
Lower left third molar is partially erupted.
ABO Discrepancy Index = 18

Facial:

Straight profile
Competent, slightly retrusive lips

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

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

Maxillary Dentition

- A - P: Align block-in tooth #10, flare central incisors
- Vertical: Incisor intrusion
- Transverse: Relieve crowding and midline correction

Mandibular Dentition

- A - P: Decrease width of the edentulous distance
- Vertical: Incisor intrusion
- Transverse: Correct tooth #29 buccal crossbite

Facial Esthetics: Maintain

TREATMENT PLAN

Both maxillary first premolars were extracted and canines were retracted to create space to correct the block-in left lateral incisor and the midline deviation. For the lower arch, the patient refused extraction treatment. So tooth #18 was moved mesially to reduce the width of the edentulous space, due to the loss of teeth #19 and #20. Space closure retracted the mandibular left canine and first premolar,

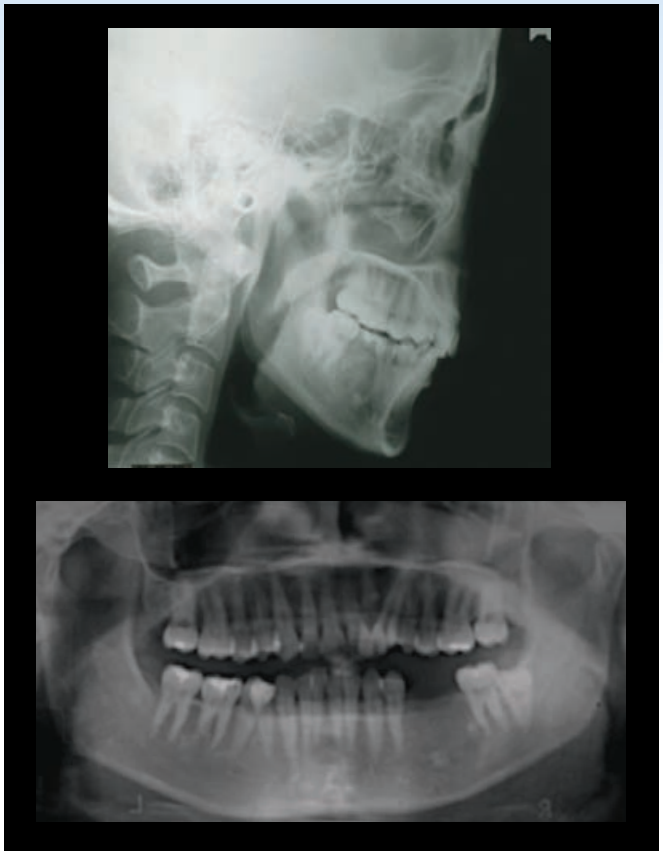


Fig. 5: Pretreatment pano and ceph radiographs

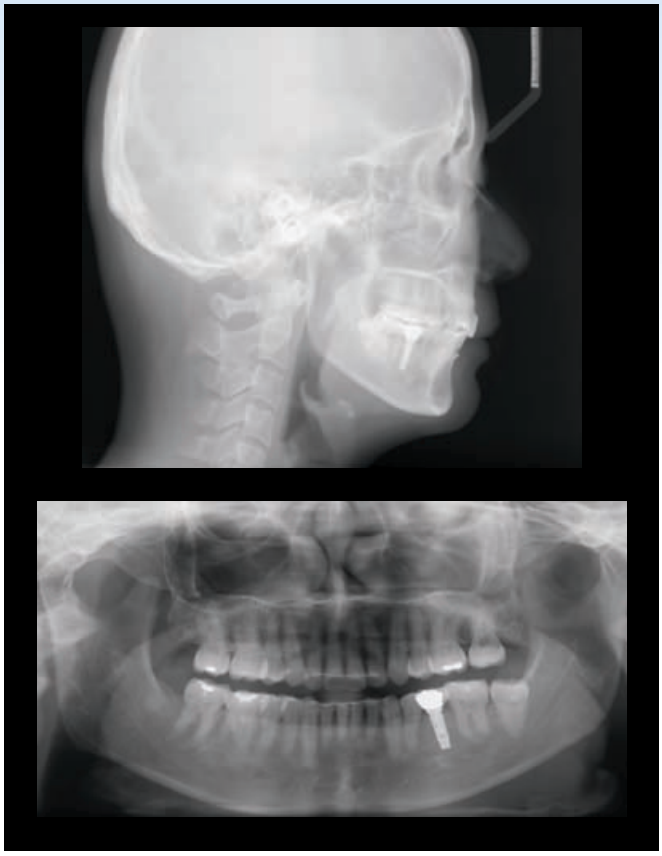


Fig. 6: Posttreatment pano and ceph radiographs

resulting in enough space to relieve lower arch crowding and help correct the midline discrepancy.

APPLIANCES AND TREATMENT PROGRESS

.022" Damon 3MX brackets (*Ormco*) were selected. The archwire sequence was .014 CuNiTi, .014x.025 CuNiTi, . 017x.025 TMA and .019x.025 SS. Two mini-screws (*2 x 12mm, OrthoBoneScrew, Newton's A, Inc.*), previously inserted in the maxilla were used to retract the maxillary canines to close extraction space and to correct the midline.

At the start of active treatment, one section of open coil springs was applied between the upper left central incisor and adjacent canine to create space for the block-in lateral incisor; meanwhile, upper

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	79°	79°	0°
SNB°	74°	74°	0°
ANB°	5°	5°	0°
SN-MP°	38°	39°	1°
FMA°	31°	32°	1°
DENTAL ANALYSIS			
U1 TO NA mm	-5.5 mm	-4 mm	1.5 mm
U1 TO SN°	76°	86°	10°
L1 TO NB mm	-7 mm	-5 mm	2 mm
L1 TO MP°	83°	93°	10°
FACIAL ANALYSIS			
E-LINE UL	-3.5 mm	-3 mm	0.5 mm
E-LINE LL	-3 mm	-2.5 mm	0.5 mm

Table 1. Cephalometric summary

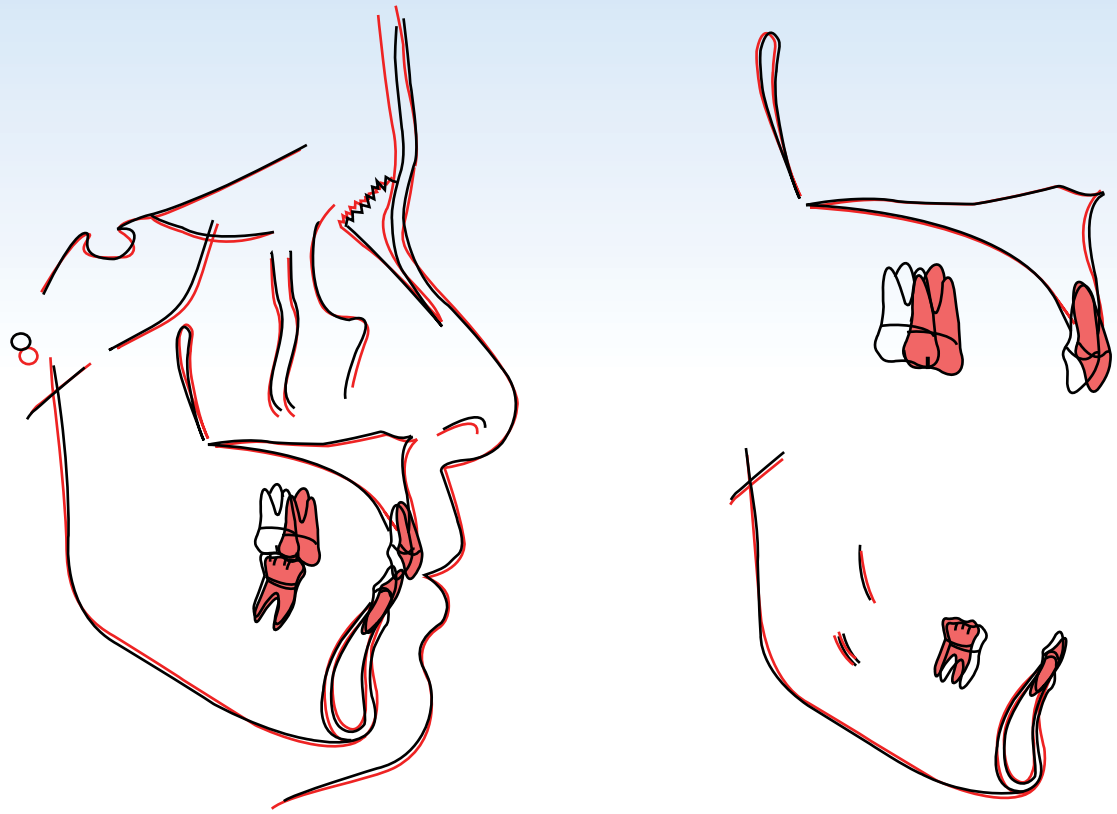


Fig. 7: Superimposed tracing showed posterior teeth were elongated and anterior teeth were flared without any significant skeletal change.

Fig. 8: Intraoral photos showed the alignment progress of tooth #10.

Fig. 9: Intraoral photos showed the progress of tooth #29 alignment.

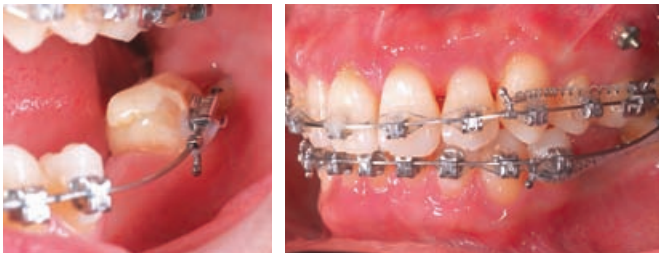


Fig. 10: Intraoral photos showed the force system for molar traction.

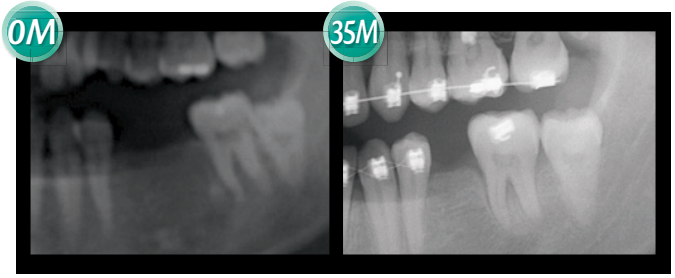


Fig. 11: X-ray film showed third molar drifted forward spontaneously.

canines were laced back to the miniscrews above the first molars to control incisal flaring. After 4 months of arch expansion, tooth #10 was bonded with a bracket and engaged on the arch wire, and the bite was opened with bite turbos on the posterior teeth (*Fig. 8*).

In the lower arch, an open coil spring was applied between #28 and #30 to open space for the block-in premolar. Limited progress was achieved after 8.5 months of expansion. A .014 CuNiTi wire segment engaged tooth #29 but there was still no progress after 2 months. After that an open coil spring, combined with the double wire technique, and crisscross elastics corrected the alignment of #29 in 2 months (*Fig. 9*).

By using mini screws and coil springs, the upper right extraction site was closed in 22 months. For

Fig. 12: 3D image showed the bone condition of implant site.

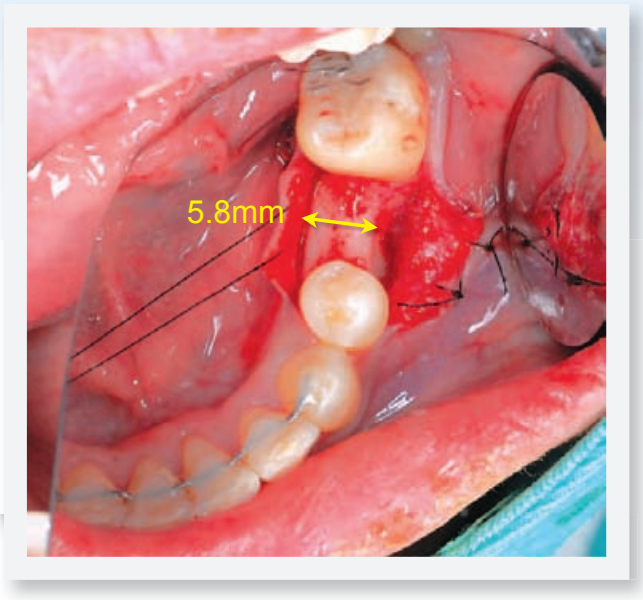


Fig. 14: Bone exposed after flap elevation.

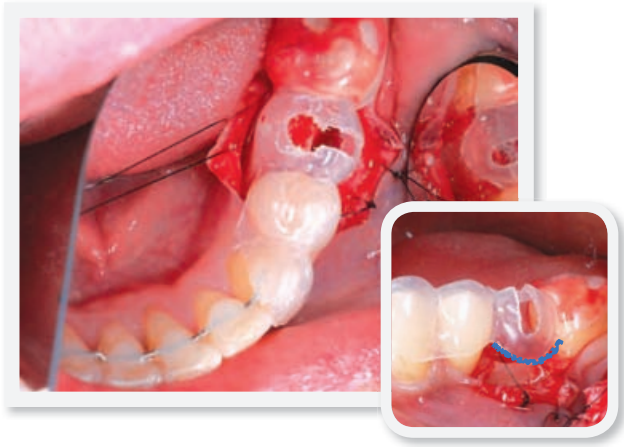


Fig. 13: Surgical stent

the lower left area, power chains, elastic threads and coil springs were used to pull the second molar forward by attaching a crimping hook on the arch wire. It took 31 months to decrease the width of the mandibular left edentulous area from 14mm to 8mm (*Fig. 10*). Moreover, the third molar drifted mesially spontaneously (*Fig. 11*), but it never erupted into occlusion.

At the debonding visit, an upper clear overlay retainer, as well as upper 2-2 and lower 3-3 fixed retainers were delivered. A fixed retainer to maintain space closure was cemented right after implant placement and restoration.

IMPLANT PLACEMENT

Before surgery, a three-dimensional cone beam computed tomography (*CBCT*) image was taken to evaluate bone density, volume (*H:13.6mm H x W:5.8mm*), and the anatomic structure of implant site (*Fig. 12*). A surgical stent was designed to guide the mesial-distal (*M-D*) position, buccal-lingual (*B-L*) position and axial angulation of the surgical bur to achieve an optimal future gingival margin (*Fig. 13*).

A mid-crestal incision was made with no.15 scalpel across the edentulous area. Sulcular incisions with

no.12 scalpel were performed on the buccal and lingual of the adjacent teeth. After exposing the bone with full thickness flaps, the buccal flap was sutured on the cheek and the lingual flap was pulled lingually with a needle holder to obtain a clear surgical view of the implant site (*Fig. 14*).[1]

Following the implant manufacturer's recommended drilling and insertion protocol, a 4.0 x 11.5mm fixture was inserted in the center of ridge with the prescribed angulation. The fixture depth was 3mm lower than the predicted clinical gingival margin, guided by the stent. The healing abutment was placed, and the flap was sutured with interrupted 5-0 nylon sutures. The positions of the teeth adjacent to the implant were retained with a bonded retainer made from .019X.025 stainless steel wire (*Fig. 15*). The prosthesis was planned for delivery 6 months later.

PROSTHESIS FABRICATION

After six months of healing, the healing abutment was removed and replaced with an abutment that had a 5mm core height and 2mm cuff height (*Fig. 16: a, b*). The torque ratchet was applied on the abutment until 35 N-cm was achieved. A snap impression with polyvinyl siloxane was fitted with an abutment analog, and type IV dental stone was poured to prepare a working cast (*Fig. 16: c, d, e, f*). Verifying the inter-occlusal space from the casts registration, suggested that trimming the abutment or the antagonist at chairside might be necessary to ensure an adequate inter-occlusal space. The marginal integrity of metal coping was confirmed with a dental explorer (*Figs. 17-18*). Once the finished crown was seated, the appropriate tightness of the contact area was confirmed with dental floss. After clinical adjustment and verification of the fit and

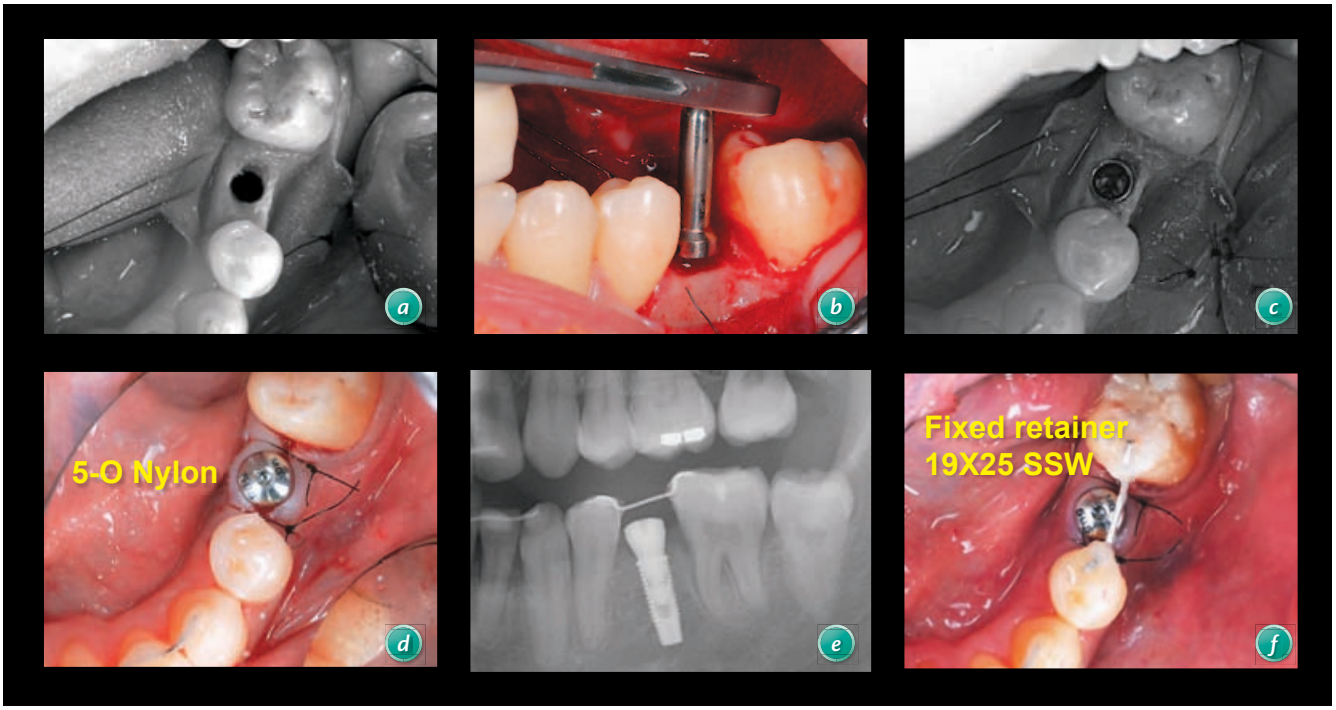


Fig. 15: Illustrations showed the surgical procedure for implant insertion.

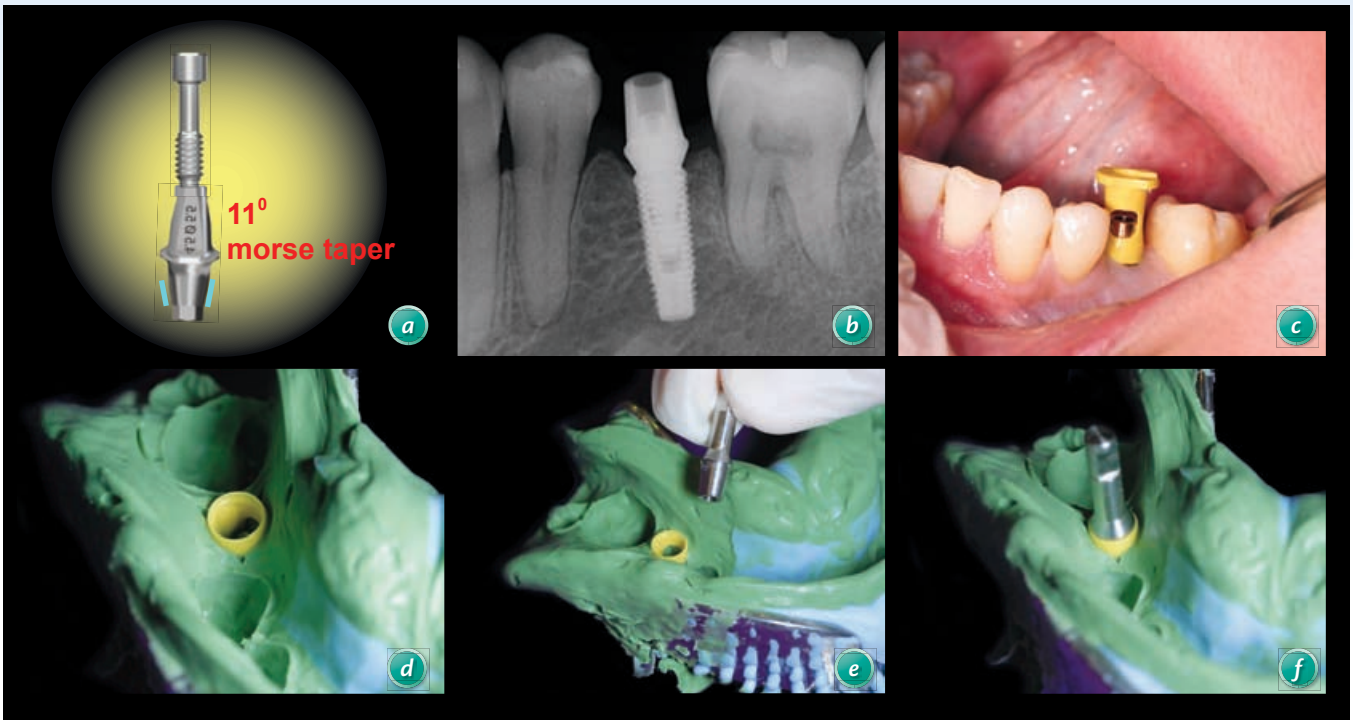


Fig. 16: a,b,11° Morse taper abutment. c,d, Snap impression copping. e,f, Analog in place.

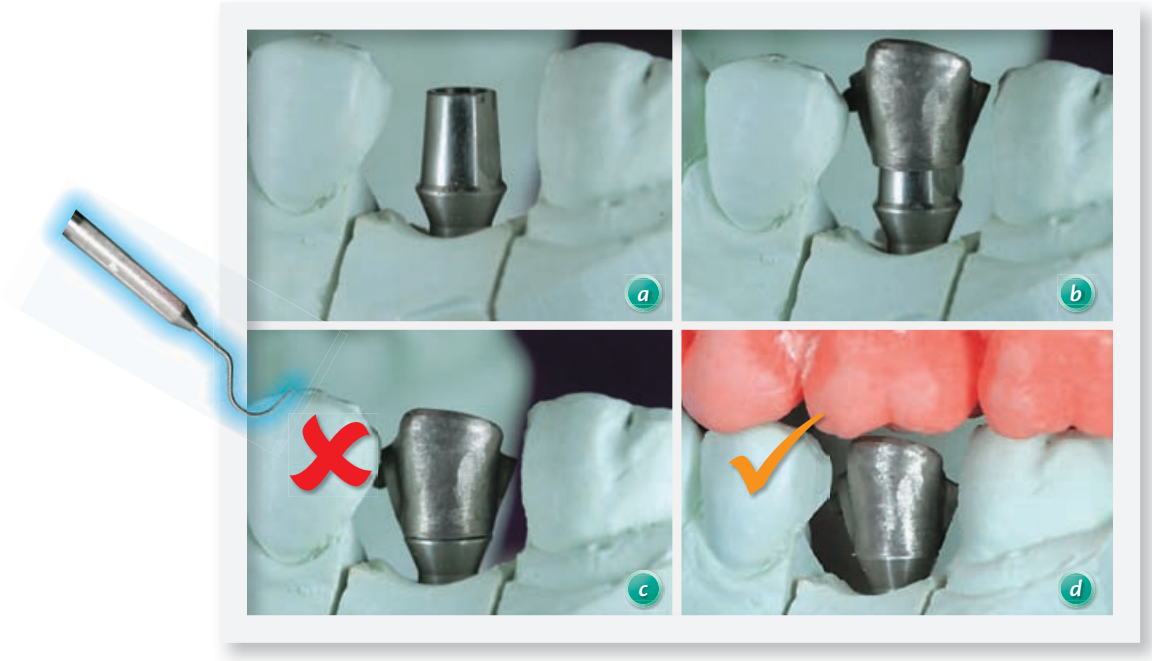


Fig. 17: Marginal integrity of metal copping was verified with a dental explorer (buccal view).

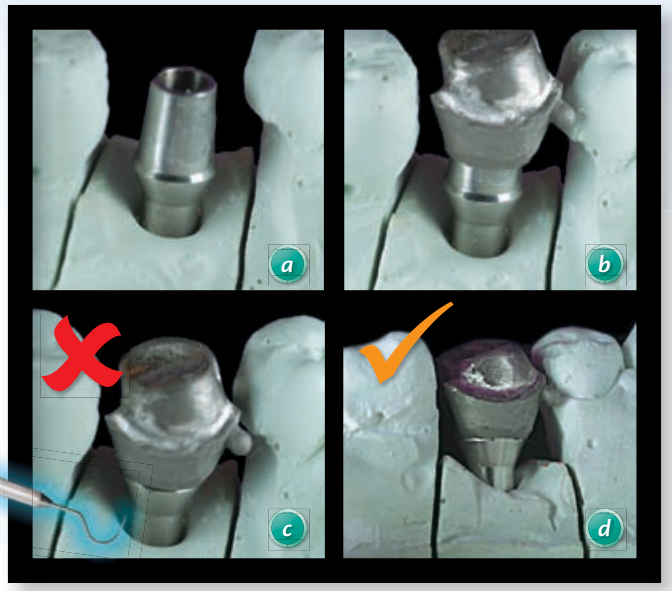


Fig. 18:
Marginal integrity of metal copping was verified with a dental explorer (lingual view).

occlusion, the definitive crown was completed and retained with temporary cement. The screw access hole was filled with composite resin. The crown remover on the lingual side was trimmed off 10 days later. The final prosthesis is shown in Fig. 19.

RESULTS ACHIEVED

Maxilla (*all three planes*):

- A - P: Maintained
- Vertical: Maintained
- Transverse: Maintained

Mandible (*all three planes*):

- A - P: Maintained
- Vertical: Maintained
- Transverse: Maintained

Maxillary Dentition

- A - P: Tooth #10 optimally aligned, incisors tipped labially
- Vertical: molars moved mesially
- Inter-molar / Inter-canine Width: Inter-molar width maintained and inter-canine width increased

Fig. 19: Final prosthesis.

Mandibular Dentition

- A - P: Maintained
- Vertical: Molars elongation
- Inter-molar / Inter-canine Width: Maintained

Facial Esthetics:

Maintained

RETENTION

The upper fixed retainer 2-2 and the lower fixed retainer 3-3 were bonded on every tooth. An upper clear overlay retainer was delivered. The patient was instructed to wear it full time for the first 6 months and nights only thereafter. Before fabrication of the implant supported prothesis, the edentulous space was maintained temporarily with a .019x.025 SS wire bonded on the adjacent teeth (*Fig. 15f*). The patient was instructed in proper home hygiene for maintenance of the retainers.

FINAL EVALUATION OF TREATMENT

The Cast-Radiograph Evaluation was scored at 24

points which was considered to be a board quality result. The major discrepancies were problems in alignment/rotation (*7 points*), marginal ridge discrepancy (*5 points*) and occlusal relationships (*4 points*). The lower midline was shifted 2mm to the left, resulting in a left side Class II canine relationship. The OB and OJ were ideal. The original profile was maintained as planned.

The parallelism and stability of the implant were good. The gingival contour of implant prosthesis was acceptable.

Overall, there was significant improvement in both dental alignment and occlusal relationship. The patient was satisfied with the result.

DISCUSSION

Full dentition should be taken into consideration for planning optimal dental treatment of complex, mutilated malocclusions. Critical consideration should be given to space distribution. For this patient, orthodontic treatment prior to implant placement and prosthesis fabrication, successfully relieved crowding and simplified the prosthesis fabrication (*Fig. 20*). In retrospect, it would have been wise to surgically uncover the lower left third molar to enhance its eruption during space closure of the edentulous space, mesial to the second molar. It may have been possible to align the third molar, thereby providing better occlusal contact for its antagonist, the upper left second molar. Using the retromolar implant, anchorage method of Roberts et al.,[2] it may have been possible to close the entire lower left edentulous space, but the treatment time would have been lengthened, because mandibular molars can be translated at a rate of only about 0.36mm per month.

In the upper arch, lace-back ties to the miniscrews prevented incisal flaring as space was created to align the block-in lateral incisor. This method favored canine retraction into the extraction spaces, and

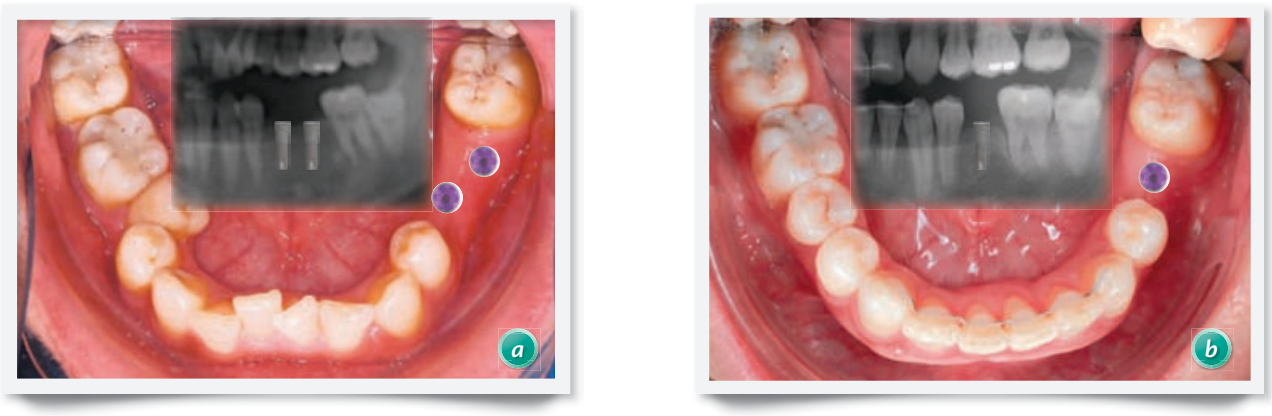


Fig 20:

a, Without orthodontic treatment intervention, the spaces might be filled with two implants in a crowding dentition.
b, With orthodontic treatment intervention, better long term prognosis is expected.

improved the angulation of the upper left canine. These efficient mechanics aligned the blocked-in lateral incisor, uprighted the tipped canine and closed the first bicuspid extraction spaces in only 7 months (*Fig. 8*).

Extraction of lower right second premolar was recommended to facilitate treatment, but the patient refused that option. Non-extraction therapy in the lower arch, combined with the use of coil springs to open space for tooth #29, was ineffective. However, significant progress was observed when cross-elastics and the double wire technique were also applied (*Fig. 21*). It took only 3 months to bring the block-in premolar into the arch. As expected, the lower midline was shifted to the left, and the canine relationship ended up being Class II (*Fig. 22*). This was considered an optimal result considering the restraints imposed by the patient.

In order to move teeth #17 and 18 mesially, a crimping hook was applied to the arch wire in front of #18. The position of the hook changed progressively, and a power chain as well as coil springs were applied between tooth #18 and the hook, for force delivery (*Fig. 10*). As previously mentioned, space closure with the retromolar implant method[2] was considered, but the extended treatment time was undesirable; the original space was about 15mm wide, which would have required about 45 months to close the space. However, the treatment option chosen required 47 months of treatment, in addition to an implant-supported prosthesis. In retrospect, the space closure approach was a viable option, particularly if the lower left

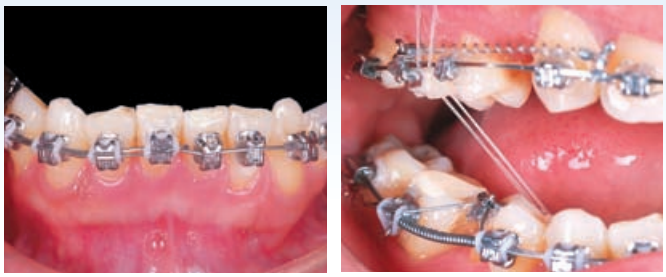


Fig. 21:
The accessary wire was tied over the main wire and brackets with O-rings.

Fig. 22:
The lower midline and occlusion of left side were compromised .

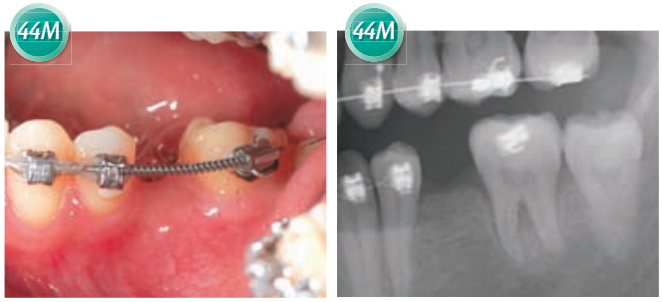


Fig. 23:
Malposed tube resulted in tipback molar, which might interfere with the protraction.

third molar could have been aligned to serve as an antagonist to the upper left second molar.

Treatment time is an important consideration in planning the management of large edentulous spaces, if the treatment requires protraction of

mandibular molars. Roberts[2] describes the bone physiology of 2nd and 3rd mandibular molars protracted into the space of a missing 1st molar. The relatively flat roots of the molars move through the center of the alveolar by resorbing primarily trabecular bone on the mesial surface and forming cortical bone on the distal surface of each root. For the first few millimeters of tooth movement, the molars move rapidly. However, when the trailing root engages the cortical bone formed by the leading root, the rate of molar protraction decreases. In addition to factors related to bone physiology, the incorrect orientation of the molar tube may lead to tip-back of the 2nd molar, which apparently contributed to the slow tooth movement for the present patient (*Fig. 23*). As a precaution, one should pay attention to the precise bonding or banding position of the buccal bracket. In the 47th month of active treatment, the present patient asked to stop the protraction process and restore the remaining space with a dental implant.

Misch[3] suggests that when mesiodistal space in molar area is 14mm, two implants with 4mm diameter is recommended (*Table 2*). However, when the full dentition was considered, teeth alignment and space redistribution by orthodontic treatment before placing the implant-supported prosthesis provided a more comprehensive treatment with a better prognosis (*Fig. 20*). After orthodontic treatment, a three-unit bridge or a single implant was suggested for filling up the remaining 8mm of space.

For better oral hygiene access and preservation of adjacent natural teeth, the patient chose to have a single implant to restore the dentition (*Table 3*).[4] Priest reported a 97% success rate of a posterior single tooth in a 10-year follow-up study. More importantly, no adjacent teeth serving as abutments would subsequently be lost due to endodontic failure.[5]

M-D dimension (mm)	Implant Diameter
7	4 mm
8 ~ 1 2	5 mm
12 ~ 14	Gain additional space,then place 2x4 mm
14	2x4 mm
15	1x4 mm, 1x5 mm
16	2x5 mm

■ Table.2 Molar replacement

Disadvantages of Fixed Partial Dentures
1. Mean life span often 10~15 years 2. Caries and endodontic failure of abutment teeth most common complication 3. Increased plaque retention of pontic increased caries and periodontal disease risk 4. Damage to healthy teeth 5. Failure of prosthesis related to loss of abutment teeth (8% ~18% within 10 years) 6. Fracture (porcelain, tooth) 7. Esthetics (anterior regions) 8. Uncemented restoration

■ Table.3 Disadvantages of Fixed Partial Denture

A natural premolar tooth root is 4.2mm in diameter at 2mm below the cementoenamel junction (*CEJ*). Therefore, the most common implant diameter is about 4mm at the crest module. This allows for approximately 1.5mm of bone on the proximal surfaces adjacent to natural teeth when the mesiodistal space is 7mm or greater.[6] The minimum implant length selected for posterior teeth is usually 9mm, and the longest length is at least 2mm less than the available bone height.[7] After verification with three-dimensional imaging, the available bone volume for the present patient was 5.8 in width and 13.6mm in height. Hence, a 4 x 11.5mm fixture was selected (*Fig. 12*). For better primary stability, preserving more buccal bone plate is indicated (*ideally 2mm thick*). Thus, the implant was inserted more lingually, which is expected to compromise the emergence profile of the crown (*Fig. 24*). In situations when primary stability of an implant cannot be achieved due to a severe bone defect,

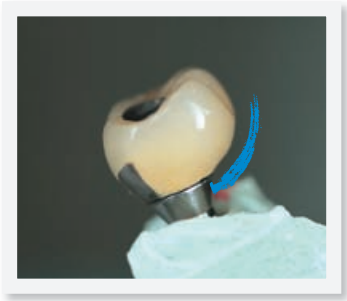


Fig. 24:

Compromised emerging profile of final prosthesis due to the lingual position of implant placement.

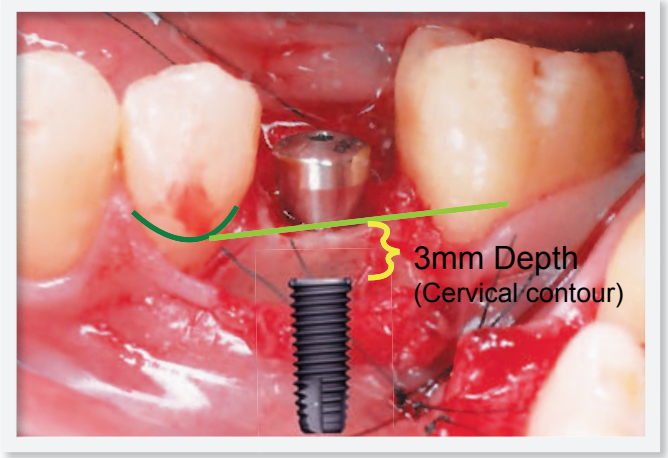


Fig. 25:

Ideally, the implant height is 3mm below the cervical contour of final prosthesis.

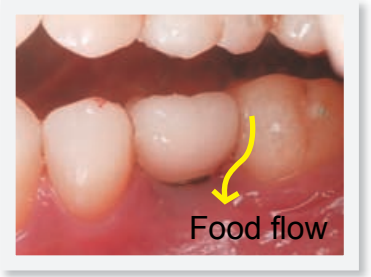


Fig. 26:

Supra-gingiva margin of final prosthesis due to inadequate depth of fixture. Yellow arrow showed the food flow on the uneven surface.

Fig.27:

Replacement the spur with a inlay box (green) would be a good alternation for the the future retrive.

or when implant placement is not possible in the ideal location for subsequent prosthetic therapy, ridge augmentation in a lateral direction has been shown to be a method with high predictability and a good success rate.[8] Therefore, ridge augmentation should be considered if the implant location will be compromised.

A well designed stent should provide guidance in the M-D, B-L position, axial inclination, as well as the height of implant placement. The Gargula[9] and Grunder[10] concepts of biologic width are 1mm of gingiva sulcus and 2mm of junctional epithelium and connective tissue. This 3mm of biologic width is a critical consideration for determining the ideal location of implant placement. implants should be placed with at least 2mm of buccal bone thickness and 3mm of fixture depth below the cervical contour.[11,12] Chang renamed it as the 2B-3D rule[13] to be considered for the future prosthesis. In this case, the implant depth was set relative to the CEJ of adjacent teeth, instead of the more ideal cervical contour of the final prosthesis. As such, the final prosthesis had a supra-gingival margin (*Figs. 25-26*). Although the esthetics was compromised, it was easier to maintain with good dental hygiene. In addition, the gingival line was uneven compared with the adjacent teeth; this could have been prevented by trimming the ridge to lower the bone height before implantation.

Before prosthesis fabrication, the space was maintained with .019X.025 stainless steel wire bonded to the adjacent teeth during the healing time (*Fig. 15*). This is particularly important for patients where the implant site was prepared orthodontically. Even slight relapse of the adjacent teeth can significantly impact the success of the subsequent implant-supported prosthesis.

The inter-arch dimension is crucial for crown design. For a porcelain fused to metal (*PFM*) crown, the ideal thickness of crown is at least 1.5mm (*0.3mm of metal and 1.2mm porcelain*). When dealing with inadequate inter-arch dimension, there are four ways to resolve the problem: 1. trim the abutment; 2. trim the antagonist; 3. use a screw retained crown; 4. intrude the antagonist by orthodontic mechanics.[14] For the present patient, a screw-retained crown was used. One of the greatest challenges for a cement-retained restoration is the removal of cement from deep sub-gingival margins, or a flat crown profile; however, screw loosening and porcelain fracture are two major complications of screw retained porcelain crown.

As mentioned above, better primary stability is achieved when the implant was inserted more lingually, which resulted in the flat profile of crown. Considering the compromised crown profile, caution should be exercised when occlusal adjustment is needed. The suggested adjustment protocol is as follows: reduce the contact force on the implant, compared to natural teeth in a normal bite; establish even contact force with natural teeth in a heavy bite; and avoid contact with natural teeth in lateral excursions. Furthermore, the immobility of the implant in contrast to the mobile adjacent teeth tends to cause food impaction and plaque accumulation on the cervical third of crown (*Fig.*

26). Thus, gentle soft tissue hygiene is advised considering the uneven surface of soft tissue around implant site.

Clinically bonding a spur on the lingual side provides a convenient point of force application to seat the crown and remove it if necessary. The lingual spur can be removed after permanent delivery of the prosthesis. However, if re-treatment is needed, crown removal can be difficult. A tip to solve this problem is to replace the spur with an inlay box as a good alternative to provide a force application point for removing the crown (*Fig. 27*).

CONCLUSION

Full mouth evaluation before any prosthesis fabrication is necessary for patients with missing teeth. Orthodontic treatment can correct alignment, improve the occlusal relation, and simplify prosthesis fabrication. Hence, the combined planning and execution of orthodontics and implant treatment is a progressive trend for complex malocclusions in adults with missing teeth.

ACKNOWLEDGMENT

The author would like to acknowledge Drs. Fang Chung Ding and Wu Chao Na for their valuable consultation to the writing of this case report and Ms. Tzu Han Huang for proofreading this article.

REFERENCES

1. Su B, Chang CH, Roberts WE. Implant-Orthodontic combined treatment. Over-erupted molar and scissors-bite correction. Int J Orthod Implantol 2012;26:36-51.
2. Roberts WE. Rate of translation of mandibular molars using implant-anchored mechanics. Angle Orthod 1996;66:331-37
3. Tarnow DR, Cho SC, Wallance SS. The effect of inter-implant distance on the height of inter-implant bone crest. J Periodontol 2000;71:546-9
4. Priest GF. Failure rates of restorations for single tooth replacements. Int J Prosthodont 1996;9:38-45
5. Priest GF. Single tooth implants and their role in preserving remaining teeth: a 10-year survival study. Int J Oral Maxillofac Implants 1999;14: 181-8
6. Small PN, Tarnow DP, Cho SC. Gingiva recession around wide-diameter versus standard-diameter implants: a 3-to 5-year longitudinal prospective study. Pract Proceed Aesthet Dent 2001;13:143-6
7. Misch CE, Steigenga J, Barboza E et al. Short dental implants in posterior partial edentulism: a multicenter retrospective 6-year case series study. J Periodontol 2006;77:1340-7
8. Buser D, Dula K, Hirt HP, Schenk RK. Lateral ridge augmentation using autografts and barrier membranes. A Clinical study in 40 partially edentulous patients. Int J Oral Maxillofac Surg 1996;54:420-32
9. Gargiulo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. J Periodontol 1961;32:261-267.
10. Grunder U, Gracia S, Capellu M. Influence of the 3-D bone-to-implant relationship on esthestics. Int J Periodont Rest Dent 2005;25(2):113-9
11. Kois JC, Kan JY. Predictable peri-implant gingival aesthetics: surgical and prosthodontic rationales. Pract Proced Aesthet Dent. 2001;13(9):691-8; quiz 700, 721-2.
12. Kois JC. Predictable single-tooth peri-implant esthetics: five diagnostic keys. Compend Contin Educ Dent 2004 ;25(11):895-6, 898, 900 passim; quiz 906-7.
13. Chang CH. Implant Forum No. 13: Implant position. Beethoven Podcast Encyclopedia 2011, Newton's A Ltd, Taiwan.
14. Liu FY, Marchack BW. Principles of Abutment Selection for the Single Implant (Part I). News and Trends in Orthodontics. 2011;22:74-82.

DISCREPANCY INDEX WORKSHEET

CASE # 1 PATIENT Shiao-Chung Pong

TOTAL D.I. SCORE 18

EXAM YEAR 2006
ABO ID# 9999

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 = 0

OVERBITE

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

Total = 3

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 7

OCCLUSION

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

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 = 2

OTHER (See Instructions)

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

Exam Year	2011
ABO ID#	9999

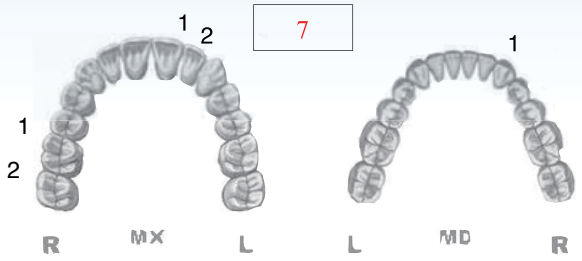
Examiners will verify measurements in each parameter.

Case # 1 **Patient** Shiao-Chung Pong

Total Score: 24

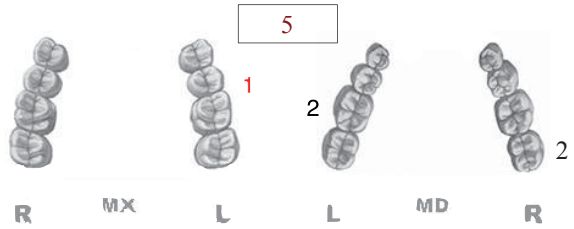
Alignment / Rotation

7



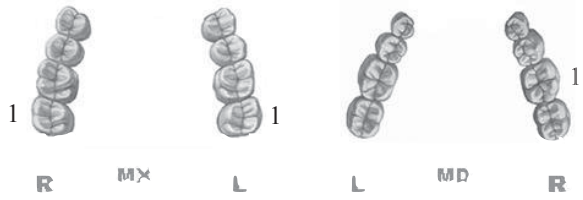
Marginal Ridge

5



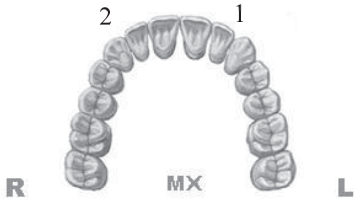
Buccolingual Inclination

3



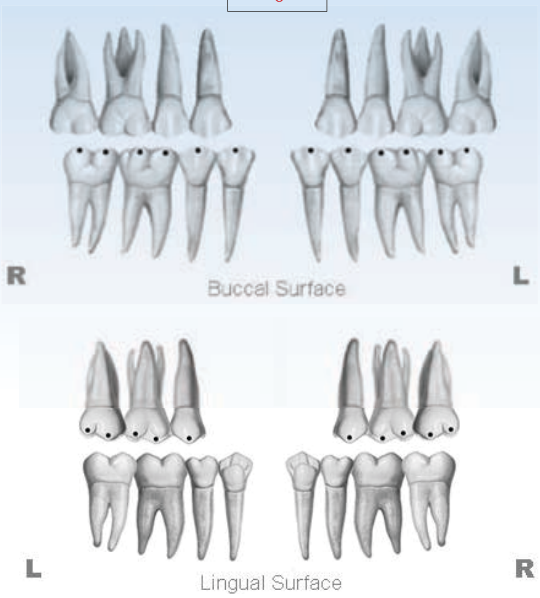
Overjet

3



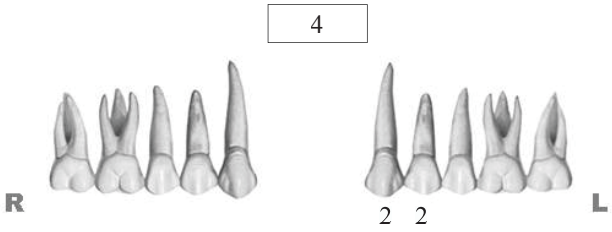
Occlusal contacts

0



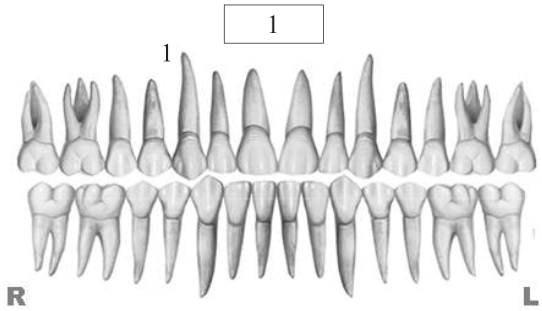
Occlusal relationships

4



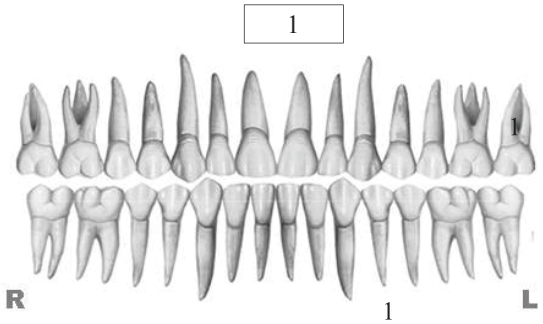
Interproximal Contacts

1



Root Angulation

1



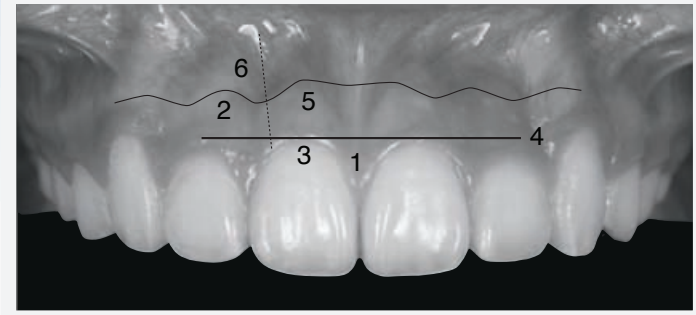
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

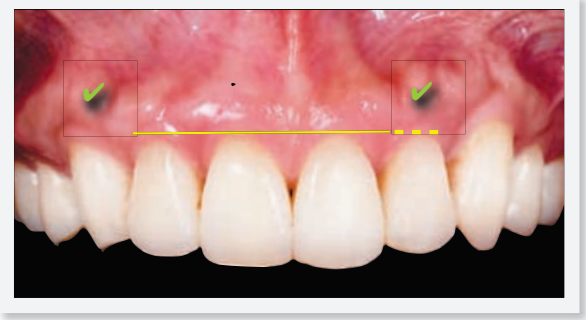
Total Score: = 4

1. Pink Esthetic Score

Total = 2



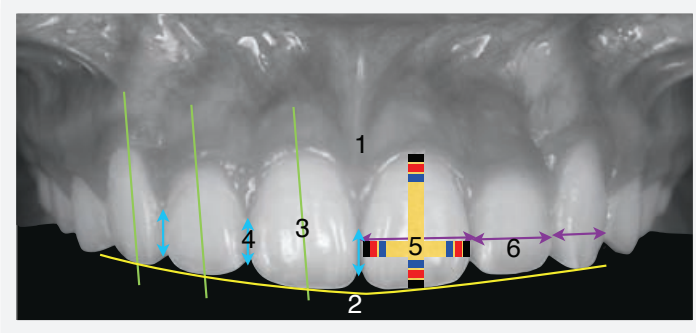
1. M-D Papilla	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2



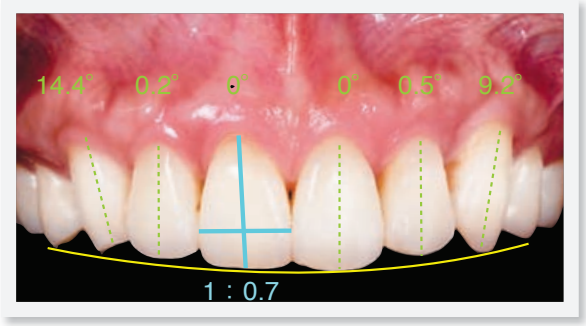
1. M&D Papilla	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	0	(1)	2
5. Root Convexity (Torque)	0	(1)	2
6. Scar Formation	(0)	1	2

2. White Esthetic Score (for Micro-esthetics)

Total = 2



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



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

Atypical Extraction of Adult Orthodontic Treatment

History and Etiology

A 27-years-old female was referred by her dentist for orthodontic consultation (*Fig. 1*). Her chief concern was maxillary anterior crowding and missing mandibular teeth (*Figures 2, 3*). There were no contributory medical problems. Clinical exam indicated that the bilateral maxillary lateral incisors were in cross-bite and mandibular left 1st molar and right 1st premolar were missing (*Fig. 2*). The patient was treated to an acceptable result as documented in Figs. 4-9. The cephalometric and panoramic radiographs document the pre-treatment conditions (*Fig. 7*) and the post-treatment results (*Fig. 8*). The cephalometric tracings before and after treatment are superimposed in Fig. 9. The details for diagnosis and treatment will be discussed below.

Fig. 1: Pretreatment facial photographs

Fig. 2: Pretreatment intraoral photographs

Diagnosis

Skeletal:

Skeletal Class I (*SNA 79°, SNB 77°, ANB 2°*)

Mandibular plane angle (*SN-MP 40°, FMA 33°*)

Dental:

Right Class II molar relationship, left Class I canine relationship.

Maxillary bilateral cross-bite of the lateral incisions associated with severe crowding of ~7mm (*Fig. 10*).

Mandibular left 1st molar and right 1st premolar were missing; redundant space of ~ 13mm.

Fig. 3: Pretreatment study models

Dr. Ming-Jen Chang, Lecturer, Beethoven Orthodontic Course (left)
Dr. Chris Chang, Director, Beethoven Orthodontic Center (middle)
Dr. W. Eugene Roberts, Consultant,
International Journal of Orthodontics & Implantology (right)

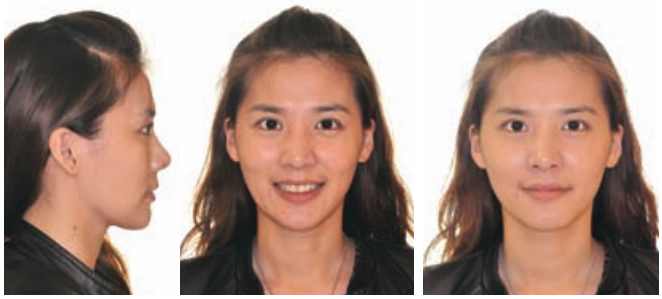


Fig. 4: Posttreatment facial photographs

Fig. 5: Posttreatment intraoral photographs

Fig. 6: Posttreatment study models

Facial:

Acceptable profile with acceptable lip position. The ABO Discrepancy Index (*DI*) was 24 as shown in the subsequent worksheet.

Specific Objectives of Treatment

Maxilla (*all three planes*):

- A - P: Modest retraction
- Vertical: Maintain
- Transverse: Maintain

Mandible (*all three planes*):

- A - P: Modest expansion
- Vertical: Maintain
- Transverse: Maintain

Maxillary Dentition

- A - P: Retract incisors
- Vertical: Maintain
- Inter-molar Width: Expand to correct the palatally displaced left 1st molar

Mandibular Dentition

- A - P: Close edentulous spaces
- Vertical: Maintain
- Inter-molar / Inter-canine Width: Round out the arch over the apical base of bone

Facial Esthetics: Maintain

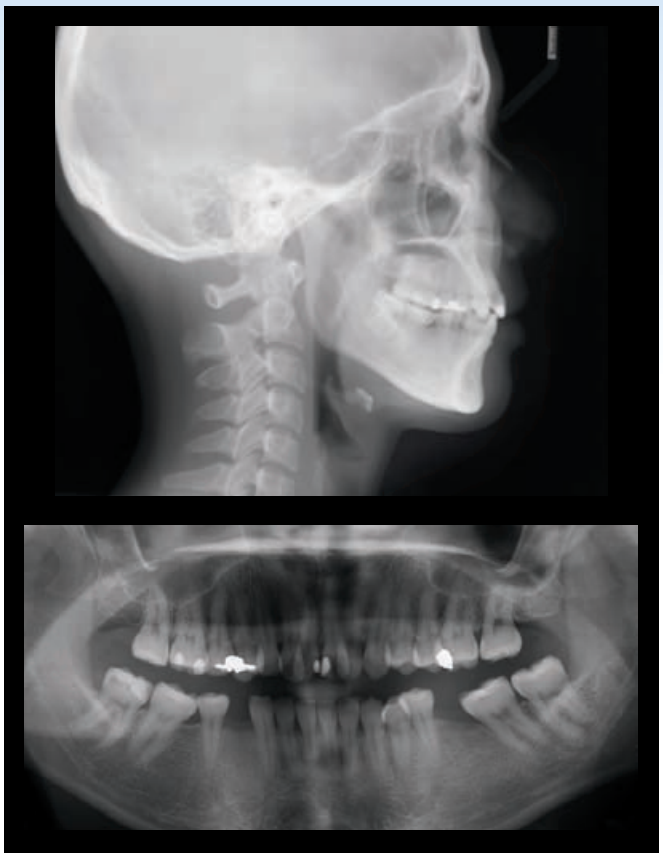


Fig.7: Pretreatment pano and ceph radiographs

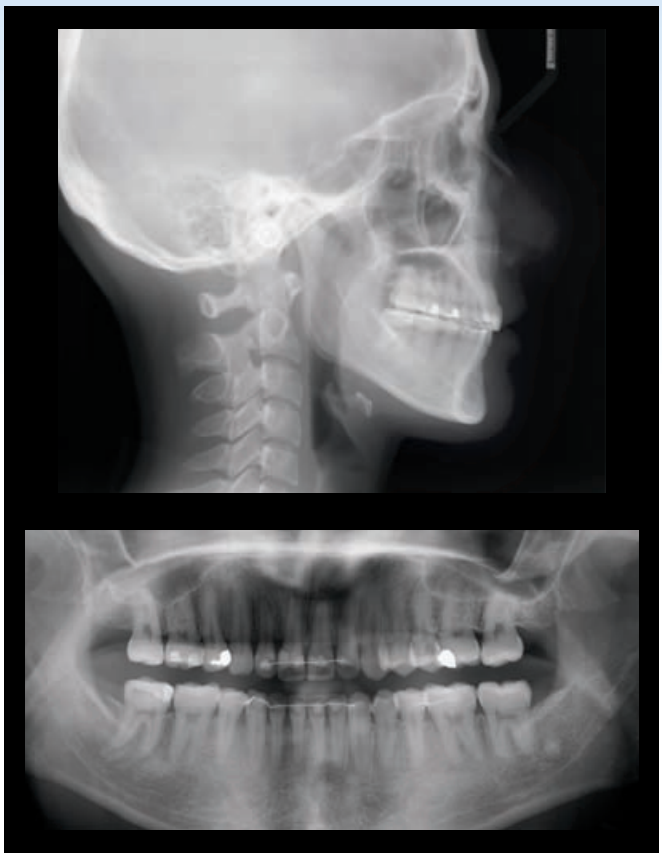


Fig. 8: Posttreatment pano and ceph radiographs

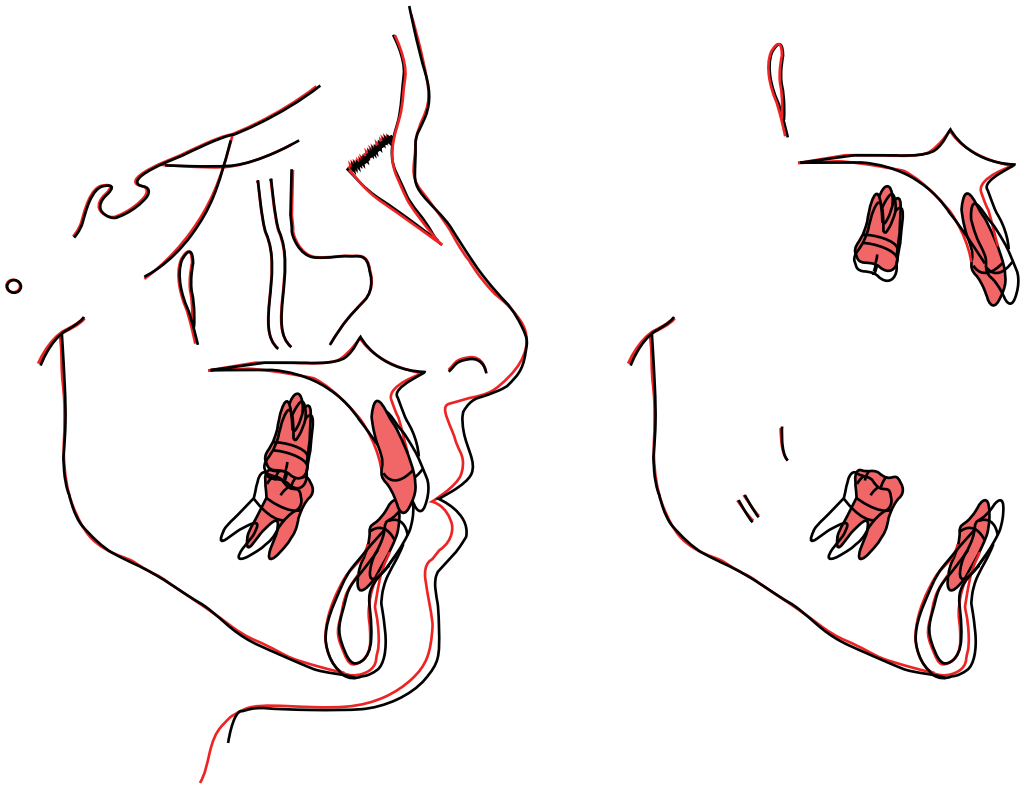


Fig. 9: Superimposed tracings showed retraction of upper & lower incisors.

Fig. 10: Bilateral lateral incisors cross-bite. Severe crowding about 7mm in upper arch.

Treatment Plan

Extraction treatment with a full fixed orthodontic appliance was indicated to align and level the maxillary dentition and close mandibular edentulous spaces. In the initial stage of treatment, the upper right 1st premolar was extracted to relieve maxillary anterior crowding (*Fig. 11*).

Posterior bite turbos assisted in anterior cross-bite correction. Class II elastics were used to resolve the sagittal occlusal discrepancy, and detail bending and settling elastics were planned to produce the final occlusion. The fixed appliances were removed and the corrected dentition was retained with a fixed anterior retainer in both arches: 1. maxillary right lateral incisor to left lateral incisor, 2. mandibular right canine to left canine, and 3. mandibular left 2nd premolar to 2nd molar. Clear overlay retainers were later delivered for both arches.

Fig. 11:
Extraction of upper right 1st premolar to relieve upper anterior crowding.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	79°	78°	1°
SNB°	77°	76°	1°
ANB°	2°	2°	0°
SN-MP°	40°	39.5°	0.5°
FMA°	33°	32.5°	0.5°
DENTAL ANALYSIS			
U1 TO NA mm	6 mm	4 mm	2 mm
U1 TO SN°	99°	92°	7°
L1 TO NB mm	6 mm	4 mm	2 mm
L1 TO MP°	90°	83.5°	6.5°
FACIAL ANALYSIS			
E-LINE UL	-4 mm	-6 mm	2 mm
E-LINE LL	-1 mm	-4 mm	3 mm

Table. Cephalometric summary

Appliances and Treatment Progress

A .022" slot Damon D3MX bracket system (*Ormco*) was used. The maxillary arch was bonded with standard torque brackets in the anterior segment, and open coil springs were placed bilaterally between the central incisors and canines to open space for correction of the lateral incisors cross-bite (*Fig. 12*). After three months of initial alignment and leveling, the bilateral lateral incisors were bonded with reversed standard torque brackets, and the mandibular arch was bonded with high torque brackets on canines & standard torque on incisors (*Fig. 13*). The posterior bite turbos were placed on the maxillary 1st molars to open the bite and reduce the occlusal interference blocking the correction of the bilateral cross-bite of the lateral incisors (*Figs. 13 and 14*). The initial archwires were .014 CuNiTi. Following correction of the anterior cross-bite, an open coil spring was placed between the maxillary central incisors to open space for restorations.

Eight months after the initiation of treatment, the round wires were replaced with rectangular .014x.025 CuNiTi wires. In the same appointment, the open coil spring already opened adequate space between the maxillary central incisors for restoration of normal dental morphology (*Fig. 15*). Four months later, .016x.025 pre-Q archwires were used on both maxillary and mandibular arches, and the maxillary anterior segment was ligated with a figure-eight tie of an .012" stainless steel ligature. Then anterior bite turbos were placed on the palatal side of maxillary central incisors to correct anterior deep bite (*Fig. 16*). Class II elastics were used from the upper left canine to the lower left 2nd molar to correct the midline deviation. In the fifteenth month of treatment, the .019x.025 pre-Q archwires were used to adjust the torque control of anterior segments in both arches (*Fig. 17*). Two months later, .019x.025 SS archwires were placed, and closed coil springs were used to close the mandibular arch spaces (*Fig. 18*). At the finishing stage, a panoramic radiograph was taken to evaluate bracket positions relative to the axial inclinations of all teeth (*Fig. 19*). Bracket repositions were performed as indicated. A torquing spring was placed on the upper left canine to move the root palatally, as the maxillary arch was leveled (*Fig. 20*).

After 29 months of active treatment, all appliances were removed. Three weeks after fixed appliance removal, a gingivectomy of maxillary incisors was performed with diode laser to improve incisal exposure (*1:0.8*) (*Fig. 21*). The corrected dentition was retained with fixed anterior retainers on both arches: 1. maxillary right lateral incisor to left lateral incisor, 2. mandibular right canine to left canine and 3. mandibular left 2nd premolar to 2nd molar. Clear overlay retainers were delivered on both arches.

Results Achieved

Maxilla (*all three planes*):

- A - P: Retracted
- Vertical: Maintained
- Transverse: Maintained

Fig. 12:

The upper arch was bonded and the open coil springs were placed between bilateral central incisors and canines.

Fig. 13:

The bilateral lateral incisors were bonded with reversed standard torque brackets and the mandibular arch was bonded with high torque brackets.

Fig. 14:

The posterior bite turbos were placed on the maxillary 1st molars to protrude bilateral lateral incisors.

Fig. 15:

The open coil spring already opened the middle space for restoration of the two central incisors.

Fig. 16:

The anterior six teeth were fixed by figure-eight ligature wires. Then the anterior bite turbos were placed on the palatal side of upper central incisors to correct anterior deep bite.

Fig. 17:

The .019x.025 pre-Q archwires were used to adjust the torque control of the anterior four teeth on both arches.

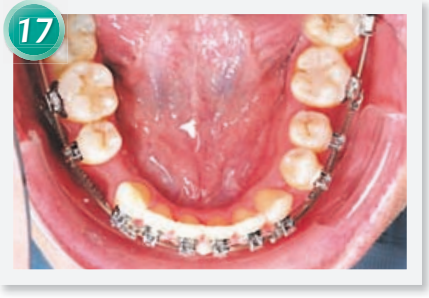


Fig. 18:

The closed coil springs were put over lower dentition on both sides for closing the extraction spaces.

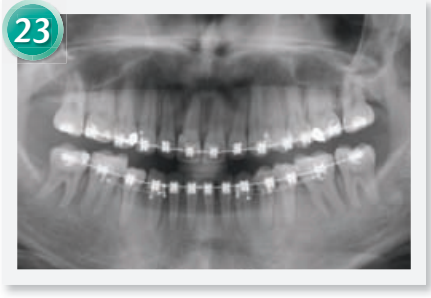


Fig. 19:

The panoramic radiograph was indicated to check the root angulation.

Fig. 20:
Use a torquing spring to increase palatal root torque.

Fig. 21:
Post-treatment intra-oral frontal photo.

Mandible (*all three planes*):

- A - P: Retracted
- Vertical: Maintained
- Transverse: Maintained

Maxillary Dentition

- A - P: Retracted
- Vertical: Maintained
- Inter-molar / Inter-canine Width: Maintained

Mandibular Dentition

- A - P: Retracted
- Vertical: Maintained
- Inter-molar / Inter-canine Width: Maintained

Facial Esthetics: Upper and lower lips were retracted consistent with acceptable facial form.

Retention

The maxillary fixed retainer was bonded on all incisors. An anterior mandibular fixed retainer was bonded on all teeth from canine to canine. In addition, a mandibular posterior retainer was bonded from the 2nd premolar to 2nd molar. Upper and lower clear overlay retainers were delivered. The patient was instructed to wear them full time for the first 6 months and nights only thereafter. The patient was instructed in the home care and maintenance of the retainers.

Final Evaluation of Treatment

The ABO Cast-Radiograph Evaluation score was 21 points. The major discrepancies were unevenly marginal ridges (*8 points*) and occlusal contacts (*6 points*).

Alignment and restorative recontouring of the upper anterior incisors, and closure of lower extraction spaces helped resolve the patient's chief complaints. The excessive spaces of the lower extraction site was eliminated, but long-term retention will be necessary to prevent relapse.

Overall, there was significant improvement in both dental esthetics and occlusion. The profile was treated to an appropriate result with no esthetic problems.

Discussion

Stepovich[1] concluded that spaces of 10mm or more can be closed in adults, but retaining the closed spaces was difficult. In the present case, the spaces was 13mm. As such, a fixed buccal retainer was placed from the left second premolar to second molar in the mandibular arch to prevent the space from reopening.

Roberts[2] described the bone physiology of second and third mandibular molars when protracted into a missing first molar space. The relatively flat roots of the molars move through the center of the alveolar process by resorbing primarily trabecular bone on the mesial surface and forming cortical bone on the distal surface of each root. For the first few millimeters of tooth movement, the molars move rapidly. However, as the trailing root engages the cortical bone formed by the leading root, the rate of molar protraction decreases until space closure is accomplished.

Vanarsdall and Swartz[3] described the common sequelae for a missing mandibular first molar as (*1*) mesially inclined second and/or third molars, (*2*) distal drift of the premolars, (*3*) extrusion of the maxillary molars, (*4*) altered gingival form with constriction of the edentulous ridge, (*5*) infrabony defect mesial to the inclined molar, (*6*) stepped marginal ridges, (*7*) food impaction, and (*8*) posterior collapse. However, the negative sequelae in the maxillary arch are usually less severe than in the mandibular arch. Many clinicians still believe that when the buccolingual width of the alveolar ridge is constricted, the second molar cannot be move mesially. However, Roberts[2] has demonstrated that even severely atrophy extraction sites can be closed if the teeth moved into the extraction site are periodontally healthy.

Moreover, there might be an incomplete space closure. For the present patient, the 13mm space was closed in the posterior region of the mandible. If the edentulous ridge is at least half the width of the teeth being moved into the ridge, then the remodeling process would probably be successful.[4] However, if the edentulous ridge is less than half the width of the tooth root, then a dehiscence in the bone is likely to form over the labial or lingual surfaces of the root.[5] When closing first molar spaces in the mandible, young adults generate more alveolar bone than older adult patients. Furthermore, retention of space closure is more difficult for older adult patient than for younger adults.

Edwards[6] suggested that excess gingival tissue could be a factor associated with residual spaces and advocated the surgical removal of any tissue that accumulates interproximally during treatment, as originally described by Casko et al.[7]

To achieve an optimal result for the present patient, the initial step was extraction of right upper first premolar and alignment of upper teeth. Coil springs were used for opening spaces. Meanwhile, posterior bite turbos facilitated the protrusion of cross-bite teeth. Anterior bite turbos were used to solve anterior deep bite, always in conjunction with early light short elastics. The panoramic radiographs were useful for checking the root angulation. To achieve excellence finishing results, diode soft tissue laser was applied to improve tooth proportion.

The curvature and level of the gingival margin were acceptable. With regard to the upper esthetic zone, the maxillary dental midline was 1.5mm to the right of the facial midline and the axial inclination of right lateral incisor was too distal. The Pink & White esthetic score worksheet listed below provides a broad array of clinical parameters for evaluation of patients with esthetics concerns.

The ABO CRE score was 21, with most of the points reflecting problems in marginal ridges. If a panoramic radiograph had been used earlier in the treatment, bracket rebonding might have facilitated a more complete correction of the marginal ridges and occlusal contacts.

Conclusion

Atypical extraction is common in orthodontic treatment of adults. Closing posterior spaces for these patients is important because lower posterior teeth play an important role in occlusal function, particularly with respect to maintaining the vertical dimension of occlusion. Axial inclination problems are best identified with a panoramic radiograph after leveling of both arches. Repositioning malaligned brackets early in treatment facilitates optimal second order alignment. The root torque spring is ideal for controlling root angulation in the buccolingual plane. Coil springs are very effective for opening and closing space, as required. Early light short elastics helped correct the midline discrepancy.

This difficult malocclusion (*DI =24*) was treated to an acceptable result (*CRE = 21*). The patient and the clinician were pleased with the treatment result.

Acknowledgment

Thanks to Ms. Tzu Han Huang for proofreading this article.

References

1. Stepovitch MI. A clinlcal study on closing edentulous spaces in the mandible. Angle Ortho 1979;49:227-33.
2. Roberts WE. Rate of translation of mandibular molars using implant-anchored mechanics. Angle Ortho 1996;66:331-37.
3. Vanarsdall RL, Swartz ML. Molar uprighting, Ormco catalog NO. 740-0014, Glendora, Calif., 1980, Ormco Corporation.
4. Kokich VG, Kokich VO. Interrelationship of orthodontics with periodontics and restorative dentistry. In: Nanda,R. Biomechanics and Esthetic Strategies in Clinical Orthodontics. St. Louis: Elseviers;2005:18.
5. Kokich VG, Mathews DP, Spear FM. Inheriting the Unhappy Patient: An interdisciplinary Case Report. Advanced Esthetics & interdisciplinary Dentistry 2005;1:12-20.
6. Ewards JG. The prevention of relapse in extraction cases. Am J Ortho 1971;60:128-141
7. Casko JS, et al. Objective grading system for dental casts and panoramic radiographs. Am Orthod Dentofacial Orthop 1998;114:589-599.
8. Liang JY, Chang CH, Roberts WE. Chapter 6: Correction of Bimaxillary Protrusion with Closing of Premolar & Molar Extraction Spaces. Orthodontics Vol.I 2012;87-100
9. Chang CH. Advanced Damon Course No. 8: Excellence in Finishing, Beethoven Podcast Encyclopedia in Orthodontics 2011, Newton's A Ltd, Taiwan.
10. Chang CH. Advanced Damon Course No. 4,5 : DI & CRE Workshop (1)(2). Podcast Encyclopedia in Orthodontics 2011, Newton's A Ltd, Taiwan.
11. Chang CH. Basic Damon Course No.5: Finish Bending. Podcast Encyclopedia in Orthodontics 2011, Newton's A Ltd, Taiwan.
12. Huang S, Pitts T. Secrets of Excellent Finishing. News & Trends in Orthodontics 2009;14:6-23.

IBOI Discrepancy Index Worksheet

TOTAL D.I. SCORE 24

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 = 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 = 4

OCCLUSION

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

Total = 2

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 1

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP 2
≥ 38° = 2 pts.
Each degree > 38° 2 x 2 pts. = 4

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

1 to MP ≥ 99° = 1 pt.
Each degree > 99° _____ x 1 pt. = _____

Total = 6

OTHER (See Instructions)

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

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) =_____

Total = 0

IBOI Cast-Radiograph Evaluation

Case # 1 **Patient**

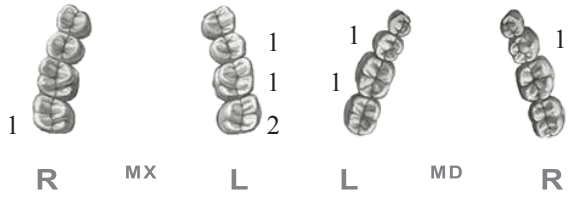
Total Score: 21

Alignment/Rotations

1

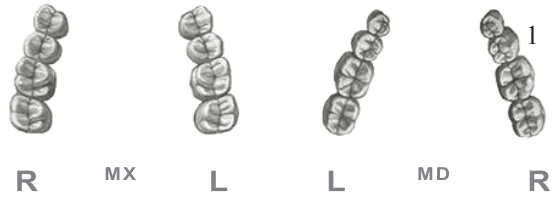
Marginal Ridges

8



Buccolingual Inclination

1

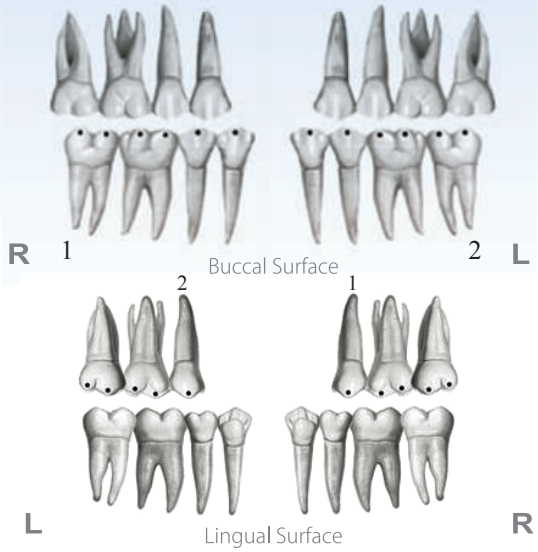


Overjet

0

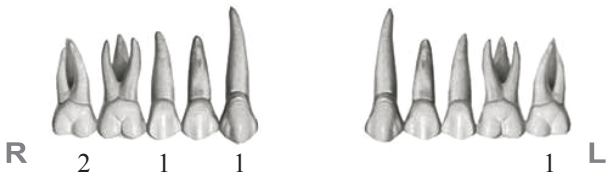
Occlusal Contacts

6



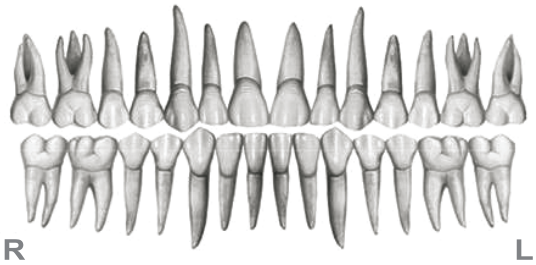
Occlusal Relationships

5



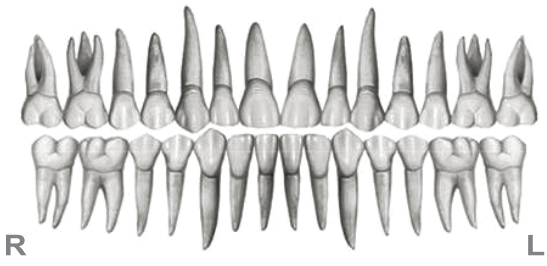
Interproximal Contacts

0



Root Angulation

0

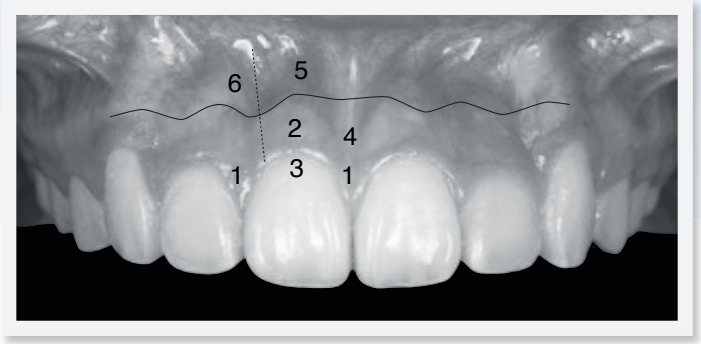


INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 4

1. Pink Esthetic Score

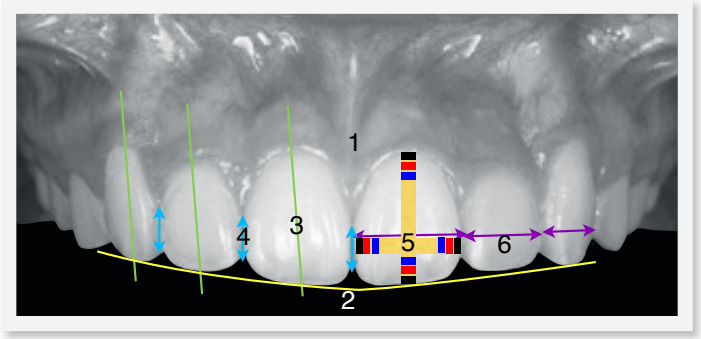


Total = 2

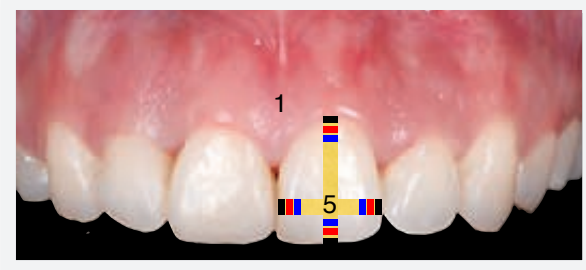
1. Mesial Papilla	0	1	2
2. Distal Papilla	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

Total = 2



1. Tooth Form	0	1	2
2. Mesial & Distal Outline	0	1	2
3. Crown Margin	0	1	2
4. Translucency (Incisal thrid)	0	1	2
5. Hue & Value (Middle third)	0	1	2
6. 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

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Implant-Orthodontic Combined Treatment: Congenital Missing Teeth with a Unilateral Crossbite

HISTORY AND ETIOLOGY

A 23-year-11-month-old male was referred by his dentist for orthodontic consultation (*Fig. 1*). His chief concern was dental spacing and multiple teeth in crossbite (*Figs. 2-3*). There was no other contributory medical or dental history. Clinical exam indicated multiple missing teeth in the maxilla: both lateral incisors, right 2nd premolar, and right 1st molar. The lower right 2nd premolar was also missing (*Fig. 2*). A treatment plan combining orthodontics, prosthetic implants and implant-supported prostheses was proposed to correct the skeletal and dental problems.

The patient was treated to the preprosthetic finish documented in Figs. 4-6. Pretreatment and posttreatment radiographs are illustrated in Figs. 7-8, respectively. Superimposed cephalometric tracings document the treatment achieved (*Fig. 9*). The details for diagnosis and treatment will be discussed.

DIAGNOSIS

Skeletal:

Skeletal Class I (*SNA 88°, SNB 87°, ANB 1°*)

Mandibular plane angle (*SN-MP 31°, FMA 26°*)

Dental:

Right side lingual crossbite malocclusion associate with a functional shift.

Fig. 1: Pretreatment facial photographs

Fig. 2: Pretreatment intraoral photographs

Fig. 3: Pretreatment study models

Dr. Ming Chen Lee, Lecturer, Beethoven Orthodontic Course
Dr. Wen Shao Lai, Lecturer, Beethoven Orthodontic Course
Dr. Chris Chang, Founder, Beethoven Orthodontic Center
Dr. W. Eugene Roberts, Consultant, *International Journal of Orthodontics & Implantology*
(from left to right)

Fig. 4: Posttreatment facial photographs

Fig. 5: Posttreatment intraoral photographs

Fig. 6: Posttreatment study models

The overbite was 0 and overjet was -1mm on the right side.

Severe maxillary spacing was about 14mm due to multiple missing teeth: UR6 UR5 UR2 UL2.

Moderate mandibular spacing was about 6mm in the lower arch due to a missing LR5 and an anterior functional shift of the lower arch.

Mandibular dental midline was 4.5mm deviated tothe right side of the facial midline.

Facial:

Moderately convex profile with relative protrusion of the lips.

The ABO Discrepancy Index (*DI*) was 25 as shown in the subsequent worksheet.

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla (*all three planes*):

- A - P: Maintain
- Vertical: Maintain
- Transverse: Increase Mandible (*all three planes*):
- A - P: Retract (*correction of anterior functional shift*)
- Vertical: Clockwise rotation of 1-2°
- Transverse: Maintain

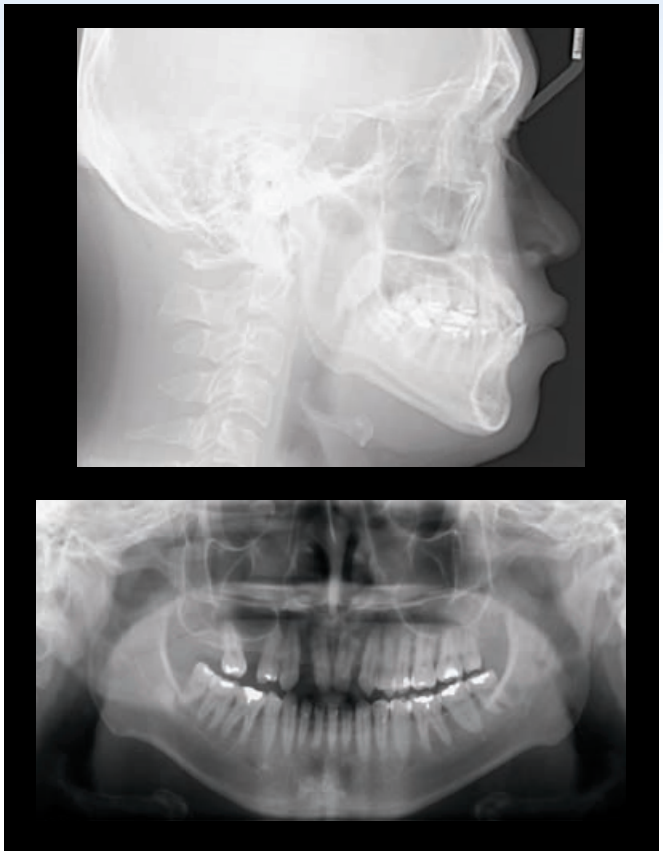

Fig. 7: Pretreatment pano and ceph radiographs

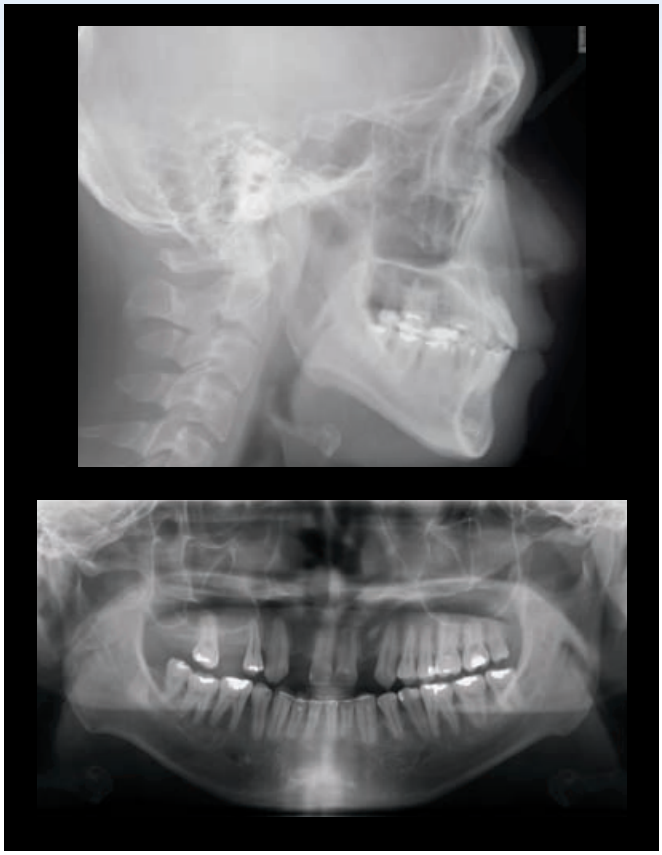

Fig. 8: Posttreatment pano and ceph radiographs

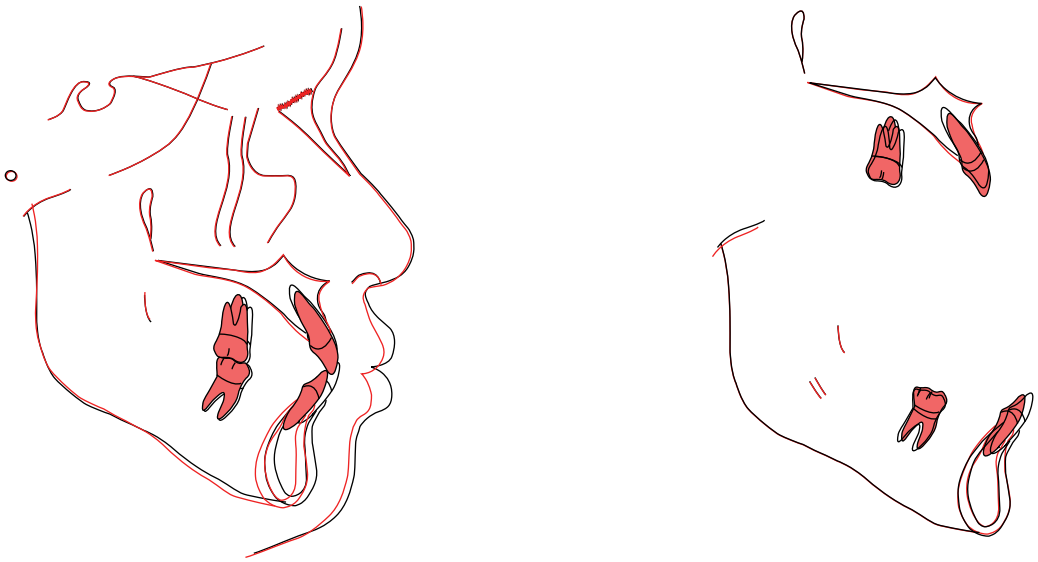

Fig. 9: Superimposed tracings

The mandible moved in a clockwise direction, the lips were retracted and the nasolabial angle was increased. The upper first molars were moved distally. The upper incisors were extruded. The lower incisors were retracted and intruded. The lower first molars were extruded.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	88°	89°	1°
SNB°	87°	86°	2°
ANB°	1°	3°	2°
SN-MP°	31°	34°	3°
FMA°	26°	29°	3°
DENTAL ANALYSIS			
U1 TO NA mm	3 mm	3 mm	0 mm
U1 TO SN°	115°	112°	3°
L1 TO NB mm	7 mm	6 mm	1 mm
L1 TO MP°	94°	96°	2°
FACIAL ANALYSIS			
E-LINE UL	2 mm	0 mm	2 mm
E-LINE LL	5 mm	0 mm	5 mm

Table. Cephalometric summary

Maxillary Dentition

- A - P: Increase arch circumference to correct anterior crossbite and create spaces for UR6 and UL2 implants.
- Vertical: Extrude incisors to create overbite.
- Inter-molar/Inter-canine width: Increase to correct right anterior and posterior crossbite, and create space for UL2 implant.

Mandibular Dentition

- A - P: Retract to correct anterior crossbite.
- Vertical: Extrude molars to open the vertical dimension of occlusion (*VDO*).
- Inter-molar/Inter-canine width: Decrease to correct right posterior crossbite.

Facial Esthetics: Retract upper and Lower Lips

Fig. 10:

0.022-in Damon 3MX standard torque brackets (Ormco) were used. Bite turbos were bonded on the mandibular molars.

Fig. 11:

Class III elastics (3.5 oz, 1/4") from upper molars to lower canines were introduced to improve anterior crossbite.

Fig. 12:

Class II elastics (4.5 oz, 1/4") from upper canines to lower molars were introduced to improve this 3mm of overjet.

Fig. 13:
.014 CuNiTi archwire was placed on upper arch.

Fig. 14:
.017x.025 low friction TMA archwire was placed on upper arch.

Fig. 15:
The open coil springs were placed between right first premolar and second molar, left incisor and canine.

Fig. 16:
Power chains were attached from upper canine to canine to close spaces of UR2 and UL2 area. After that, reopen spaces to create adequate bone volume for implantation.

Fig. 17:
The open coil springs were placed between right first premolar and second molar, right canine and incisor, left incisor and canine.

Fig. 18:
The created space for UR6, UR2 and UL2 were 9mm, 7mm, and 7mm respectively. The bony concavity of upper lateral incisors was noted.

TREATMENT PLAN

A full fixed orthodontic appliance was used to correct the right posterior crossbite, close lower anterior spacing, coordinate the arches, and improve the soft tissue profile (*Fig. 10*). The UR7 lingual crossbite was corrected with cross elastics on the affected side with bite turbos on the opposite side to open up the bite. The lower arch was constricted to help correct the right posterior lingual crossbite.

Posterior bite turbos with Class III and Class II elastics corrected the sagittal discrepancy in occlusion and improved the facial profile (*Figs. 11-12*). The occlusion was detailed with finishing bends. The spaces for implantation were prepared with open coil springs (*Figs. 13-18*). Mandibular anterior spaces were closed with "*power tube*" (*elastic ligature*) from LR3-LL3. After fixed appliance were removed, a clear overlay retainer was delivered for the upper arch and a lower fixed 3-3 retainer was bonded to all teeth in the anterior segment.

APPLIANCES AND TREATMENT PROGRESS

.022" Damon 3MX standard torque brackets (*Ormco*) were used. Both arches were bonded and aligned. The archwire sequence for the upper arch was .014 CuNiTi, .014x25 CuNiTi, .017x25 TMA and

.019x25 SS. The lower archwire sequence was .014 CuNiTi, .014x25 CuNiTi, .016x22 SS, .017x25 TMA and 019x25 SS. Posterior bite turbos were bonded on the mandibular molars (*LR6, LL7*) to facilitate crossbite correction (*Figs. 10-12*). After four months of initial alignment and leveling, a panoramic film was taken. The malaligned brackets (*LR5, LL4, LL5*) were rebonded. In the 7th month of treatment, a .017x25 low friction TMA archwire was placed in the upper arch and a .016x22 SS arch wire was inserted in the lower arch (*Figs. 7, 20*). Constriction of the lower SS arch-wire was performed to assist in correction of the right posterior, lingual crossbite. Class III elastics (*3.5 oz, 1/4"*) from upper molars to lower canines were introduced to correct the anterior crossbite (*Fig. 11*). The A-P discrepancy was corrected by flattening the plane of occlusion and opening the vertical dimension of occlusion. A power tube, elastic ligature from lower 3-3 was activated to close the interdental space and decrease the intercanine distance (*Fig. 19*). A power chain was attached from the LL3 lingual button to the LL5 lingual button to achieve rotation of LL5 (*Fig. 20*). After 8 months, an open coil spring was applied between the upper left central incisor and canine to create space for an implant (*Fig. 15*).

In the 10th month of treatment the anterior crossbite was overcorrected. Class II elastics (*4.5 oz, 1/4"*) from upper canines to lower molars were introduced to increase the overjet to 3mm (*Fig. 12*).

In the 14th month of treatment, the lower arch-wire was changed to .019x25 SS. Constriction of lower archwire was performed to assist in correction of the posterior lingual crossbite on the right side. Open coil springs were applied between UR7 and

Fig. 19:

A power tube from lower 3-3 was inserted to close inter dental space and decrease inter canine distance.

Fig. 20:

A power chain was attached from LL3 lingual button to LL5 lingual button to improve the rotation of LL5.

Fig.21:

An anterior periapical radiograph was exposed to evaluate bracket positions.

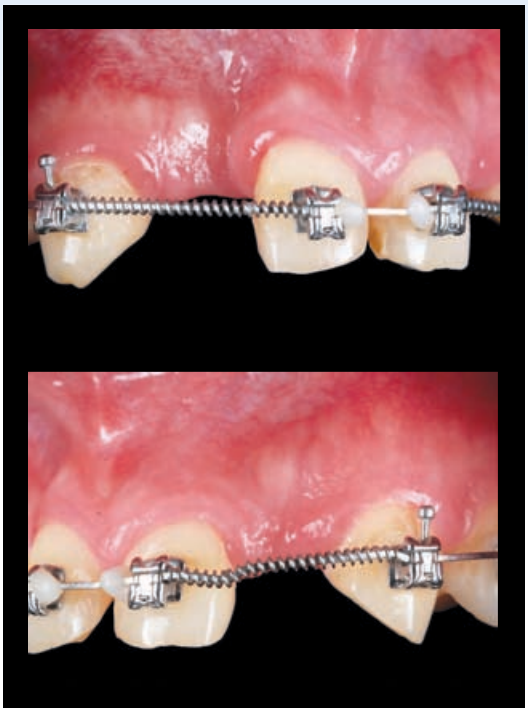

Fig. 22:
The bony concavity of upper lateral incisors would be improved by augmenting buccal bone with GBR procedure after orthodontic treatment.

UR4, UL1 and UL3 to create spaces for implants. In the 14th month of treatment, a button was bonded on the lingual side of the upper right second molar to accommodate upper and lower cross elastics for lingual crossbite correction. In the 19th month of treatment, after the crossbite bite was corrected, an anterior periapical radiograph and a panoramic film were exposed to evaluate the bracket positions relative to the axial inclinations of all teeth (*Fig. 21*). The bracket of UR1 was then rebonded to improve axial inclination. The differential spacing achieved was 7mm between UR7 and UR4, 8mm between UR3 and UR1, and 6.5mm between UL1 and UL3. In the 23rd month of treatment, power chains were attached from upper canine to canine to close the spaces in the areas of the UR2 and UL2. Previously constricted spaces in the maxillary arch were widened to stimulate new bone formation to create adequate osseous volume for subsequent implantation; the principal concern was the labial concavity in the area of the missing upper lateral incisors (*Figs. 16-18*). One month later, the patient asked to finish the orthodontic treatment as soon as possible for personal reasons. The space closing then re-opening procedure was terminated. The bony concavity in the upper lateral incisal areas could be improved by augmenting buccal bone with GBR procedure after orthodontic treatment, if necessary (*Fig. 22*). The major concern was to create adequate space and bone volume for implants to replace UR2 and UL2. In the 32nd month of treatment, the space created for UR6, UR2 and UL2 implants was 9mm, 7mm, and 7mm, respectively (*Figs. 5, 6, 8 and 18*).

After 32 months of preprosthetic orthodontics treatment, all appliances were removed. An upper clear overlay retainer and a fixed lower anterior (*Md 3-3*) retainer were delivered, and the patient was referred to receive implant-supported prostheses by a specialist.

RESULTS ACHIEVED

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

- A - P: Retracted with clockwise rotation
- Vertical: Increased ~2mm with clockwise rotation
- Transverse: Maintained

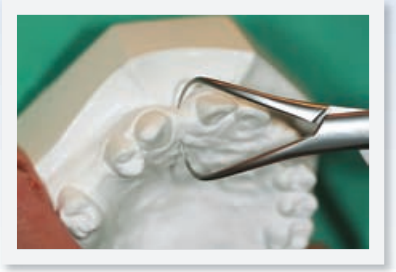

Fig. 23: Bone height and width were estimated.

Fig. 24: The wax up model

Maxillary Dentition

- A - P: Right Molar was moved distally.
- Vertical: Incisors extruded
- Inter-molar/inter-canine width: Increase the inter-canine width.

Mandibular Dentition

- A - P: Incisors retract
- Vertical: Incisors intruded
- Inter-molar/inter-canine width: Spacing closed and crossbite corrected.

Facial Esthetics: Upper and lower lips were retracted.

RETENTION

The lower fixed retainer (3-3) was bonded on every tooth. An upper clear overlay was delivered. The patient was instructed to wear the overlay full time for the first 6 months and nights only thereafter. Home care and maintenance instructions for the retainers was provided. The patient was referred to

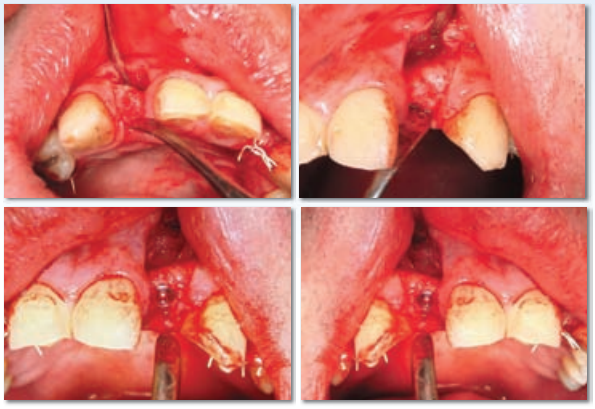

Fig. 25: .

A #12 blade was used to make an incision along the gum line. The Nobel Active implants were chosen for this case.

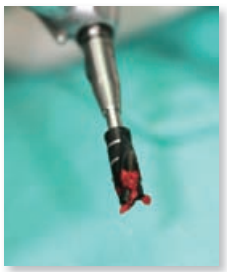

Fig. 26:

Using low speed (800rpm) to collect bone chips.

Fig. 27:

*The healing abutments, 5*5mm, were inserted to allow the patient with his continuous use of the clear retainer.*

Fig. 28:

The APF incision of UR2 appeared unnatural and separated from the adjacent gum line.

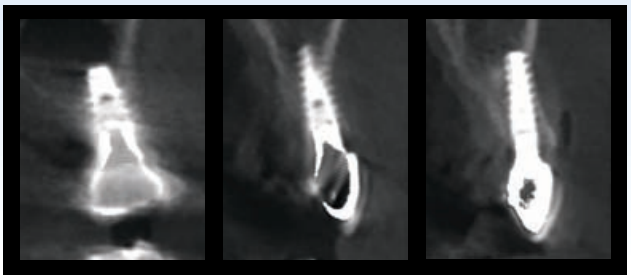

Fig. 29: .

Cone Beam Computed Tomography (CBCT) was used to check implant conditions at the one year follow-up.

a specialist for subsequent implants placement and prosthetic restoration of the partially edentulous maxillary arch.

IMPLANT PLACEMENT PROCEDURES

Step 1. Bone height and width were estimated by traditional panoramic, periapical film technique and study model measurements (*Fig. 23*). In addition, crown morphology and the pathway of insertion were designed using a model wax up (*Fig. 24*).[11-14]

Step 2. Following injection of local anesthetic, a #12 scalpel blade was used to make vertical incisions to reflect an apically positioned flap (*APF*) on the labial surface (*Fig. 25*). When preparing the implant site, the bur was turning at low speed (*800 rpm*) to allow the collection of bone chips for subsequent grafting procedures as needed (*Fig. 26*).

Step 3. Although no CBCT scan was taken initially to evaluate the bone height, the UR2 implant site was estimated to require at least 8.5mm of bone height. In addition, for an implant 3.5mm in diameter, the following osseous requirements are necessary: 2mm on the buccal side, 1mm on the lingual

Fig. 30:

Posttreatment photographs of Implant-Orthodontic combined treatment

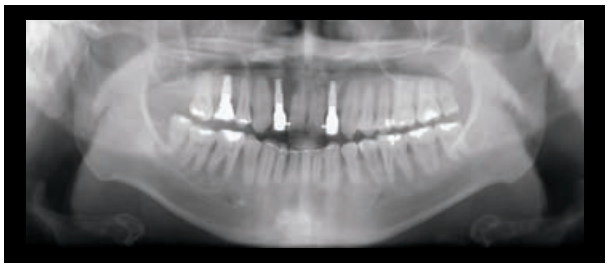

Fig. 31:

Posttreatment pano radiograph of Implant-Orthodontic combined treatment

side, and at least 2mm on the mesial and distal to provide for adequate soft tissue contours. Fig. 23 reveals that only 6mm of bone height is available so bone grafting[15-17] was indicated. The UR6 area was estimated to have 5mm of bone height. If the planned implant was 10mm in length, a sinus lift procedure was indicated prior to implant placement. Thus, the order of surgical procedures was UR6, UL2, and UR2 (*Fig. 27*).

Fig. 32:
Posttreatment study models of Implant-Orthodontic combined treatment

Step 4. An osteotome was used to elevate the bone at the site of missing UR6 after reflecting a full thickness flap.[18] A 5x10mm implant (*Nobel Active RP*) was inserted with a torque of 35 N-mm to achieve good initial stability.

Step 5. After elevation of the full thickness flap, it was observed that the bone shape was slightly concave on the buccal for UL2. Because of the expansion capability of the Nobel Active implant, it is typically chosen for the anterior area, especially for areas with thin bone. In this case, a 3.5x13mm Nobel Active NP implant (*Fig. 25*) was chosen to ensure no exposure of any groove on the body of the implant. No bone graft material was used. Strong initial stability was observed with torque of 45 N-cm.

Step 6. After elevation of the full thickness flap on UR2, it was observed that the bone shape was actually more concave on the buccal side, relative to UL2. A 3.5x13mm Nobel Active NP implant was used for this procedure. However, bone chips were collected from the hole drilling procedure for UL2 to be used for the buccal side of UR2 to provide added bone thickness (*Fig. 26*).[15]

Step 7. A submersion healing technique was chosen, so the soft tissue flap was closed and sutured. This approach allowed the patient to continue to wear clear retainers to retain all spaces and alignment of dentition.

Step 8. Three months later, the implant base was exposed and soft tissue healing abutments (*5x5mm*) were inserted (*Fig. 27*). The patient continued to wear the clear retainer. The following week, an impression was taken to fabricate a final screw-retained porcelain fused to metal (*PFM*) crowns with a UCLA angled abutment. The gingival lines across the original APF incisions of UR6 and UL2 appeared smooth and related to the adjacent gingival contour harmoniously (*Fig. 30*). However, the APF incision of UR2 appeared unnatural and unharmonious with the adjacent gingival margin (*Fig. 28*). It was necessary to accept this abnormal gingival morphology as an esthetic compromise; fortunately, the adjacent papilla appeared to be healthy.

Step 9. Cone Beam Computed Tomography (*CBCT*) was used for the one year follow-up (*Fig. 29*). As predicted, the buccal bone of UR2 was thin, but it was relatively thicker for UL2. The UR6 had less bone density particularly at the implant apex.

FINAL EVALUATION OF TREATMENT

The Cast-Radiograph Evaluation was scored at 27 points, which was deemed to be an excellent result

for a severe malocclusion. The major finishing discrepancies were occlusal interdigitation (*6 points*), uneven marginal ridges (*5 points*), occlusal contacts (*5 points*), and alignment (*4 points*). The retraction of the anterior dentoalveolar process resulted in the E-line decreasing from 2/5mm to 0/0mm. As documented in Fig. 30, facial esthetics improved as the lips were retracted and the nasolabial angle was increased. As planned, the mandible rotated in a clockwise direction due to the extrusion of lower molars by using Class II elastics. The posterior intercuspation was acceptable and the panoramic radiograph (*Fig. 31*) showed good root position overall. Posttreatment facial photographs, following completion of implant-orthodontics treatment are shown in Fig. 30. Overall, there was significant improvement in both dental esthetics and occlusion.

DISCUSSION

The key issue for this case was determining how much space was required for restoration of the missing teeth, as well as how to correct the crossbite on the right side. Unilateral lingual crossbite is a difficult clinical problem for orthodontists. The first step in resolving the problem is expanding the upper arch[1] or constricting the lower arch. As the crossbite is corrected, appropriate spaces must be produced for restoration of the missing teeth. Missing maxillary lateral incisors can be managed with fixed partial dentures, implant-supported prostheses or canine substitution.[2-5] The selection of the type of restoration is based upon several factors: 1. amount of space available, 2. bone remaining between the adjacent teeth, 3. the type and mass of gingival tissue surrounding the missing teeth area, 4. the age of the patient, and 5. economic considerations. For the present patient, the missing teeth were restored with implant-supported crowns.[5] Preprosthetic orthodontics is important adjunctive treatment to prepare implant sites relative to osseous volume, bone height, sufficient interdental space, and optimal soft tissue conditions, prior to implant placement. However, controlling treatment time is another critical issue to achieve satisfactory results for patients. Esthetic analysis[7,8] is particularly advantageous for evaluating the amount of space required for implantation, especially in the esthetic zone. The latter is defined as any dentogingival areas exposed during normal function or social interaction, such as smiling. The spaces for implants were prepared by sliding mechanics with NiTi springs on .019x25 SS and/or .017x25 TMA archwires (*Figs. 14-17*). It is important to monitor the torque of incisor brackets and/or archwires to control the axial inclination of teeth, particularly in the anterior segments. Periodic periapical films of upper and lower anterior areas can help identify problematic bracket positions in the second order (*Fig. 21*). For example, the bracket of UR1 was rebonded for the present patient. However, for third order control of axial inclination, as well as for evaluation of available bone, a CBCT is indicated.

Constriction of the lower arch-wire was performed to assist in correction of the posterior lingual crossbite. Cross elastics from UR7 to lower LR6 were introduced to correct lingual crossbite relation. These procedures, however, result in discrepancies in the buccolingual inclination of lower right molars. The other major deduction in the Cast-Radiograph Evaluation was uneven marginal ridges, particularly of the right posterior teeth. The best

way to avoid this problem is to take a diagnostic model a few months before appliance removal. Detailing problems can be identified and corrected. In brief, pre-torqued, self-ligated brackets and posterior bite turbos in conjunction with Class III elastics and constricted SS archwire are effective mechanics for the correction of unilateral crossbite in adult patients. A satisfactory result was achieved within 32 months of active treatment.

Important considerations for managing complex malocclusions, with congenitally missing teeth, are as follows:

1. Upon reviewing the outcome of UR6, bone grafting was indicated during the osteotome procedure when the bone height was preliminarily estimated as 4.7mm.[18] Bone grafting could have generated more bone surrounding the implant surface, especially at the root apex area adjacent to the maxillary sinus.

2. CBCT can provide accurate and precise diagnostic information, such as bone height, width, and density. The procedure should be routinely used for preliminary patient evaluation. Unfortunatley, the traditional evaluation tools, such as panoramic and periapical films, provide only limited and partial information.

3. The surgical procedures could be modified to minimize peri-implant gingival compromise. Taking impressions, constructing a provisional crown (*plastic*), installing the provisional crown, and then delivering a new retainer, can all be performed on the same day of the initial implant surgery.[14] Using this modified approach, the gingival margin would be stabilized in three months, making it possible to obtain an impression for the permanent crown. This approach is more predictable esthetically.

4. The post-APF results of UR2 were less than ideal due to the unnatural appearance and separation from the adjacent gingival line. However, the same APF procedure was used for UR6 and UL2, and satisfactory results were observed. Possible explanations as well as future recommendations are:

a. If the incision line is above the mucogingival junction (*MGJ*), scarring will be more apparent.

b. After the elevation of the full thickness flap, the gingiva tends to be more constrictive and tight. Therefore, it is recommended that a periosteum releasing procedure be conducted one more time before suturing. In addition, suturing should not be too tight. The soft tissue margins should just be brought into contact.

c. Scarring is diminished if a bevel technique is utilized during incision.

d. If the attached gingiva is thin, regardless what procedure is used, significant scarring will be unavoidable.

e. To minimize objectionable scarring, the incision can be conducted in a less visible site, such as the premolar area.

f. Recommended procedures for resolving scarring are first to apply the vertical incision subperiosteal

tunnel access (*VISTA*) technique. An additional adjunctive procedure is a connective tissue graft (*CTG*) under the site of the scar, followed by gingivoplasty with a bur after three months of healing.[19, 20]

CONCLUSION

Effective treatment of maxillary deficiency, associated with a functional shift, unilateral crossbite and multiple congenitally missing teeth, requires extensive preprosthetic preparation. Dentofacial orthopedic treatment combined with implant-supported prostheses can achieve optimal outcomes in many challenging clinical situations. A thorough diagnosis, well planned implant site preparation, and efficient force systems are essential components. Management of unfavorably positioned spaces, as well as correction of skeletal deficiency and functional anomalies are critical preparation for optimal restoration of esthetics and function.

ACKNOWLEDGMENT

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REFERENCES

1. Huang S. Non-extraction management of skeletal Class III malocclusion with facial asymmetry. News & Trends in Orthodontics 2010;20:22-31.
2. Kokich VO Jr, Kinzer GA, Janakievski J. Congenitally missing maxillary lateral incisors: Restorative replacement. Am J Orthod Dentofacial Orthop 2011;139:435-445.
3. Kokich VO Jr, Kinzer GA. Managing congenitally missing lateral incisors. Part I: Canine substitution. JERD 2005;17:5- 10.
4. Kokich VO Jr, Kinzer GA. Managing congenitally missing lateral incisors. Part II: Tooth-supported restorations. JERD 2005; 17:76-84.
5. Kokich VO Jr, Kinzer GA. Managing congenitally missing lateral incisors. Part III: Single-tooth implants. JERD 2005; 17:202-210.
6. Sandstedt C. Contributions to the theory of orthodontic tooth movement, Nord. Tand., No. 4, 1904.
7. Sarver DM. Principle of cosmetic dentistry in orthodontics: Part 1. Shape and proportionality of anterior teeth. Am J Orthod Dentofacial Orthop 2004; 126:749-53.
8. Belser C, Linda G, Francesca V et al. Outcome Evaluation of Early Placed Maxillary Anterior Single-Tooth Implants Using Objective Esthetic Criteria: A Cross-Sectional, Retrospective Study in 45 Patients With a 2- to 4- Year Follow-Up Using Pink and White esthetic Scores. J Periodontal 2009; 80:140-151.
9. Chang CH. Advanced Damon Course No. 4,5 : DI & CRE Workshop (1)(2). Podcast Encyclopedia in Orthodontics 2011, Newton's A Ltd, Taiwan.
10. Huang CL. The ABO Discrepancy Index - A Measure of Case Complexity. News & Trends in Orthodontics 2009;13:24.
11. Gargiulo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. J Periodontol 1961;32:261-267.
12. Grunder U, Gracis S, Capelli M. Influence of the 3-D bone-to-implant relationship on esthetics. Int J Periodontics Restorative Dent 2005;25(2):113-9.
13. Grunder U. Stability of the Mucosal Topography Around Single – Tooth Implants and Adjacent Teeth: 1 – Year Results. Int J Periodontics Restorative Dent 2000;20:11-17.
14. Rojas-Vizcaya F. Prosthetics Considerations in Treatment Planning: The Restoration of the Cervical Contour– a Key to Implant Planning, Placement, and Restoration. News & Trends in Orthodontics 2011;21:82-88.
15. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: Anatomic and surgical considerations. Int J Oral Maxillofac Implants 2004; 19:43-61.
16. Kan JY, Rungcharassaeng K, Lozada J. Immediate placement and provisionalization of maxillary anterior single implants:1-year prospective study. Int J Oral Maxillofac Implants 2003;18:31-39.
17. Kan JY, Rungcharassaeng K. Immediate placement and provisionalization of maxillary anterior single implants: A surgical and prosthodomtic rationale. Pract Periodontics Aesthet Dent 2000;12:817-824.
18. Tatum HJ. Maxillary sinus and implants reconstructions. Dent Clin North Am 1986;30:207-29.
19. Summers RB. A new concept in maxillary implant surgery: the osteotome technique. Compendium 1994;15:152-158.
20. Hisao HY, Su B, Hsu YL et al. Approaching Efficient Finishing: Hard and Soft Tissue Contouring. News & Trends in Orthodontics 2008;11:16-22.

IBOI 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 = 3

Total = 3

OVERBITE

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

Total = 0

ANTERIOR OPEN BITE

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

Total = 2

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 = 4

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP

≥ 38° = 2 pts.

Each degree > 38° _____ 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. =	2
Missing teeth (except 3rd molars)	_____	x 1 pts. =	_____
Missing teeth, congenital	5	x 2 pts. =	10
Spacing (4 or more, per arch)	2	x 2 pts. =	4
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: Trans-alveolar impaction

Total = 16

IMPLANT SITE

Lip line : Low (0 pt), Medium (1 pt), High (2 pts)	= 0
Gingival biotype : Low-scalloped, thick (0 pt), Medium-scalloped, medium-thick (1 pt), High-scalloped, thin (2 pts)	= 0
Shape of tooth crowns : Rectangular (0 pt), Triangular (2 pts)	= 0
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)	= 0
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)	= 1
Soft tissue anatomy : Intact (0 pt), Defective (2 pts)	= 0
Infection at implant site : None (0 pt), Chronic (1 pt), Acute(2 pts)	= 0

Total = 1

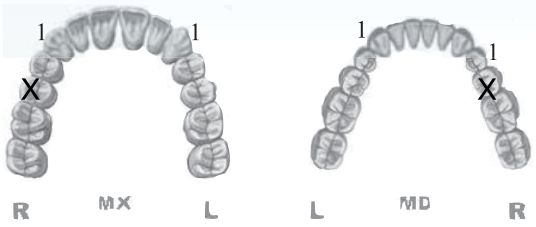
IBOI Cast-Radiograph Evaluation

Case # 1 **Patient**

Total Score: 27

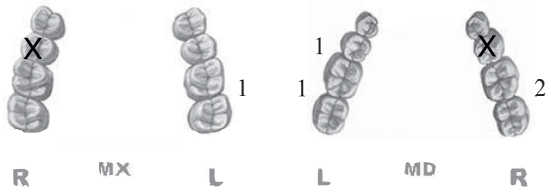
Alignment/Rotations

4



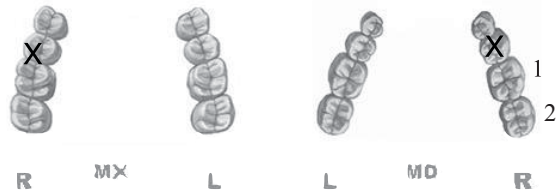
Marginal Ridges

5



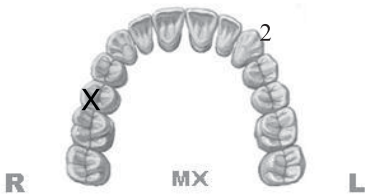
Buccolingual Inclination

3



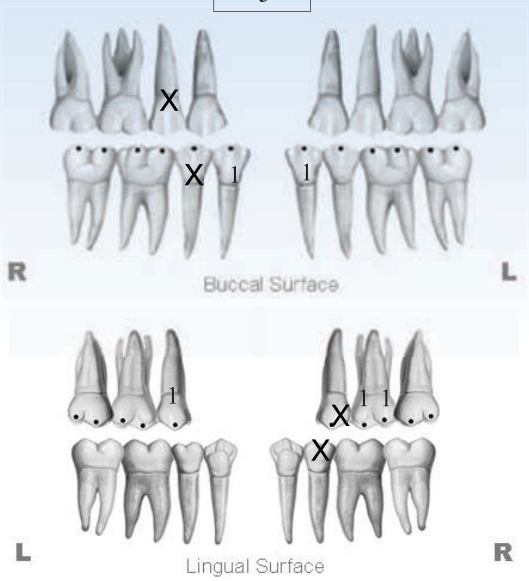
Overjet

2



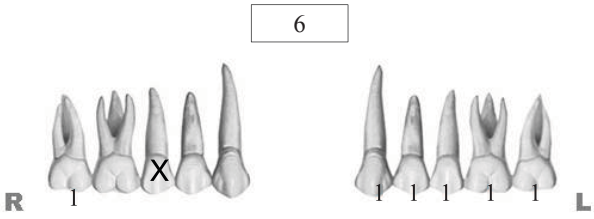
Occlusal Contacts

5



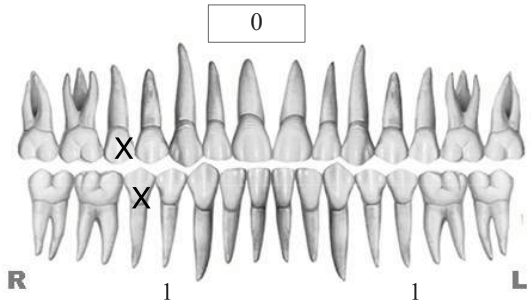
Occlusal Relationships

6



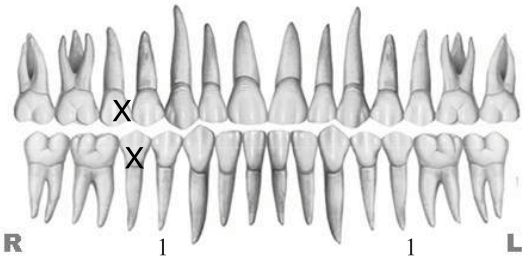
Interproximal Contacts

0



Root Angulation

2



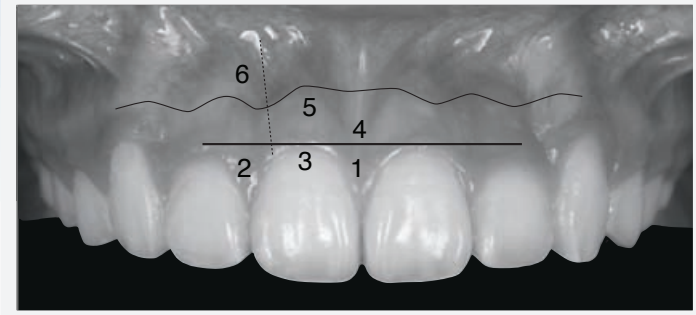
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 7

1. Pink Esthetic Score

Total = 3

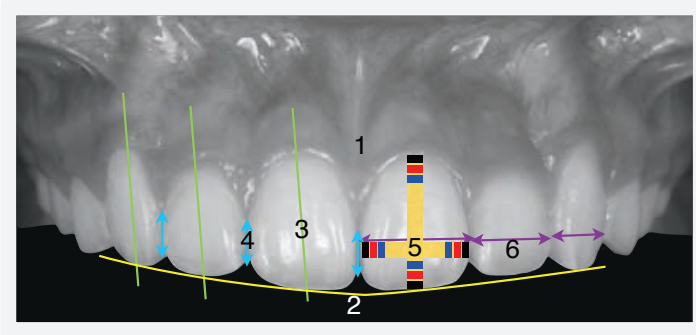


1. Mesial Papilla	0	1	2
2. Distal Papilla	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

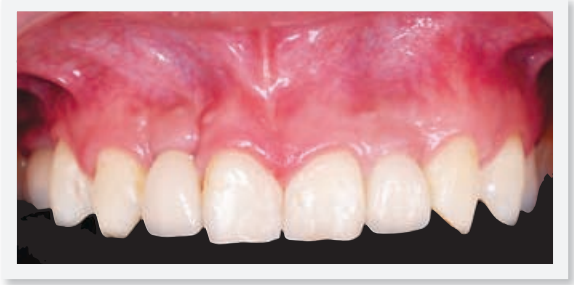
1. M&D Papilla	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	(0)	1	2
5. Root Convexity (Torque)	0	(1)	2
6. Scar Formation	0	1	(2)

2. White Esthetic Score (for Micro-esthetics)

Total = 4



1. Tooth Form	0	1	2
2. Mesial & Distal Outline	0	1	2
3. Crown Margin	0	1	2
4. Translucency (Incisal thrid)	0	1	2
5. Hue & Value (Middle third)	0	1	2
6. 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

Congenital Missing of Mandibular Incisors with Class I Malocclsuion

HISTORY AND ETIOLOGY

A 21 year old female was evaluated for maxillary dental crowding (*Figs. 1-3*). She had received orthodontic treatment for 1 year at the age of 12, but was dissatisfied with the long-term result. The initial clinical exam revealed a Class I molar relationship bilaterally, associated wth maxillary anterior crowding and two missing mandibular incisors. The overjet was 6mm, and overbite was 4mm. The maxillary dental midline was shifted 1mm to the right of the facial and mandibular midlines. Oral soft tissues, frena and gingival health were all within normal limits. There was no history of dental trauma or aberrant oral habits. There was no other contributory medical or dental history. The patient desired comprehensive orthodontic treatment to achieve an ideal alignment of the entire dentition, which was achieved as documented in Figs. 4-6.

Fig. 1: Pretreatment facial photographs

Fig. 2: Pretreatment intraoral photographs

The pretreatment radiographs (*Fig. 7*) revealed that the distal curvature of the mandibular right second molar was flattened, possibly during the process of extracting the adjacent third molar. The post-treatment cephalometric radiograph shows normal overjet and overbite (*Fig. 8*). Since there was no history of extraction(s), the mandibular incisors were deemed to be congenitally missing lateral incisors (*Fig. 9*). The before and after treatment cephalometric data are summarized in Table 1. Superimposition of cephalometric tracings documents the skeletal

Fig. 3: Pretreatment study models

Dr. Joy Hung, Lecturer, Beethoven Orthodontic Course (Left)
Dr. Chris Chang, Director, Beethoven Orthodontic Center (Middle)
Dr. W. Eugene Roberts, Consultant, *International Journal of Orthodontics & Implantology* (Right)

Fig. 4: Posttreatment facial photographs

Fig. 5: Posttreatment intraoral photographs

Fig. 6: Posttreatment study models

and dental changes associated with the treatment rendered (*Fig. 10*).

DIAGNOSIS

Skeletal:

- Skeletal Class I (*SNA 83°, SNB 80°, ANB 3°*)
- Normal angle (*SN-MP 30°, FMA 23°*)

Dental:

- Bilateral Class I molar relationship
- OJ 6mm; OB 4mm
- The maxillary dental midline was shifted 1mm to the right of the facial and maxillary midlines.
- Bilateral mandibular central incisors missing
- Left maxillary second molar partially erupted
- Impacted left third molars

Facial:

- Moderate convex profile with protrusive lip position

The ABO Discrepancy Index (*DI*) was 14 as shown in the subsequent worksheet.

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

Fig. 7:

Pretreatment pano and ceph radiographs show bilateral anterior teeth proclination and lip protusion.

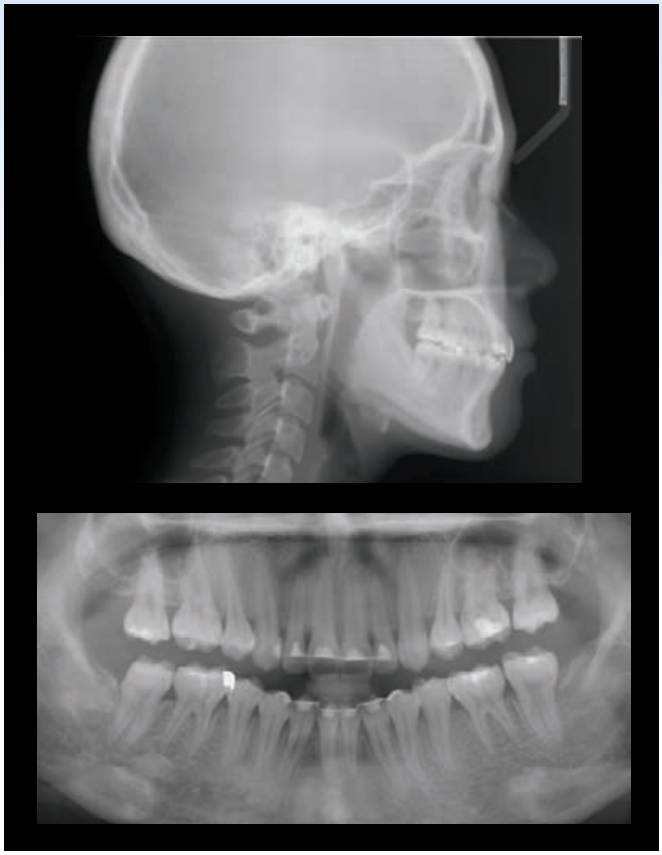


Fig. 8:

Posttreatment pano and ceph radiographs show a balancing lip profile.

Fig. 9: Congenital missing of both mandibular central incisors

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	83°	83°	0°
SNB°	80°	80°	0°
ANB°	3°	3°	0°
SN-MP°	30°	30°	0°
FMA°	23°	23°	0°
DENTAL ANALYSIS			
U1 TO NA mm	8 mm	3.5 mm	4.5 mm
U1 TO SN°	113°	105°	8°
L1 TO NB mm	8 mm	5 mm	3 mm
L1 TO MP°	100°	93°	7°
FACIAL ANALYSIS			
E-LINE UL	-1 mm	-2 mm	1 mm
E-LINE LL	2 mm	0 mm	2 mm

Table 1. Cephalometric summary

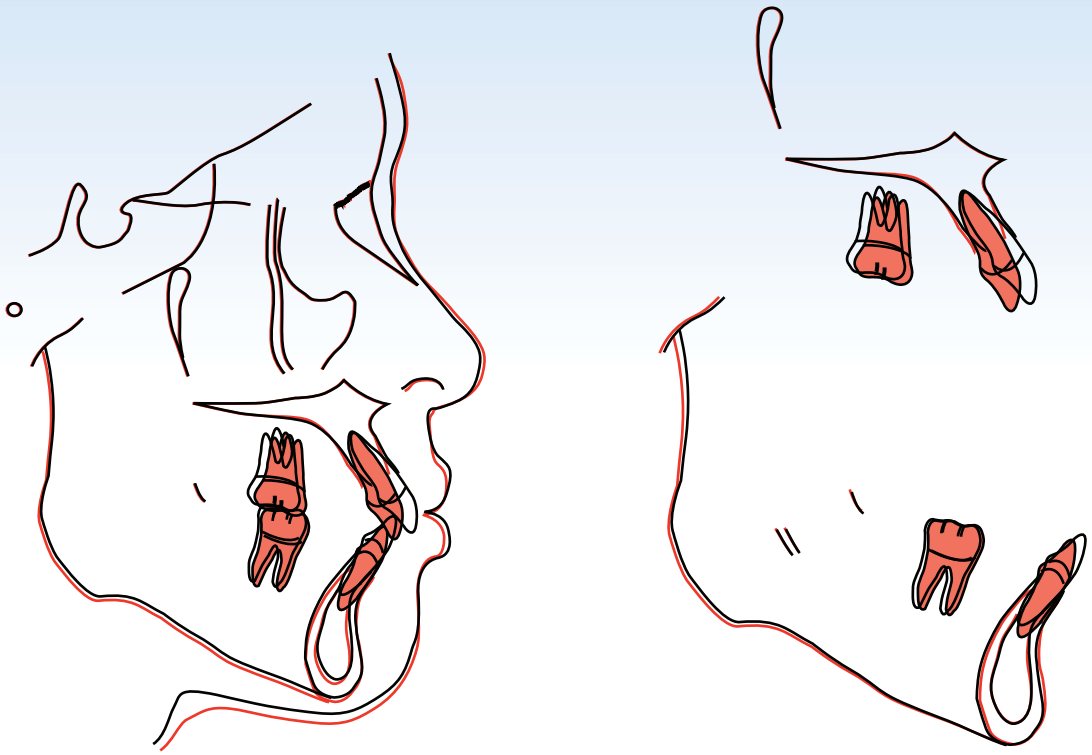


Fig. 10:
Superimposed tracings revealed intrusion of lower anterior teeth and retraction of upper anterior teeth. These contributed to the improvement of profile.

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

Maxillary Dentition

- A - P: Retract to correct excessive overjet, maintain axial inclination of about 110°
- Vertical: Maintain
- Inter-molar Width: Maintain

Mandibular Dentition

- A - P: Maintain
- Vertical: Maintain
- Inter-molar / Inter-canine Width: Maintain

Facial Esthetics:

Improved profile with better lip position

TREATMENT PLAN

The Class I occlusion relationship was associated with the absence of lower lateral incisors. Therefore, in order to correct the crowding and coordinate the arches, extraction of bilateral upper first premolars and a full fixed orthodontic appliance were indicated. The final occlusion goals would be Canine Class III and Molar Class I.

APPLIANCES AND TREATMENT PROGRESS

Extraction of three remaining third molars and upper first premolars was accomplished before the orthodontic treatment started. Standard Damon D3MX .22" Brackets (*Ormco Corporation*) were used. The wire sequence was as follows: .014 copper NiTi,

a. inset bends for mandibular canines

b. original arch form showing the eminence of canine labial side.

c. inset bends for mandibular canines

Fig. 11a-c: Inset bends for mandibular canines

.014 x .025 copper NiTi, .017 x .025 TMA, .019 x .025 SS, followed by .014 x .025 copper NiTi and then .017 x .025 TMA for detailed finishing. Class II elastics were used after the .019 x .025 SS (*Max.*) and .017 x .025 TMA (*Mand.*) archwires were engaged. In the 5th month of treatment, interproximal enamel reduction was performed on the lower incisors and canines to reshape the canine and eliminate black triangles between the lower incisors. After 22 months of active treatment, diagnostic casts and a panoramic radiograph were taken to assess the 1st and 2nd order correction. Inset bends were made for both lower canines in order to mimic the labial contour of lower lateral incisors (*Fig. 11*). Consistent with Bolton's Ratio (*Fig. 12*), as well as the Class I molar and Class III canine occlusal goals (*Fig. 13*), interproximal enamel reduction was performed again on the incisors of both arches, and the prominent lingual line angles were recontoured (*Fig. 14*). Once the overjet was corrected, the occlusion was finished, and the fixed appliances were removed after 26 months of active treatment. Immediately after removing the fixed appliances, an upper 2-2 and a lower 4-4 fixed retainer were bonded on each tooth, respectively.

$$\text{Anterior ratio} = \frac{\text{Sum of mesiodistal widths of mandibular six anterior teeth (mm)}}{\text{Sum of mesiodistal widths of maxillary six anterior teeth (mm)}} \text{ X100\%}$$

$$\text{Overall ratio} = \frac{\text{Sum of mesiodistal widths of mandibular twelve teeth (first molar-first molar) (mm)}}{\text{Sum of mesiodistal widths of maxillary twelve teeth (first molar-first molar) (mm)}} \text{ X100\%}$$

Fig. 12: Bolton's Ratio

Fig. 13:
Final occlusal relationships: Canines Cl III and Molar Cl I.

RESULTS ACHIEVED

Maxilla (*all three planes*):

- A - P: Maintained
- Vertical: Maintained
- Transverse: Maintained

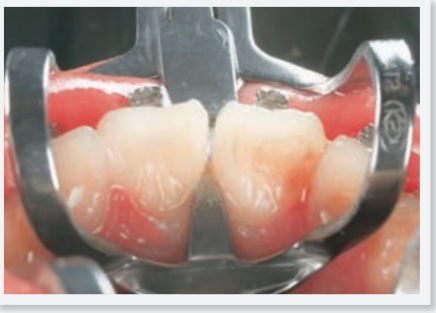
Mandible (*all three planes*):

- A - P: Maintained
- Vertical: Maintained
- Transverse: Maintained

Maxillary Dentition

- A - P: Upper incisors axial inclination reduced to 105°

a. Place the teeth separator over the papilla between the target teeth.



b. Tighten the screw to stabilize the separator and open the interproximal area.

c. Shape the marginal ridge at palatal line angle with high speed diamond fissure.

d. Smoothen the surface with coarse abrasive strip.

e. Use fine abrasive strip for finishing touch.

f. Interproximal area was reducted for 1-2mm.

Fig. 14: Interproximal enamel reduction technique

Fig. 15: Rotation of left upper first molar

- Vertical: Maintained
- Inter-molar / Inter-canine Width: Maintained

Mandibular Dentition

- A - P: Lower incisors intruded and axial inclination reduced
- Vertical: Maintained
- Inter-molar / Inter-canine Width: Maintained

Facial Esthetics

- Optimal profile achieved

RETENTION

The upper fixed 2-2 retainer and the lower fixed 4-4 retainer were bonded on every tooth. An upper clear overlay retainer was delivered. The patient was instructed to wear it full time for the first 6 months and nights only thereafter. Home care and maintenance instructions for the retainers were also provided.

FINAL EVALUATION OF TREATMENT

The IBOI Cast-Radiograph Evaluation (*CRE*) was originally scored at 30 points, but a careful reassessment of the records revealed that the appropriate CRE score was 25. The major discrepancies were occlusal relationship (*9 points, Fig. 13*), alignment/rotation problems (*5 points, Fig. 15*) and unevenly marginal ridges (*5 points*). Due to the congenitally missing of mandibular incisors, the canine Class III occlusion was intentionally achieved for esthetics.

Extraction of maxillary first premolars, as well as retraction and alignment of upper incisors helped resolve the patient's chief complaint. The excessive overjet and overbite were reduced. Wearing elastics as instructed helped to achieve canine Class III occlusion.

The posterior intercuspation was adequate and the panoramic radiograph (*Fig. 8*) showed good root positions. Posttreatment facial photographs are shown in Fig. 4. Overall, there was a significant improvement in both dental esthetics and occlusion. The prognosis for stability is good, and the corrections should be maintained with adherence to the prescribed retention plans.

DISCUSSION

The prevalence of congenitally missing teeth (*third molars excluded*) was 6.9% for both sexes combined (*6.1% in males and 7.7% in females*). The

most common congenitally missing teeth are the maxillary lateral incisors in Caucasians[1] and mandibular incisors in Chinese.[2] Davis[2] reported that the missing lower incisors affected 58.7% of the Chinese children with hypodontia.

There are three options for replacing a missing incisors. These include canine substitution, a tooth-supported restoration, and a single-tooth implant.[3] Moreover, in order to achieve an optimal occlusion with ideal overjet and overbite, the maxillary and mandibular teeth must be proportional in size. A number of researchers have evaluated the relationship between the width of the upper and lower teeth.[4] Among them, Bolton's analysis (*Fig. 11*) has the most profound influence on the examination of orthodontic patients and treatment planning.

According to Bolton, the ideal overall ratio, from the right first molar to the left first molar, is 91.3%. In this case, due to the congenitally missing of two mandibular incisors, the overall ratio is 80.8%.[5] In the case of Angle Class I malocclusion and a convex profile, canine substitution with extraction of two upper first premolars helps produce a favorable intercuspid relationship and improves the profile. [6]

After extraction of two maxillary first premolars, the overall ratio improved to 95.7%. The interproximal enamel reduction performed on the incisors in the 5th and 24th months (*Fig. 14*), according to the method of Chang,[7] further improved the relationship to 92.6%, which is much closer to the ideal ratio of 91.3%. However, failure to achieve the ideal Bolton Ratio probably conributed to the less than ideal CRE buccal occlusal score of 9 points. Also, the latter could have been improved by maintaining at least 110° of torque on the maxillary incisors (*Figs. 7, 8 and 10*). The decrease in axial inclination of the maxillary incisors as they were retracted also contributed to the less than ideal CRE buccal occlusal score (*9 points*).

Interproximal enamel reduction has long been used in orthodontic treatment to obtain more space for alignment and maintainance (*retention*) of incisal correction long-term.[8] It can also be useful for improving tooth proportion, establishing better interrpoximal contacts, and reducing black triangles.[9] In addition, enamel stripping can affect Bolton's overall and anterior ratios.[10] Moreover, the present patient had prominent lingual line angles that formed V-shape contact areas. Undesirable interproximal contacts not only affect tooth alignment, but they also are traps for stains on the teeth, raising esthetic concerns. This problem can be eliminated by reshaping the lingual line angle with interproximal reduction procedures. Studies show that interproximal enamel reduction produces furrows in the enamel surface, which cannot be completely eliminated, even with the finest finishing strips.[8] Furrows facilitate plaque accumulation, which cannot be prevented by the use of dental floss.[11] However, in Zachrisson et al.'s 10 year study,[8] interdental enamel reduction did not increase the risk of dental caries, gingival problems or alveolar bone loss. Furthermore, the distance between the roots of the teeth in the mandibular anterior area was not reduced.

At the finishing stage, inset bends were made for both mandibular canines (*Fig. 11*). The purpose of this wire bending is to compensate the variations in the shape and contour of incisors and canines, as well as to correct errors in positioning brackets.[12] For canine substitution, aligning canines more lingually, by making inset bends, creates an illusion of lateral incisors for canines, that is esthetically harmonious.

CONCLUSION

Congenitally missing mandibular incisors have a prevalence of 58.7 % in Chinese children with hypodontia.[2] Treatment options include canine substitution, restorative replacement, and single tooth implants. For Class I malocclusion with a convex profile, extraction of two maxillary premolars with canine substitution usually achieves the best outcome. Moreover, interproximal enamel reduction procedures and inset bends for mandibular canines can help achieve a good occlusion relationship and satisfactory esthetic results. However, it is important to maintain adequate torque as the maxillary incisors are retracted to achieve an optimal posterior interdigitation, as reflected in the CRE occlusal relationships score.

ACKNOWLEDGEMENT

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REFERENCES

1. Muller TP, Hill IN, Petersen AC, Blayney JR. A survey of congenitally missing permanent teeth. J Am Dent Assoc 1970; 81:101-7.
2. Davis PJ. Hypodontia and hyperodontia of permanent teeth in Hong Kong schoolchildren. Commun Dent Oral Epidemiol 1987;15:218-20.
3. Kokich VO Jr, Kinzer GA. Managing congenitally missing lateral incisors. Part I: canine substitution. J Esthet Restor Dent 2005;17:5-10
4. Kayalioglu, M et al. Tooth-size ratio for patients requiring 4 first premolar extractions. Am J Orthod Dentofacial Orthop 2005;128:78-86.
5. Bolton WA. The clinical application of a tooth-size analysis. Am J Orthod 1962;48:504-529.
6. Curiel P, Santoro M. Treatment of a patient with a crowded class I malocclusion and a congenitally missing mandibular incisor. Am J Orthod Dentofacial Orthop 2002;122:661-5.
7. Chang CH. Basic Damon Course No. 5: Finish Bending, Podcast Encyclopedia in Orthodontics 2012, Newton's A Ltd, Taiwan.
8. Zachrisson BU, Nyoygaard L, Mobarak K. Dental health assessed more than 10 years after interproximal enamel reduction of mandibular anterior teeth. Am J Orthod Dentofacial Orthop 2007;131:162-169.
9. Hsu YL. Approaching Efficient Finishing: Hard and soft tissue contouring. Part II: hard tissue contouring. News & Trends in Orthodontics 2008;11:17-19
10. Spies HJ, Sangalli JM, Cambauva RDP. (2011), "Could Interproximal Enamel Reduction be a Risk Factor for Bolton's Discrepancy?" (access 2012/03/03, available at:http://orthocj.com/2011/02/could-interproximal-enamel-reduction-bea-risk-factor-for-boltons-discrepancy/)
11. Radlanski RJ, Jäger A, Schwestka R, Bertzbach F. Plagque accumulations caused by interdental stripping. Am J Orthod Dentofacial Orthop 1988;94(5):416-20.
12. Chang CH. Basic Damon Course No. 6: Fixed retainer. Podcast Encyclopedia in Orthodontics 2012, Newton's A Ltd, Taiwan.

IBOI Discrepancy Index Worksheet

TOTAL D.I. SCORE 14

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 = 3

OVERBITE

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

Total = 2

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 2

OCCLUSION

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

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 2

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

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

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

SN-MP

≥ 38° = 2 pts.

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

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = 1 pt.

Each degree > 99° 1 x 1 pt. = _____

Total = 1

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)	_____ 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 = 4

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) =_____

Total = 0

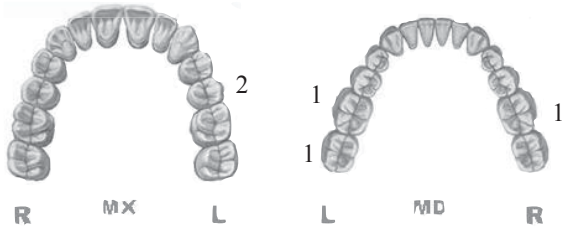
IBOI Cast-Radiograph Evaluation

Case # 1 **Patient**

Total Score: 25

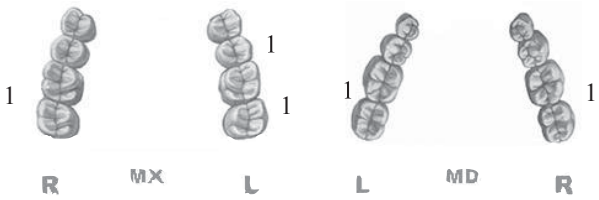
Alignment/Rotations

5



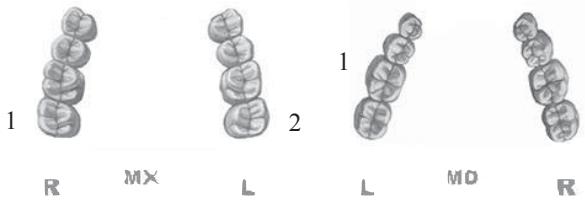
Marginal Ridges

5



Buccolingual Inclination

4

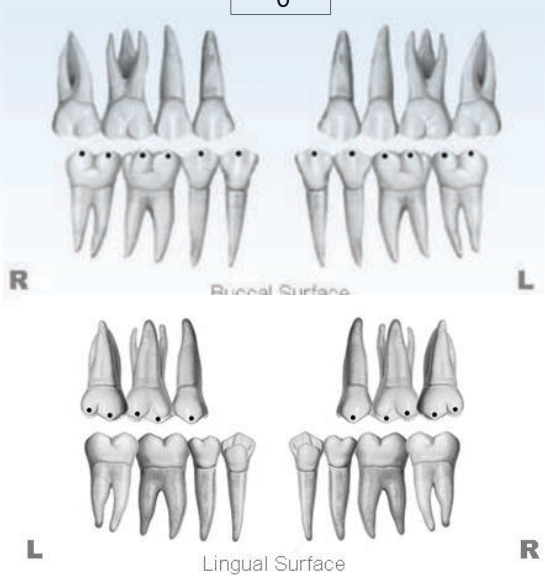


Overjet

2

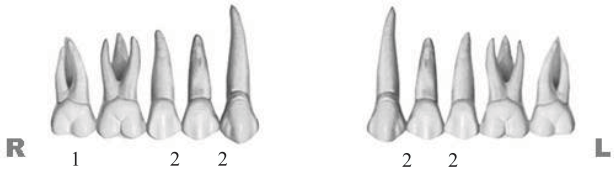
Occlusal Contacts

0



Occlusal Relationships

9



Interproximal Contacts

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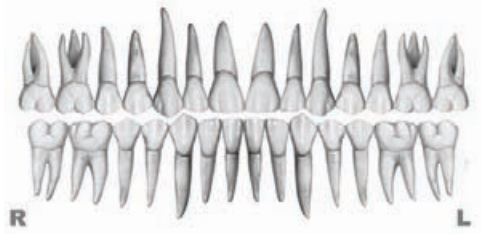

Root Angulation

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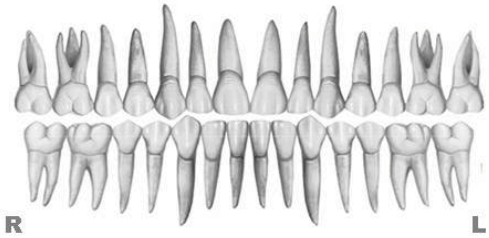


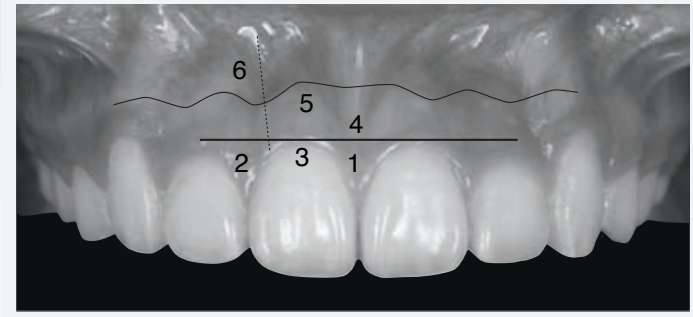
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 0

1. Pink Esthetic Score

Total = 0

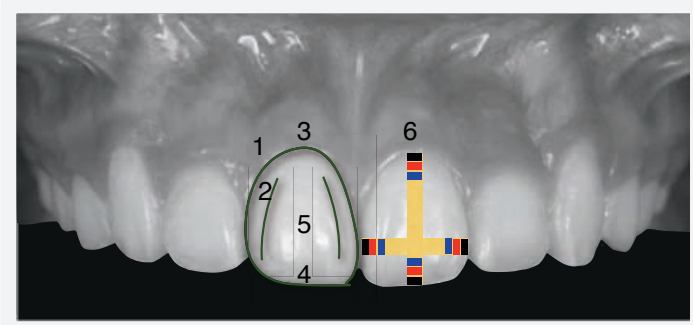


1. Mesial Papilla	0	1	2
2. Distal Papilla	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

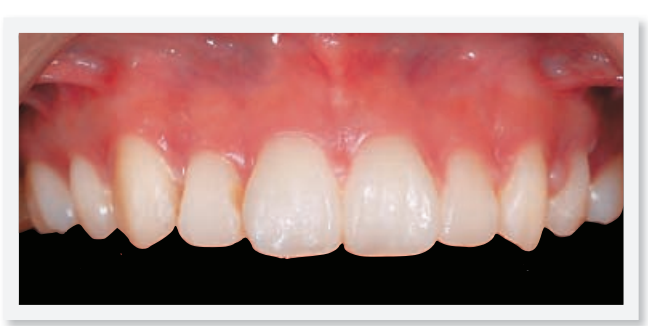
1. Mesial Papilla	(0)	1	2
2. Distal Papilla	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	(0)	1	2
5. Root Convexity (Torque)	(0)	1	2
6. Scar Formation	(0)	1	2

2. White Esthetic Score (for Restorative Prosthesis)

Total = 0



1. Tooth Form	0	1	2
2. Mesial & Distal Outline	0	1	2
3. Crown Margin	0	1	2
4. Translucency (Incisal third)	0	1	2
5. Hue & Value (Middle third)	0	1	2
6. Tooth Proportion	0	1	2



1. Tooth Form	(0)	1	2
2. Mesial & Distal Outline	(0)	1	2
3. Crown Margin	(0)	1	2
4. Translucency (Incisal third)	(0)	1	2
5. Hue & Value (Middle third)	(0)	1	2
6. Tooth Proportion	(0)	1	2

超快速X超完美

臨床應用與操作　根管充填術

2012新式鎳鈦根管治療密技

呂志明 醫師

SHAPING

鎳鈦合金器械在近幾年來發展迅速，要如何使用鎳鈦器械做出正確的診斷、完美的髓腔開擴及建立滑行路徑、達成根管治療成功的目的？

如何選擇一套適合臨床使用的旋轉鎳鈦根管銼針？演講中將會詳細介紹這些新器械的設計特點及使用方法。透過呂志明醫師現場操作，將**根管治療**的「**開擴、清創、修形**」等關鍵因素**逐一剖析**，讓您輕鬆成就安全、高效率完美、又迅速的根管治療。

林郁恆 醫師

OBTURATION

新式的**熱塑馬來膠根管封填**技術有很多的優點：**穩定性強、精確度高**；可達到根尖0.5mm左右且封閉性好，側根管也能緻密的封填。因此熱塑馬來膠根管封填技術已成為今後根管治療發展的方向。然而熱充填技術的步驟非常複雜繁瑣、十分耗時。

林郁恆醫師，將利用最新式的機器，以最精準的技術及最簡化的方式，帶領您達成根管封填最完美的結果。

報名資訊

衛署醫器輸壹字第 009148 號
衛署醫器輸壹字第 010742 號

主辦單位
中華民國牙髓病學會

協辦單位
湧傑企業股份有限公司

時間
2012年 9/23 (日) 台北班
10/21 (日) 高雄班
11/4 (日) 台中班

報名專線
台北 02-2778-8315 分機124 王's
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高雄 07-536-1701 王's

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上課地點
台北-恆逸教育訓練中心
台北市復興北路99號12樓
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高雄-高雄科學工藝博物館 203 教室
高雄市三民區九如一路720號

課程時刻表

- 09:00 – 10:30 Lecture
- 10:30 – 10:50 Coffee Break
- 10:50 – 12:00 Hands-on
- 12:00 – 13:00 Lunch
- 13:00 – 14:30 Lecture
- 14:30 – 14:50 Coffee Break
- 14:50 – 16:00 Hands-on
- 16:00 – 16:30 Discussion

POSTERIOR AESTHETICS

A LECTURE DEMONSTRATION COURSE

October, 10, 2012 Taipei

Dr. Ronald D. Jackson

一定要知道 Contemporary Materials & Techniques

現代實用的**牙科美學**應用技術

Dr. Ron Jackson is a 1972 graduate of West Virginia University School of Dentistry. He has published many articles on esthetic, adhesive dentistry and has lectured extensively across the United States and abroad. Dr. Jackson has presented at all the major U.S. scientific conferences as well as to Esthetic Academies in Europe, Asia and South America. He is an Accredited Fellow in the American Academy of Cosmetic Dentistry, a Fellow in the Academy of General Dentistry, a Diplomate in the American Board of Aesthetic Dentistry and is Director of the Mastering Dynamic Adhesion and Composite Artistry programs at the Las Vegas Institute for Advanced Dental Studies. Dr. Jackson practices comprehensive restorative and cosmetic dentistry in Middleburg, Virginia, USA.

INTRODUCTION OF LECTURE

POSTERIOR COMPOSITES CASES - BY DR. JACKSON

後牙複合樹脂補綴技術已漸漸成為主流。上午的演講中，Dr. Jackson 將整合黏著劑、複合樹脂材料和最新穎的器具，透過標準操作示範，清楚呈現如何在後牙樹脂補綴時，有效減少操作時間且耗費較少的精力，同時達到預期的美觀效果。近幾年來，**無金屬牙冠 - 新瓷牙**正快速的發展，牙醫師們必須去了解學習這些材料，並決定何時、何地使用它們。下午，Dr. Jackson 將告訴大家，這些材料最新的發展報告；除了分析優、缺點外，並說明在製備與黏著放置時應注意的細節。主題將涵蓋：

- The materials – Leucite, Lithium Disilicate, Alumina, Zirconia, CAD-CAM
- Strength vs. Esthetics
- Preparation and Immediate Dentin Seal
- Adhesive placement vs. Conventional cementation
- Adhesives: to the tooth – to the restoration
- The cements – glassionomers, resin ionomers, compomers, resin and the new adhesive resins

INFORMATION OF LECTURE

Organizer 中華民國牙體復形學會

Co-Organizer 湧傑企業股份有限公司

Host Dr. 林光勳

Speaker Dr. Ronald D. Jackson

Time 2012/10.10 (三) 9:00-17:00

Venue 台大集思國際會議中心 - 蘇格拉底廳
台北市羅斯福路四段85號B1 (捷運公館站2號出口)

Fee 2012/9/30 前，主協辦單位會員2500元，非會員3000元
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衛署醫器輸壹字第 002613 號

The 2B-3D rule for implant planning, placement and restoration

1. What is biologic width?

Is there a golden rule for implant planning, placement and restoration as the Newton's laws of motion for force prediction? In order to answer this question, one needs to refer back to the biologic system which the implant site attempts to mimic.

In the human body, ectodermal tissue serves to protect against invasion from bacteria and other foreign materials. However, both teeth and dental implants must penetrate this defensive barrier. The natural seal that develops around both and protects the alveolar bone from infection and disease, is known as the biologic width.[1] Around natural teeth, the biologic width has been shown to consist of approximately 1mm sulcular depth, 1mm junctional epithelium, and 1mm connective tissue attachment (*Fig. 1*).[2,3]

To summarize then, the biologic width is equal to 3mm: 1mm sulcular depth, 1mm junctional epithelium and 1mm connective tissue attachment above the crestal bone. This is true on the broad facial surface. In the proximal papillae area, the correct biologic width increases to 4mm.[4,5] This can be measured on any tooth using the "sounding" technique.

This "sounding" technique of the crestal bone is not routinely practiced by most clinicians. However, for anterior esthetic cases where the margin is desired to remain subgingival, this "sounding" procedure will ensure its long term stability and esthetics.

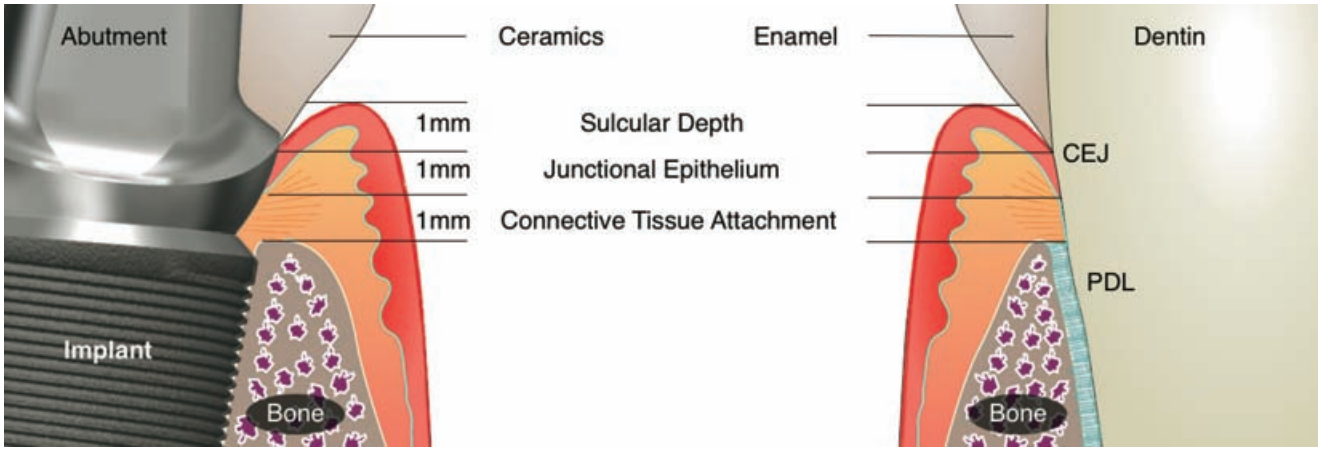


Fig. 1:

The biologic width is equal to 3mm: 1mm sulcular depth, 1mm juntional epithelium and 1mm connective tissue attachment above the crestal bone. As a general rule, the implant head should be placed 3mm apical to the future labial gingival margin position in order to allow development of the desired emergence profile, esthetics, and biologic width.

Chris Chang, DDS, PhD.
- *Founder, Beethoven Orthodontic Center*
- *Publisher, International Journal of Orthodontics & Implantology*

The "Sounding" Procedures:

First, anesthetize the area to be sounded. Second, use a narrow tipped periodontal probe, place it in the sulcus and lean it away from the tooth while keeping the tip against the enamel. Third, push through the attachment apparatus until the crest of bone is felt.[2,3] Finally, record three measurements per facial tooth surface.

One should be aware that the crest of bone follows the scallop of the cemento-enamal junction (*CEJ*) but DOES NOT always follow that of the gingival margin. Based on these measurements of the teeth to be restored (*proximals and center of facial*), one can predict how the tissue will respond post-cementation of the new prostheses.[3,4] The goal is to keep the prosthesis margin within the sulcular depth without interfering with the junctional epithelium and connective tissue attachment. [4,5]

2. Does an implant need this defense barrier-biologic width?

If a tooth needs a defense barrier to protect its supporting alveolar bone, it is reasonable to assume the same for an implant. Based on the study of Berglundh T, et al.,[6] the biologic width that develops around implants at the time of abutment connection has been shown to incorporate tissue zones of similar dimensions which is 1mm sulcular depth, 1mm junctional epithelium, and 1mm connective tissue attachment with insufficient principle fibers. This concept of biologic width around implants has been further investigated by Hermann JS, et al.[7] This group evaluated the impact of the position of the implant-abutment interface relative to the crestal bone and periimplant tissues. The investigation indicated that the biologic width around implants differed according to the depth and position of the interface. When the implant-abutment connection was placed at the gingival level, supracrestal to the alveolar bone (*i.e., as in a conventional single-stage implant placement*),[8] the biologic width was similar to that of natural dentition. When the interface was placed at a deeper level (*i.e., as in a standard submerged implant design*),[8] however, the biologic width increased accordingly. The primary difference was found in the depth of the junctional epithelium height, which extended just apical to the interface. The sulcus depth and connective tissue attachment width appeared stable regardless of the level of interface. It was, therefore, determined that implant placement with the implant-abutment interface placed supracrestal to the bone facilitated maintenance of the biologic width with minimal apical bone resorption.[9-11]

In the esthetic area, however, the prosthesis margin should always be placed subgingivally, regardless of whether the implant fixture is a one- or two-stage

design. As a general rule, the implant head should be placed 3mm apical to the future labial gingival margin position in order to allow development of the desired emergence profile and esthetics.[12-14] More importantly, this rule of 3mm depth from the future labial gingival margin is based on the biologic width which develops around the implant. With 3mm in depth from gingival margin, a defense barrier can form and further protect the alveolar bone around the implant which mimics natural dentition.[14]

3. Does buccal bone thickness affect biologic width?

The answer is YES. Buccal bone thickness and biologic width are inter-related. According to the long-term clinical study by Grunder U, et al.,[12-14] they concluded that to achieve a stable, optimal esthetic result with implants, given the anticipation of the circumferential bone resorption around the implant heads,[15] the thickness of the bone on the buccal side of an implant should be at least 2mm.[14] When the bone is found to be insufficient, a bone augmentation will be performed on the buccal side. For a papilla between two adjacent implants to be established, the inter-implant distance has to be more than 3mm. The study further suggests that additional bone on the buccal side of the papilla is required in order to prevent black triangle.[14] Grunder's conclusion[12-14] is based on the assumption of the inevitable occurrence of circumferential bone resorption around implant heads. Tarnow el al.,[15] proved that a certain amount of bone resorption occurred around implants as soon as the implant was placed. On average, the first bone to implant contact is about 1.5 to 2mm below the implant shoulder shortly after implant exposure.[16] This bone resorption occurs not only in a vertical but also in a horizontal direction.[14,16]

Can modern implant design[17,18] prevent circumferential bone resorption around implant heads? One promising solution involves the concept of platform switching.[18] This is based on the observation that, when the interface between the implant shoulder and abutment is moved horizontally away from the bone, bone resorption does not occur. This might be the result of distancing the contaminated microgap[19] away from the bone. To take a step further, the current morse taper design of abutment with a conical seal can dramatically reduce or eliminate this contaminated microgap.[20] Without the contaminated microgap, infection due to the pumping effect of the microgap and the consequential bone resorption can be avoided. Therefore, the crest bone can be preserved. In terms of bone preservation and preventing gingiva recession, abutment with the capacity of platform switching and a conical seal seems to be the answer. However, clinical observation shows that the labial gingiva recession will occur regardless the type of implants used if the buccal bone thickness is insufficient.[14] This begs another question: what make the existing buccal bone stable? For example, gingiva recession is rare in natural dentitions even when the buccal bone thickness is less than 1mm.[21] However, it is a common occurrence in implant sites where buccal bone is thin. Why? The reason may be due to the loss of supporting system or structure, i.e., periodontal ligament (*PDL*). Without PDL, the

buccal bone resorption will occur. This condition has been well documented by Araújo and Lindhe.[22] Beside the structure change, the nurturing system, i.e., vascular supply, is also modified.[23-25] Makigusa [24,25] had illustrated morphologic differences in the distribution of the vascular network around marginal gingiva between implant sites and natural dentitions as the following.

The origins of these blood supply routes[25] in marginal gingiva can be described as: (*1*) from the periodontal ligament to the connective tissue, (*2*) from the cancellous bone to the periodontal ligament and then to the connective tissue, (*3*) from the cortical bone directly to the connective tissue, (*4*) from the apical mucosa directly to the marginal gingiva (*Fig. 2*).

When implants replace lost teeth, and a new biologic width develops after connecting conventional two-stage implants to abutments, the overall blood supply to the gingival connective tissue is reduced, due to the lack of a periodontal ligament. Clinicians should take this into consideration when planning for implant placement, particularly in the esthetic zone, where buccal gingival tissue recession is common.[26,27] The reduction in blood supply, first after extraction and then after implant placement, may lead to this loss of soft-tissue volume and prompt implant and/or abutment exposure. Thus, evaluation of the patient's tissue biotype and bone thickness should be performed during treatment planning, with anticipations for the clinical outcome adjusted accordingly. The thicker the native hard and soft tissue are, the more robust the blood supply can be expected after implant placement, with enhanced expectations for esthetic success.

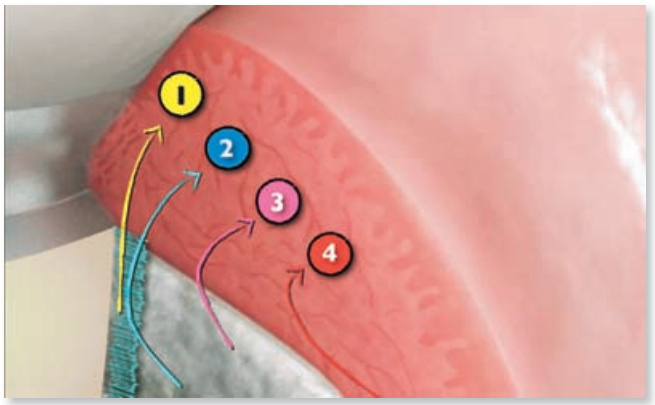


Fig. 2:

The origins of these blood supply routes in marginal gingiva are as follows:

(1) from the periodontal ligament to the connective tissue,

(2) from the cancellous bone to the periodontal ligament and then to the connective tissue,

(3) from the cortical bone directly to the connective tissue, and

(4) from the apical mucosa directly to the marginal gingiva.

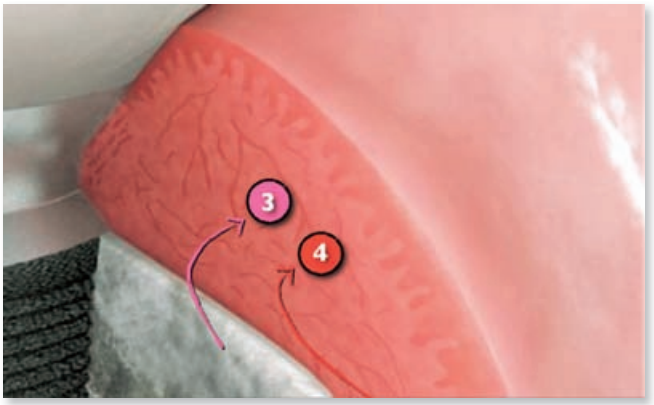


Fig. 3:

After losing the periodontal ligament, blood supply around dental implants is less than that around natural dentition due to the loss of first route and second route of blood supply. This may be the reason why Grunder consistently found that ***2mm of buccal bone thickness*** *could prevent gingiva recession. Because we can get a broader area of blood supply.*

After losing the periodontal ligament, blood supply around dental implants (*Fig. 3*) is reduced due to the loss of first and second route[25] as well as the result of a dynamic process of bone remodeling. After implant placement, the biologic width must be reestablished. As this occurs, circumferential bone loss typically takes place around the implant's coronal aspect up to the first implant thread. Also, resorption in a palatal direction following tooth loss leads to ridge thinning. The thin bone remaining on the facial aspect of the implant tends to be cortical, with significantly reduced vascularity. Furthermore, in a thin ridge, there is rapid drop off (*sloping*) of the buccal aspect of the crest, resulting in more of the blood supply being positioned apically, where the bone crest is wider and more cancellous. This may be the reason why Grunder[14] consistently asserts that 2mm buccal bone thickness proves to be advantageous for preventing gingiva recession for the broader area of blood supply.[25]

4. Conclusion: The 2B-3D rule

Based on the biologic evidence [28,29] discussed above, implants should be placed with 2mm buccal bone thickness and 3mm in depth from future prostheses margin to ensure the stability of implant restoration. In short, the author summarizes the above principle as the 2B-3D rule for ideal implant placement. What is the 2B-3D rule? 2mm of buccal bone thickness should be preserved before placing an implant 3mm in depth from the future prosthesis cervical margin. This 2B-3D rule is a practical guide, both for single implants or full mouth rehabilitation,[30] to achieve ideal implant positions. When these conditions could not be satisfied at the time of implant placement, bone augumentation, bone reduction, lingually positioning implant or smaller diameter of implant should be considered to ensure long-term stability of both hard and soft tissues.[14,30]

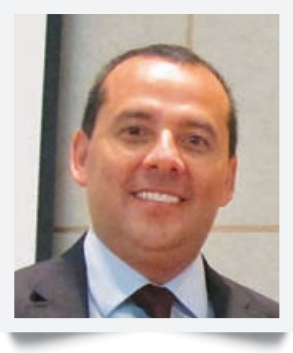
REFERENCES

1. Gargiulo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. J Periodontol 1961;32:261-267.
2. Kois JC. The restorative-periodontal interface: Biological parameters. Periodontol 2000 1996;11:29-38.
3. Van der Velden U. Regeneration of the interdental soft tissue following denudation procedure. J Clin Periodontol 1982;9:455–495.
4. Kan JYK, Rungcharassaeng K, Umezu K, Kois J. Dimensions of peri-implant mucosa: An evaluation of maxillary anterior single implants in humans. J Periodontol 2003;74:557–562.
5. Salama H, Salama MA, Garber D, Adar P. The interproximal height of bone: A guidepost to predictable aesthetic strategies and soft tissue contours in anterior tooth replacement. Pract Periodontics Aesthet Dent 1998;10:1131–1141.
6. Berglundh T, Lindhe J, Ericson et al. The soft tissue barrier at implants and teeth. J Clin Oral Implants Res 1991;2:81-90.
7. Hermann JS, Buser D, Schenik RK, Higginbottom FL, Cochran DL. Biologic width around titanium implants. A physiologically formed and stable dimension oven time. Clin Oral Implants Res 2000;11:1-11.
8. Ericsson I, Nilner K, Klinge B et al. Radiographical and histological characteristics of submerged and nonsubmerged titanium implants. An experimental study in the Labrador dog. Clin Oral Implants Res 1996;7:20-26.
9. Abrahamsson I, BerglundhT, Wennström J, Lindhe J. The peri-implant hard and soft tissues at different implant systems. Clin Oral Implants Res 1996;7:212–219.
10. Cochran DL, Hermann JS, Schenk RK, Higginbottom FL, Buser D. Biologic width around titanium implants. A histometric analysis of the implan-to-gingival junction around unloaded and loaded non-submerged implants in the canine mandible. J Periodontol 1997;68:186–198.
11. Abrahamsson I, Berglundh T, Glantz PO, Lindhe J. The mucosal attachment at different abutments. An experimental study in dogs. J Clin Periodontol 1998;25:721–727.

12. Grunder U, Spielman HP, Gaberthüel T. Implant-supported single tooth replacement in the aesthetic region: A complex challenge. Pract Periodontics Aesthet Dent 1996;8:835–842.
13. Grunder U. Stability of the mucosal topography around single tooth implants and adjacent teeth: 1-year results. Int J Periodontics Restorative Dent 200;20:11-17.
14. Grunder U, Gracis S, Capelli M. Influence of the 3-D Bone-to-Implant Relationship on Esthetics. Int J Periodontics Restorative Dent 2005;25:113-119.
15. Tarnow DP, Cho SC, Wallace SS. The effect of inter-implant distance on the height of interimplant bone crest. J Periodontol 2000;71:546-549.
16. Adell R, Lekholm U, Rockler B, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1981;10:387-416.
17. Wöhrle PS. Nobel Perfect esthetic scalloped implant: Rationale for a new design. Clin Implant Dent Relat Res 2003; 5(suppl 1):64-73.
18. Lazzara RJ, Porter SS. Platform switching: a new concept in implant dentistry for controlling postrestorative crestal bone levels. Int J Periodontics Restorative Dent 2006;26:9-17.
19. Jansen VK, Conrads G, Richter EJ. Microbial leakage and marginal fit of the implant-abutment interface. Int J Oral Maxillofac Implants 1997;12:527-540.
20. Zipprich H, Weigl P, Lange B, Lauer HC. Micro-movements at the Implant-Abutment Interface: Measurement, Causes, and Consequences. Implantologie 2007;15(1):31-46.
21. Kan JKY, Roe P, Rungcharassaeng K, et al. Classification of sagittal root position in relation to the anterior maxillary osseous housing for immediate implant placement: a cone beam computed tomography study. Int J Oral Maxillofac Implants 2011;26(4):873-876.
22. Araújo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. J Clin Periodontol 2005; 32:212-218.
23. Berglundh T, Lindhe J, Jonsson K et al. The topography of the vascular systems in the periodontal and peri-implant tissues in the dog. J Clin Periodontal 1994; 21:189-193.
24. Makigusa K, Toda I, Suwa F. Microvasculature of the mandibular periosteum in the Japanese monkey. Japan Soc Periodontol 2001;43(3):227-239.
25. Makigusa K. Histologic comparison of biologic width around teeth versus implants: The effect on bone preservation. J Implant Reconstructive Dent 2009;1(1):20-24
26. Small PN, Tarnow DP. Gingival recession around implants: a 1-year longitudinal prospective study. Int J Oral Maxillofac Implants 2001;5(4):527-532.
27. Small PN, Tarnow DP, Cho SC. Gingival recession around wide-diameter versus standard-diameter implants: a 3- to 5-year longitudinal prospective study. Pract Proced Aesthet Dent 2001;13(2):143-146.
28. Esposito M, Ekestubbe A, Grondahl K. Radiological evaluation of marginal bone loss at tooth surfaces facing single Brånemark implants. Clin Oral Implants Res 1993;4:151–157.
29. Spray RJ, Black CG, Morris HF, Ochi S. The influence of bone thickness on facial marginal bone response: Stage 1 placement through stage 2 uncovering. Ann Periodontol 2000;5:119– 128.
30. Rojas-Vizcaya F. Rehabilitation of the maxillary arch with implant-supported fixed restorations guided by the most apical buccal bone level in the esthetic zone: A clinical report. J Prosthet Dent 2012;107:213-220.

Rehabilitation of the Maxillary Arch with Implant-supported Fixed Restorations Guided by the Most Apical Buccal Bone Level in the Esthetic Zone: A Clinical Report

Dr. Fernando Rojas-Vizcaya



Dr. Fernando Rojas-Vizcaya
Instructor, USC Implant
Training Program in Taiwan

摘要

本篇摘錄整理 Dr. Fernondo 投稿於 J Prosthet Dent 2012；107：213-220 文章。全文為以 prosthetically-driven 觀念來進行上顎全口無牙重建，立即植牙負重的案例。從上顎正中門齒的切端開始，一步步利用 most apical buccal bone level (MAPPL) 的原則進行全口補綴物的設計過程分析介紹。

前言

任何形式的上顎全口重建贋復，我們建議以上顎正中門齒切端 (incisal edge of the maxillary central incisors, IEMCI) 為起始點延伸完整的治療計劃[1]。切端 IEMCI 到 remaining healed buccal bone 的距離代表了將來贋復物的形式 (Fig. 1)。如果 IEMCI 到bone的距離 ≤14mm，可選擇 fixed prosthesis 復形牙冠的部分，此時門牙牙冠長度為10~11mm，我們可預留約 3mm 的biologic width 讓軟組織成型[2,3]。如果距離超過 14mm，此時選擇 implant-supported fixed denture，牙齦的部分可使用 acrylic resin 或 gingival-colored ceramics[4,5]。Fixed Prosthesis 要滿足美觀的需求時，牙冠邊緣的軟組織需要保有一定的適當比例以及對稱[6,7,8]。為了達到適當的 biologic width，植體應該放置於牙冠邊緣最高點處往根尖 3mm 處 (Fig. 2)[2,3]。另外需保留頰側骨約 1.8mm 到 2.0mm 的厚度，植體的位置應往顎側 2mm[9,10]，我們利用這原則來進行下面案例的治療計畫。

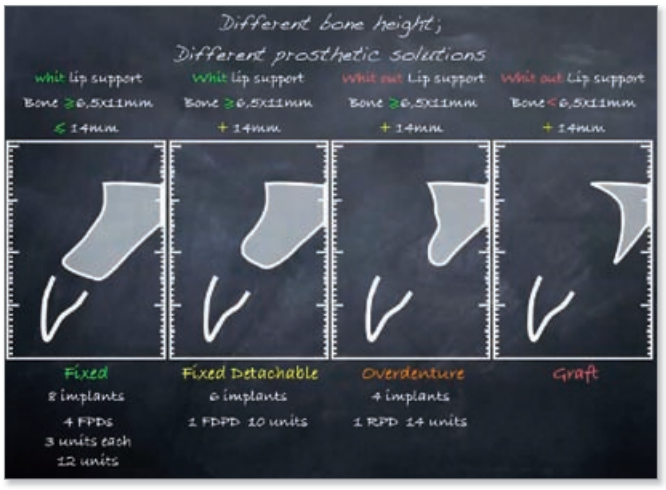


Fig. 1

蘇筌瑋 醫師
高雄醫學大學研究所牙周病碩士
金牛頓植牙中心院長

臨床案例

一位 67 女性來院尋求補綴贋復諮詢，診斷為上顎嚴重型牙周病伴隨廣泛性齲齒，牙齒預後為 hopeless (figures 3a, b)。依照 American College of Prosthodontists 的分類，此病例屬於 Class IV[11]。與病人討論諮詢後，選擇 fixed prosthesis (immediate implant placement/immediate loading protocol)。首先從 IEMCI 為開端，接下來評估 MABBL 位置一步步設計整個補綴物。拍攝臨床照片後，我們從患者年紀，性別，resting position 時上下唇的長度尋找 IEMCI，通常露出約 2mm 的門牙[12]。病人微笑時，可以找到兩邊canine tip的位置，然後我們將這些位置標註在石膏模型上 (Fig. 4)。正中門牙 labial surface 到 incisive papilla 取平均值 12.3mm 決定了前牙的 A-P position[13]。

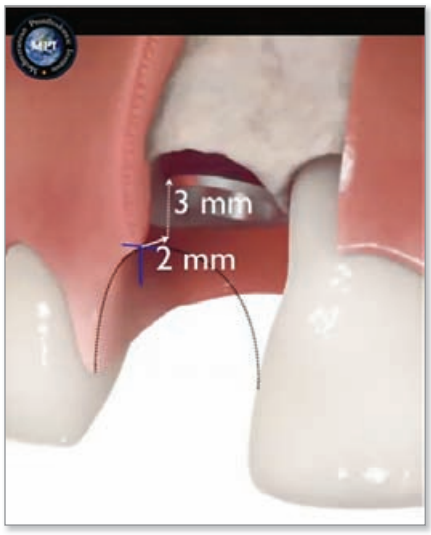


Fig. 2

上了局部麻醉後，利用 probing 與根尖 X-ray 確定每顆殘存牙周圍的骨高度。以 Fig. 5a 為例，先看右上正中門牙，黃線是我們決定的 IEMCI 位置，紅線為 crown margin，黑線是病人現存的骨高度，紅線往根尖 3mm 就是 MABBL，也就是將來植體預計放置的深度，從黑線到預定植體深度距離有 1.5mm，就是我們在手術時需要將骨頭往下修的距離。從兩側對稱延伸依序就是側門牙、犬齒，到後牙的理想位置 (figures 5b, c)。使用 high-speed 在模型上修出每顆齒位理想的植體深度，以蠟復型 (Fig. 6a)，然後再將這 diagnostic waxing 複製兩組石膏模型 (Fig. 6b)，右邊可看到其中一付複製模用 silicone 取牙冠形態後，將石膏上的牙冠修除只保留 soft tissue contour，非植牙區則預留 ovate pontic 所需要的空間。然後製作出

Fig. 4

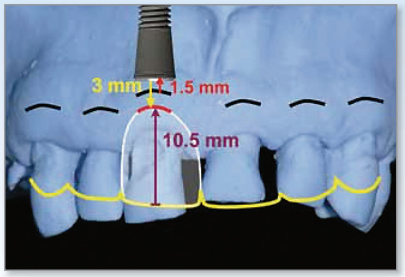


Fig. 5a

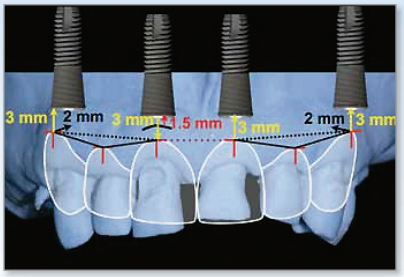


Fig. 5b

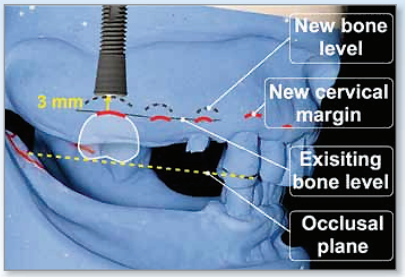


Fig. 5c

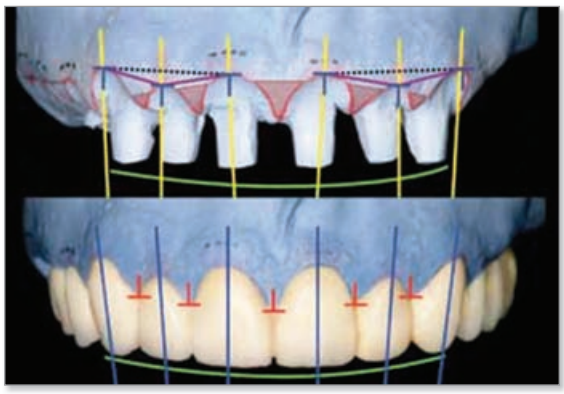


Fig. 6a

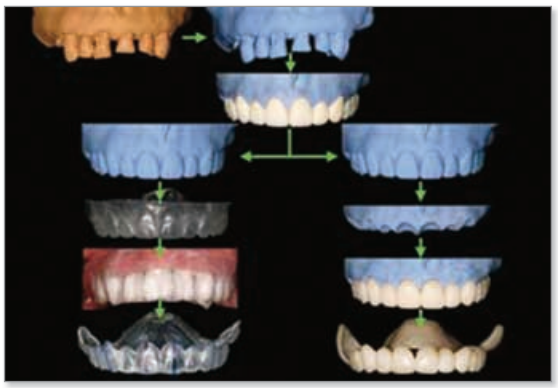


Fig. 6b

Fig. 6c

Fig. 6d

全口臨時假牙 (保留 palatal plate 與 tuberosity 以當做臨床定位用)。Fig. 6b 左邊的複製模則利用熱塑板 (0.5mm 厚) 作出 thermoplastic template，同樣保留 palatal plate 作定位，病人試戴的時候 over-extrude 的牙齒需將 template 挖洞 (Fig. 6c)，另外將每顆牙齒的外型處用 sticky wax 黏上寬1mm 的鉛條 (從根尖片的鉛片剪出)，當做 radiographictemplate 定位器讓病人去拍攝 CT[5]。(Fig. 6d)

依照上顎 6-6 這十二片鉛條顯示出每顆牙齒中間位置的牙齒外型以及牙冠的邊緣，我們選擇植牙的位置為兩邊的 1x3、4x6。從要放置植體的牙位切出該位置的 CT slice view 進行植牙位置深度角度的分析：例如從 Fig. 7a 的這張 slice view，從 buccal crown margin 往顎側 2mm、根尖 3mm，中心 screw hole 在 buccal cusp tip 以內就是理想上植體的位置，bone level 也剛好落在此，所以不需要修骨或補骨，植體深度可以剛好 equal bone。

從 Fig. 7b 這張來看，骨高度與 crown cervicalmargin 距離小於 3mm，因此，此區放置植體時需要先修骨到理想的位置。面對 Fig. 7c 這樣牙齒拔除後，cervialmargin 到 bone level 距離大於 3mm 的情況，我們就需要在此區進行 GBR 的術式。Fig.

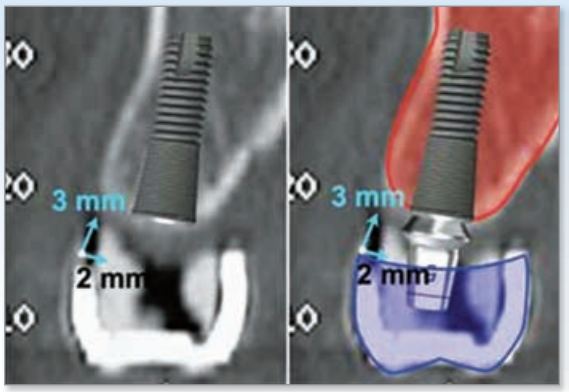


Fig. 7a

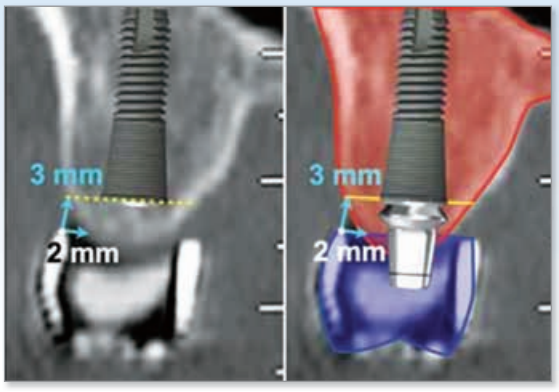


Fig. 7b

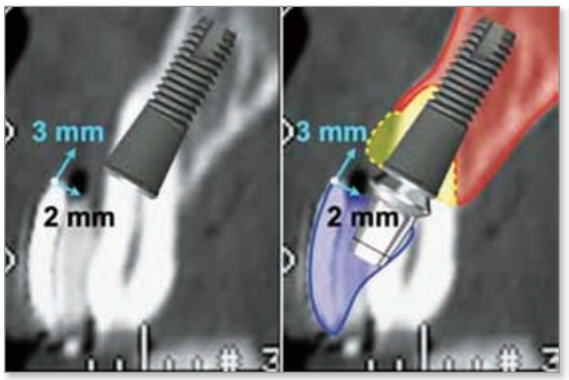


Fig. 7c

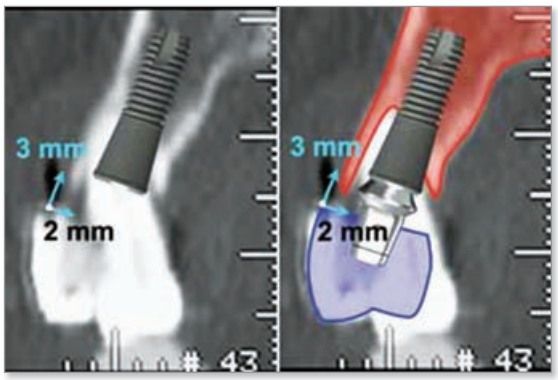


Fig. 7d

7d 的 slice view 裡，可看到牙齒拔除後仍有足夠的 buccal bone plate，而且植體選擇理想的位置 (3mm 深、2mm 往頰側) 植入後 jumping gap 小於 2mm，則此區就不需補骨或修骨。

在 pontic #15 的區域 (Fig. 8a)，我們可以拿 provisional restoration 來當做手術模板[14]，要形成自然的ovate pontic，cervical margin 需要往下多延伸 1.5mm 的部分塑型軟組織，cervical margin 往下 3mm 為理想的 bonelevel (Fig. 8b)，從 Fig. 8a 可看到 #15 pontic 處骨頭太多，需要修至理想的位置，同時臨時假牙的posteriorpalatal seal 也能放置定位不會浮起偏移 (Fig. 8c)，如果臨時假牙無法定位，需檢查何處的骨頭需要做reduction 直到完全密貼 posterior palatal seal。

4 支 fluoride -modified screw-shape dimplant (Fixture MT OsseoSpeed; Astra Tech AB) 4.5x13mm 植入兩邊 canine，first premolar。first molar 選用 5.0x11mm (Fig. 8d)。植體在拔牙窩洞區至少低於 buccal bone level 1~1.5mm，離 planned crowns cervical margin 3mm。上顎正中門齒區需要作 GBR，Dr. Fernando 使用 Human freeze dried demineralized ground cortical bone 填補缺損區域，上面覆蓋 collagen membrane。植體置入後選擇六個 preparable abutments 鎖入植體後，以 3-0 silk 縫合，再以 close tray 用 vinyl polysiloxane 作 abutment level impression，倒模前在 tray 中放入 abutment analogs，人工牙齦的部分仍用 vinyl polysiloxane，剩下的部分用 Type IV stone 灌模。臨時假牙的部分先以 autopolymerizing acrylic resin reline，經過 pumice ，goat hair brush 拋光後以 0.12% CHX 擦拭消毒， 黏著劑選用 Temp Bond。經過 12 星期等待 GBR 的區域骨成熟，正中門牙再植入兩隻植體 (Fixture MT OsseoSpeed; Astra Tech AB)，並使用可修型的 direct abutment，abutment 套上 plastic coping (healing cap; Astra Tech AB)，再將臨時假牙 reline 後，在口外拋光後與以黏著劑 TempBond 接合，以 3-0 silk 縫合。

Fig. 8a

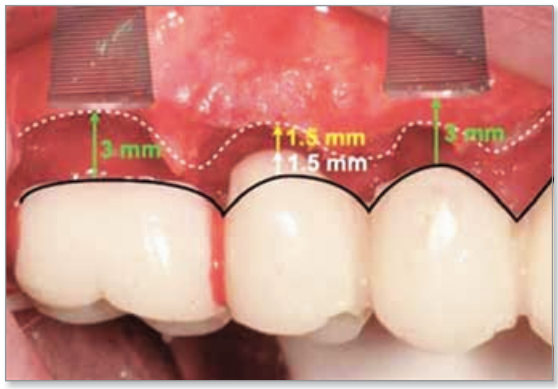


Fig. 8b

Fig. 8c

Fig. 8d

等待 8 周植體與軟硬組織穩定後，開始進行假牙贋復的階段 (Fig. 9a)，將 8 顆 abutment 轉下後 (Fig. 9b)，連結 impression coping (Fixture Pick-up; Astra Tech AB)，使用 open tray impression technique 以 vinyl polysiloxane 取模，灌出含人工牙齦部分的石膏工作模，送去 lab 以軟體進行掃描設計 virtual abutment (VAD Atlantis; AstraTech Dental, Waltham, Mass) (Fig. 9c)，milling 製成 8 顆 Zirconia computer aided design-computer aided manufacturer (CAD/CAM) abutment (Fig. 10a)，並分別製成四組 1x3, 4x6 的 zirconia frameworks (ICE Zircon; Zirhonzahn, Gais, Italy) 及完成最後的 fixed dentalprostheses (FDPs) (figures 10b, c, d)，配戴黏合後拍攝根尖片檢查密合度與骨高度。術後追蹤 3 年，患者沒有表示有不適的症狀。

結論

本篇介紹一個上顎全口固定式贋復假牙以 immediate implant placement 與 immediate loading，臨時假牙的設計依照 IEMCI 與 MABBL 的原則依序從第一支正中門齒的植體位置開始延伸到全口，假牙的 cervical margin 決定了植體的位置深度與骨頭是否修整或作 GBR。IEMCI 到 MABBL 在 healed bone 至少需 14mm，在 post extraction socket 至少需 12.5mm，植體在 socket 中應置於 buccal bone 1~1.5mm 以下。如果超過 14mm，則代表將來贋復物需要以 acrylic resin 或 ceramic 作牙肉的部分。

參考文獻

1. Spear FM, Kokich VG, Mathews DP. Interdisciplinary management of anterior dental esthetics. J Am Dent Assoc 2006;137:160-9.
2. Hermann JS, Buser D, Schenk RK et al. Biologic Width around Titanium Implants. A Physiologically Formed and Stable Dimension over Time. Clin Oral Implants Res 2000;11:1-11.
3. Kan JY, Rungcharassaeng K, Umezu K et al. Dimensions of Peri-implant Mucosa: An Evaluation of Maxillary Anterior Single Implants in Humans. J Periodontol 2003;74:557-562.
4. Zitzmann NU, Marinello CP. Treatment Plan for Restoring the Edentulous Maxilla with Implant-supported Restorations: Removable Overdenture versus Fixed Partial Denture Design. J Prosthet Dent 1999;82:188-196.
5. Cooper L, De Kok IJ, Reside GJ et al. Immediate Fixed Restoration of the Edentulous Maxilla After Implant Placement. J Oral Maxillofac Surg 2005;63 suppl 2:113-120.
6. Chu SJ, Tan JH, Stappert CF et al. Gingival Zenith Positions and

Fig. 9a

Fig. 9b

Fig. 9c

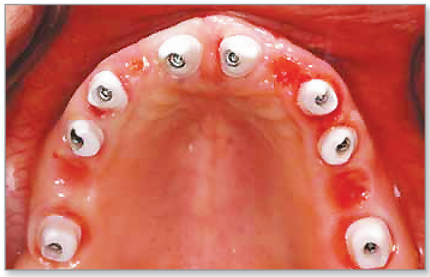


Fig. 10a

Fig. 10b

Fig. 10c

Fig. 10d

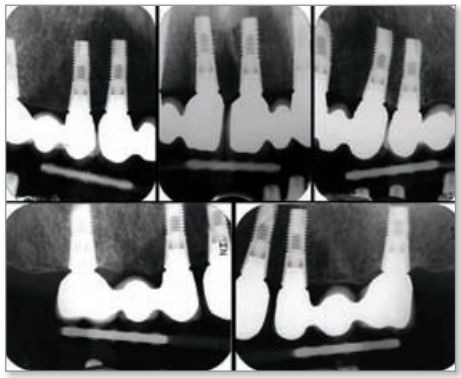


Fig. 10e

Levels of the Maxillary Anterior Dentition. J Esthet Restor Dent 2009;21:113-120.

7. Mattos CM, Santana RB. A Quantitative Evaluation of the Spatial Displacement of the Gingival Zenith in the Maxillary Anterior Dentition. J Periodontol 2008;79:1880-1885.
8. Charruel S, Petez C, Foti B et al. Gingival Contour Assessment: Clinical Parameters Useful for Esthetic Diagnosis and Treatment. J Periodontol 2008;79:795-801.
9. Spray JR, Black CG,Morris HF et al, The Influence of Bone Thickness onFacial Marginal Bone Response: Stage 1 Placement through Stage 2 Uncovering. Ann Periodontol 2000;5:119-128.
10. Evan CD, Chen ST. Esthetic Outcomes of Immediate Implant Placements. Clin Oral Implants Res 2008;19:73-80.
11. McGarry TJ, Nimmo A, Skiba JF et al. Classification System for Partial Edentulism. J Prosthodont 2002;11:181-193.
12. Vig RG, Brundo GC. The Kinetics of Anterior Tooth Display. J Prosthet Dent 1987;38:502-504.
13. Ellinger CW. Radiographic Study of Oral Structures and Their Relation to Anterior Tooth Position. J Prosthet Dent 1968;19:36-45.
14. Kinsel RP, Lamb RE, Moneim A. Development of Gingival Esthetics in the Edentulous Patient with Immediately Loaded, Single-stage, Implant-supported Fixed Prostheses: A Clinical Report. Int J Oral Maxillofac Implants 2000;15:711-721.

Feedback from the International Damon Workshop

Respected Doctor,

Taking flights for more than 20 hours from Colombia to Taipei and leaving behind seven days of a hectic work and teaching routine, represented a great strain not only economically but also in terms of work and family. Today, I realize the wonderful opportunity I had to find people like you-a wealth of wisdom and knowledge.

Now that I'm back in my hometown, I would like to write these affectionate words, with the sincere aim to express my deep and heartfelt gratitude for all professional education and philosophy of life received from you during my short stay in Taiwan.

My development as lecturer and orthodontist has evolved greatly, thanks to this great experience. I came back form Taipei with the best and latest technique knowledge, valuable and practical tools, including how to make successful presentations using the resources of MAC technology-rightly led by you in your country. I have also received invaluable and unparalleled academic material on the proper use, benefits and applications of the mini-implants.

I must emphasize that the sum of all of the above and you as a professional and businessman role model, has expanded my vision of professional development affirming that professional growth, social work and business dynamics can go hand in hand to achieve the expected results.

I will always be thankful not only to you but also to your friendly and dedicated wife, your clinic team in which I found a model for organization, care and functionality. I will never forget all the attention received and all the time spent on my professional development regardless of the multiple roles and other responsibilities you all have.

In our friendly, beautiful and historic city of Cartagena de Indias, I will always have the doors open for anything you might need in the future.

With feelings of appreciation,

Patricia Vergara Villarreal

Orthodontist, the Military University. CIEO. of Bogota

Teaching of graduate orthodontics at the University of Cartagena

Lecturer on orthodontic mini implants

Dear Chris:

Thank you very much for your kind words, Dr. Chang. I will continue to write and send clinical cases to you. I hope to go to Brazil or Argentina in October to attend your lectures there. My project is to publish my experience next year (*web, Journals, and books*). It would be interesting publish some of my cases in your journal. We'll be in touch.

Your words are very encouraging and have inspired me to pursue further work in orthodontics and radiology. THANK YOU very much. I'm sending a special greeting from Colombia.

With special affection,

Gustavo Ruiz

from Bogotá. Colombia

張醫師的視訊課程教材很精彩，文字簡單都是重點，畫面漂亮，不會充斥一大堆文字，讓眼睛很吃力，看不久就想睡覺。視訊的聲音很清楚，看著畫面就像現場坐在第一排聽演講一樣。此外，視訊可以隨時隨地就看，讓我們充分利用瑣碎時間反覆聽，聽到會為止，是很效率的學習方法。而且還有很多臨床治療的影片可以觀看，拍攝得很清楚，讓我們就像真的站在旁邊看，身歷其境，不遺漏重要鏡頭。

貝多芬的矯正視訊課程就像一本矯正百科全書，「Damon Q」是一套完整的矯正課程，有了基礎能力後，「矯正進階」裡面分好幾個主題，比如前牙錯咬、後牙錯咬、gummy smile、CI-II要怎麼治療，這對我臨床上幫助很大。比如當我在臨床上看到後牙錯咬的case就會再去聽一遍視訊，看看張醫師把它分幾類，每一類是如何解決的。「矯正骨釘OBS」兩個小時的課程，把所有OBS該知道的知識與技術，都講得很清楚。「矯正精修」帶我們閱讀經典矯正教科書，了解矯正歷史，教我們如何獨立的思考，這點很重要，盡信書不如無書。不要完全相信教科書，有時候教科書也會寫錯的。「植牙論壇」有時會請外賓演講，張醫師也會把他參加外國演講的心得，整理歸納好，用他自己的方式表達出來，等於幫我們用中文上課，吸收最新的國外知識。

整體而言，整個系列除了矯正植牙的內容，連兒牙、牙周、假牙、美學等主題都可以學到，有新的版本都可免費更新，真的很慷慨，我只能說是物超所值的學習！

西盛牙醫診所
王致偉醫師

Beethoven Scholarship Reports

從第一堂簡介課程就非常印象深刻，很好奇什麼樣的公司文化能讓員工們這樣熱愛老闆、崇拜老闆！直到見到張醫師才理解這一切，張醫師的熱誠輕易地感染給周遭的每一個人，對工作的熱誠，如站在病人的角度思考什麼對病人是最好的；對教學的熱誠，無私地分享累積多年經驗，鼓勵學生。

這次的學習真是棒極了，捨不得這麼結束。除了專業知識外更學習到張醫師的態度。過程中，張醫師常分享的話，有些話小時候聽過就忘，但張醫師的提醒讓我突然覺得很多困難突然迎刃而解。求學的挫折、對目標遙遠的無力感等等...因為「點滴改進、盡心盡力」加上幽默的生活態度，讓我找到了方向。

這三天真的很充實，專業知識、診所經營、行醫的態度，對理想的熱情與堅持，讓心靈充滿了電。期待自己能記住張醫師的精神，堅持自己的目標！

也很感謝一樣樂於分享的高老師，細心地關心每位同學是否學習到每個細節，這裡是充滿溫暖的學習環境，謝謝每一位樂於分享的工作人員，我好愛這裡！^^

中國醫藥大學牙醫學系
王靖玟

首先非常感謝張醫師及金牛頓團隊的各位，給我這次的見習機會，並且提供了這麼豐富的課程，使我在這短短兩天之內大開眼界。其中為期一個早上加一個下午的矯正中心觀摩，雖然不是非常長的時間，但我在那裡看到了非常多的巧思及創新，無論是在空間的配置上，診所運作的方式或是矯正的治療本身，都可以輕易看出許多和一般診所不一樣之處。雖然注重治療效率的提升，但是優質及完善的服務也是張醫師要求要做到的。從最初的檢查評估到治療完成後的持續追蹤，亦可以看出張醫師是確實很關心病患的情形，並希望他們能對結果滿意。

張醫師關於其故事的演講也相當令人印象深刻。「成功並非幻想，而是公式。」很具體地描繪出了他個人是具備了什麼樣的特質及經過了什麼樣的努力，才能達到今日的成功。「Passion」、「Practice」、「Persistent」三個P，也是張醫師非常強調的三大特質，也是大多數人相當不易做到的事，讓我對自己未來應以什麼樣的態度努力，又更清楚也更確定了一點。

張醫師非常鼓勵我們學員發問，也樂於給予我們詳盡的解說，甚至即時開啟以前case的資料讓我們更瞭解它們的意思，雖然這並不是在學校上課，但聽張醫師生動的教學所得到的收穫，我認為絕對不亞於學校的課程。

我認為這三天真的過得非常有價值！！這樣一個有特色且樂於求新求變的牙科診所系統，能來到其中去瞭解它的核心精神，去瞭解牙科治療能有什麼樣的改革及進步，確實如一開始我所收到的報名成功通知信所說，是一個非常難得且珍貴的機會！！再次謝謝金牛頓給我這個機會，以及我所學習到的一切！！

高雄醫學大學牙醫系
謝恩

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9/21（五）

課程介紹：OrthoBoneScrew in - office Workshop

牙醫師不敢或是不知如何植入 miniscrews，大抵有兩個原因：一是無法突破心理障礙；另一則是認為操作困難。然而，張醫師透過高效率的課程講授，直接切入重點，使您輕鬆掌握；簡潔的步驟，讓您不再求助牙周或口外醫師。百聞不如一“做”，相信短短一天的課程，您將親身見證！

全方位牙醫診所
王肖龍醫師

助理訓練課程

兩階段實務課程，含 Morph 製作及病患公關和衛教。

10/5、12（五）

課程介紹：訓練得力助手好時機

針對矯正助理的臨床技巧，包含：照相、X 光拍攝、Damon 系統相關知識介紹等等，以及牙科電腦應用，例如：衛教檔案製作、Morph 病例以及 Keynote 病例製作進行示範教學。 結合課堂講解以及診間實習雙重教學方式，務必幫助您快速培養出得力的矯正助理。此外，本期課程新增 iPad 在診間的應用，讓您的助理可以善用科技，為病人創造理想的就診經驗。

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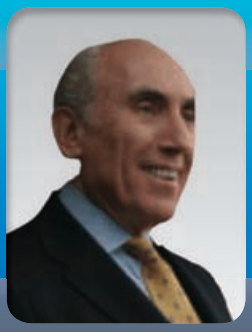


K1 簡報聖經 2012 8/16・12/27

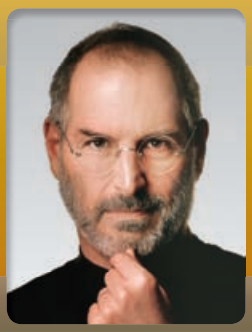
看過太多充滿複雜文字和圖表的幻燈片，聽過就忘了的演講嗎？ Keynote 系列一的演講要教你如何利用 Keynote，製作出令人目眩神迷、印象深刻的電腦簡報。透過小班教學，貼身指導，務必讓你在八小時裡輕鬆掌握 Keynote 的簡報技巧。

學習重點：1.Keynote 操作入門　2. 演講常見十大謬誤　3. 資料視覺化技巧

K2 Dr.Kokich 令人屏息的十大演講秘訣 2012 9/20・2013/1/17

Keynote 系列二位各位介紹世界牙醫界的天王講師 Dr.Kokich 的十大演講秘訣，讓您在進階的課程中更加掌握演講設計的關鍵原則，不但讓你知其然，更知其所然！

學習重點：1.Dr.Kokich 十大演講秘訣　2. 準備演講的九個步驟　3. 多媒體影片剪輯



K3 賈伯斯令人目眩神迷的五項演講技巧 2012 10/18・2013/3/14

總結我們 Keynote 系列的系列三，我們為大家逐步解析跨界演講大師 Steve Jobs 是如何說出打動人心、價值數十億美金的關鍵故事。透過逐步的分析拆解，要讓您也可以成為獨具魅力的演講人。

學習重點：1.Steve Jobs 的五項演講技巧　2. 幻燈片的設計概念　3. 幻燈片修改應用

好康

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iAOI

時間：12/09(日) 地點：台灣金融研訓院 2F菁業堂

台北市羅斯福路三段62號

2012 iAOI 年度大會

矯正與植牙的合奏

A Symphony of Orthodontics and Implantology

議程表

Dr. Thomas Han
美國UCLA
牙周病研究所教授

Dr. Kwang Bum Park
韓國連鎖MIR
牙科醫院聯盟負責人

林錦榮 醫師
台北林錦榮
齒列矯正中心負責人

張慧男 醫師
新竹貝多芬
齒顎矯正中心負責人

08:00	iAOI Exam
09:10	Registration
09:30	Topic: **Anterior Aesthetic Nightmare - Why do they occur? How to Avoid them?**
10:20	Break
10:40	Topic: **Hard Tissue Defect - How to solve it? Is the result ideal?**
11:30	Diplomate Oral Presentation 1 & 2
12:10	Lunch
13:00	Topic: **Ortho-Implant combined treatment-I**
13:50	Diplomate Oral Presentation 3 & 4
14:30	Break
15:00	Diplomate Oral Presentation 5 & 6
15:40	Topic: **Ortho-Implant combined treatment-II**
16:30	Closing comments and Certificate ceremony

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專業簡報	Keynote 簡報法 series 1 簡報聖經	1. 常見簡報謬誤 2. Keynote 入門	*2012/8/16 • 12/27* （四） 09:00 ～ 17:00	科技人、醫師 教師、學生
專業簡報	Keynote 簡報法 series 2 Kokich 的 10 大演講秘訣	1. 多媒體影像處理 2. 簡報設計	*2012/9/20 • 2013/1/17* （四） 09:00 ～ 17:00	科技人、醫師 教師、學生
專業簡報	Keynote 簡報法 series 3 How to Wow'em like Steve Jobs?	1. 賈伯斯演講秘訣 2. 簡報設計進階應用	*2012/10/18 • 2013/3/14* （四） 09:00 ～ 17:00	科技人、醫師 教師、學生
專業簡報	Keynote 簡報法 4-6 繪圖精修課程	1. How to use a digital drawing board. 2. Design illustration in your Keynote. 3. Showcase your own drawing with stunning animation in Keynote. 4. Create complicated diagrams using Adobe Illustrator and Photoshop. 5. Animation Competition	*2012/11/17-19* （六、日、一） 09:00 ～ 17:00	科技人、醫師 教師、學生
International	Damon and OBS workshop	1. Damon System 2. OrthoBoneScrew	*2012/11/13-15*	International Orthodontist

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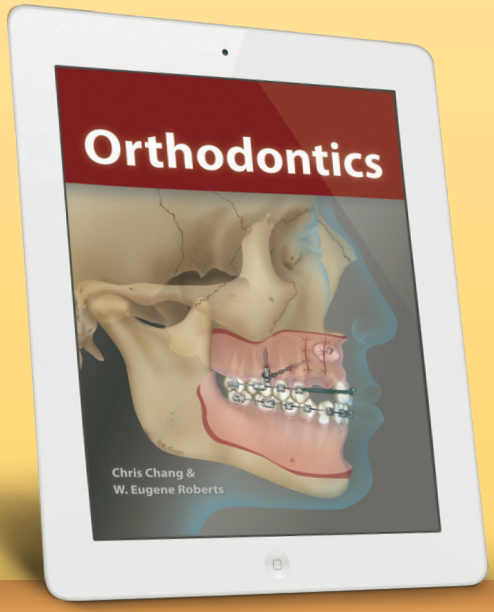

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Drs. Chris Chang (center left), Fernando Rojas-Vizcaya (center), Homa Zadeh (center right) with participants.

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