

Common Complications in Orthodontic Bone Screws: Causes, Management, and Prevention

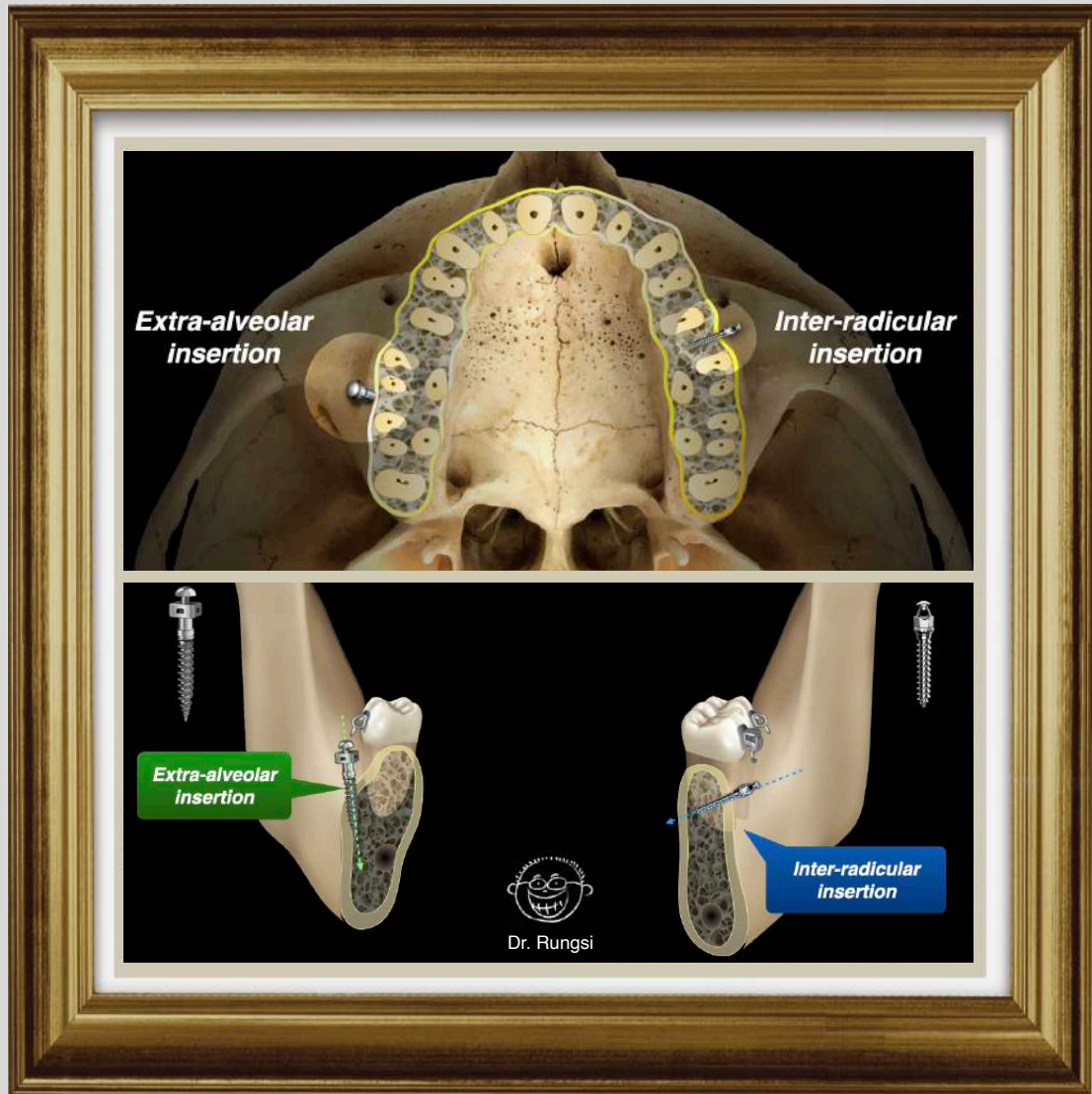
Vicky T. Huang, Chris H. Chang & W. Eugene Roberts

Non-Extraction Treatment and Correction of Generalized Interdental Spacing and Protrusive Anterior Teeth in an Adolescent

Ping-Hsuan Yeh, Chris H. Chang & W. Eugene Roberts

Non-Extraction Treatment of a Class II Openbite with Amelogenesis Imperfecta

Yu-Hsin Huang, Kim-Choy Low, Po-Jan Kuo, John Jin-Jong Lin & W Eugene Roberts



Temporary skeletal anchorage device (TSAD) insertion sites are generally categorized into two locations: inter-radicular (I-R) and extra-alveolar (E-A). I-R TSADs are typically placed within the alveolar process between tooth roots, E-A TSADs are installed away from the root structures. The extra-alveolar area offers broader and more abundant bone, allowing for the placement of thicker screws (2 mm in diameter), thus reducing the risk of screw fracture and enhancing stability for effective anchorage.



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# 2024-25 熱愛學矯正

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

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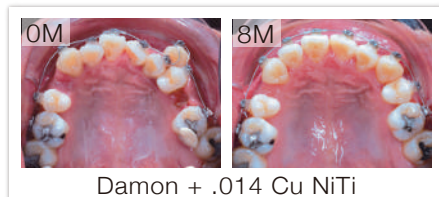
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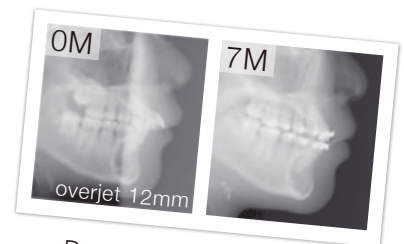
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*Reflections on Visiting Machu Picchu, Peru*

This year in February, I was invited to give an orthodontic lecture for a day in Lima, Peru. Having concluded the lecture, I visited Machu Picchu, arguably the most famous ancient Inca icon in Peru. Even though it lies only 230 km away from Cusco, it was in fact a full-day venture, taking us from 4:00am until 10:00pm. However, despite the amount of time required, we actually only spent just over an hour exploring it. Furthermore, as a cultural heritage site, there are no restroom facilities inside, and visitors must pay one US dollar to use the restroom before entering.

If someone asked me whether Machu Picchu was worth visiting or not, my answer would be that yes, it is certainly worth visiting, but it's not worth enduring such an arduous ordeal. My wife questioned that if that were the case, why would so many people find this mysterious place worth visiting? My response is that it is a lost city from five hundred years ago and was discovered completely intact and with no existing records since the Inca Empire had not established a writing system. It's hard for me to imagine an Empire without a writing system since over a thousand years ago, China had already produced written Tang poems and Song lyrics. When Machu Picchu is referred to as a cultural heritage site, I'm inclined to view it as a relic of human preliterate society, given the absence of written records and relying solely on oral legends for understanding and insight. This reiterates why I feel so strongly that culture and human achievements must be well-documented.

Twenty-eight years ago, upon returning to Taiwan to start my practice and career, I set myself the goal of leaving a positive and meaningful dent in the field of orthodontics, which has ultimately transpired into documenting how I practice orthodontics. Over the course of the last 28 years, orthodontic technology has matured to a relatively advanced stage. I believe now is the time to publish extensively on how orthodontics is being practiced. Therefore, I encourage all the young doctors in our clinic to pursue publishing articles as a routine task, since only by documenting how problems are solved can a mark be left in the history of orthodontics.

"Putting a dent in the orthodontic world" is the ultimate goal of my practice because a human life is nothing but a brief sojourn in history, but through written records, eternity can be created. We cannot allow orthodontics to be a second Machu Picchu, with no written records and only speculative guesswork derived from oral legends. Orthodontics is not about legends; it is a science. Human progress is achieved through continuous and consistent documentation enabling us to move forward step by step along our path to glory.

I hope this can inspire you to help in enlarging the dent in orthodontics by documenting as much of your personal orthodontic experience as possible.

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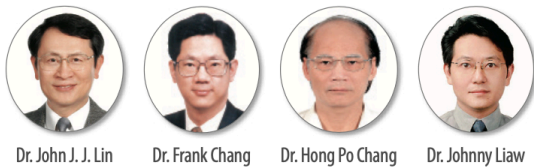
*Chris Chang* PhD, ABO Certified, Publisher of JDO

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# Common Complications in Orthodontic Bone Screws: Causes, Management, and Prevention

(*J Digital Orthod* 2024;74:4-10)

## Introduction

Orthodontic bone screws, also known as temporary skeletal anchorage devices (TSADs), have significantly expanded the possibilities in orthodontic treatment. However, like any orthodontic intervention, complications can arise. This article examines three common complications associated with TSADs: soft tissue damage, hard tissue damage, and screw fracture. We explore the causes, management strategies, and preventive measures for each of these issues.

## 1. Soft Tissue Damage

### Causes:

Soft tissue injuries frequently occur in the use of temporary skeletal anchorage devices (TSADs). The risk of soft tissue injury during installation often arises when clinicians encounter difficulties with screw placement, potentially leading to unintended slips in the positioning stage.<sup>1</sup>

Likewise, the angle and location at which TSADs are inserted play a crucial role in influencing the soft tissue response. Improper placement can result in excessive soft tissue hypertrophy, inflammation, or peri-implantitis. There has been an ongoing debate regarding the advantages and disadvantages of screw placement through movable mucosa (MM) versus attached gingiva (AG). Generally, it is recommended to position the screw within the area

of keratinized gingiva due to its potential to reduce irritation and enhance resistance to inflammation, thereby decreasing screw failure rate.<sup>2,3</sup>

However, it is worth noting that Chang et al.<sup>4</sup> did not observe significant differences between MM and AG placements. Placing the screw head in an upright and elevated position about 5 mm away from MM can also effectively maintain screw stability with good oral hygiene practices, thereby minimizing the risk of peri-inflammation (Fig. 1).

Oral hygiene plays a vital role in bone screw stability, with patients demonstrating better oral hygiene exhibiting a higher success rate compared to those with poor oral hygiene.<sup>5</sup> Unsatisfactory oral hygiene can result in soft tissue overgrowth around the TSADs and increase the risk of peri-implantitis, a polymicrobial disease driven by plaque accumulation. Poor oral hygiene may consequently decrease screw maintenance and lead to screw failure.<sup>5,6</sup> Therefore, patient compliance and postoperative care are closely correlated to screw stability.

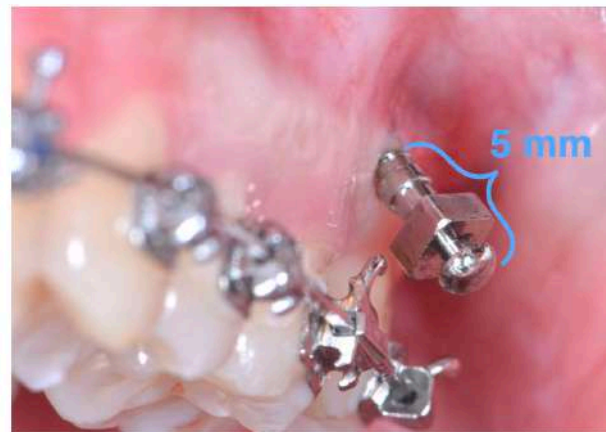
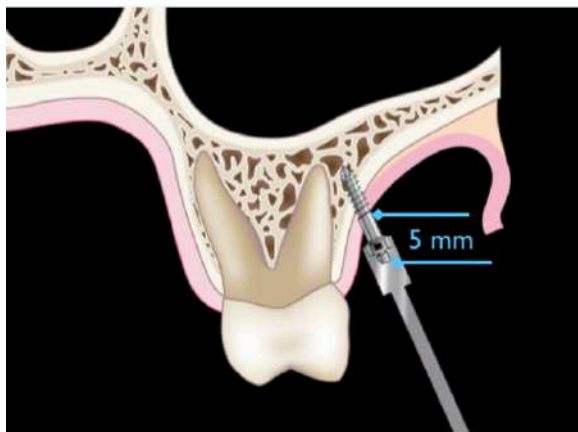
### Management and Prevention:

Excessive soft tissue growth covering TSADs is best corrected with electrosurgery or diode lasers, to meticulously remove the surplus tissue so the screw can be accessed clinically. In the case of severe inflammation, antibiotics may be necessary. In certain situations, relocating the TSADs to a more suitable

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



**Fig. 1:** *Placing the screw head in an upright and elevated position (about 5 mm away from the gingiva) within the MM or MG location can effectively maintain screw stability by facilitating good oral hygiene practices, thereby minimizing the risk of peri-inflammation.*

position may be necessary to prevent further soft tissue overgrowth and other complications.

To prevent slippage during insertion, especially in the maxilla, it is suggested to insert the TSADs with the following procedures (refer to video demonstration on YouTube: How to prevent screw fracture | **【Chris Chang Ortho】** CC657):

1. Begin with local anesthesia administration to ensure patient comfort.
2. Retract the mucosa gently to achieve a taut and level surface.

3. Employ a cotton roll to cleanse and dry the surface thoroughly, providing a clear field of vision.
4. Utilize a dental explorer to create a small indentation at the preferred insertion location.
5. Start inserting the TSAD at a modest, near-perpendicular angle to the bone. Once it engages with the cortical bone (approximately 2 mm deep), gradually alter the direction to minimize any impact on nearby roots.

Assuming adequate soft tissue clearance (approximately 5 mm) for better hygiene control, screws can be positioned in MM or AG.<sup>4</sup> It is

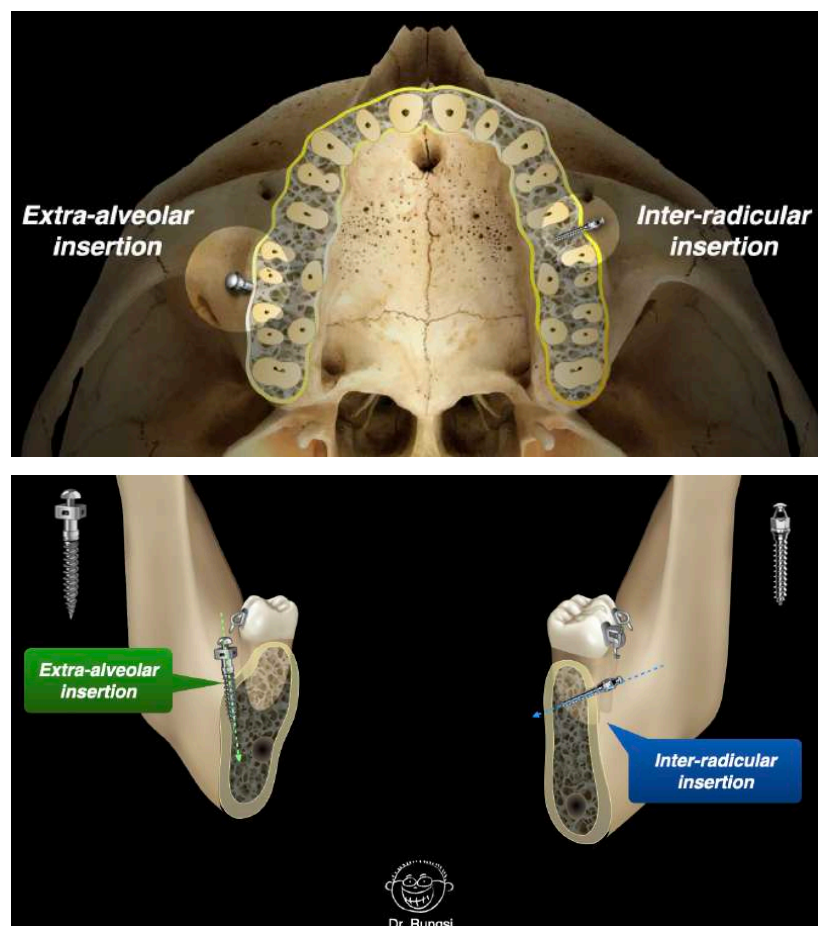
imperative to advise patients on the importance of maintaining optimal oral hygiene practices to enhance TSAD stability.

## 2. Hard Tissue Damage

### Causes:

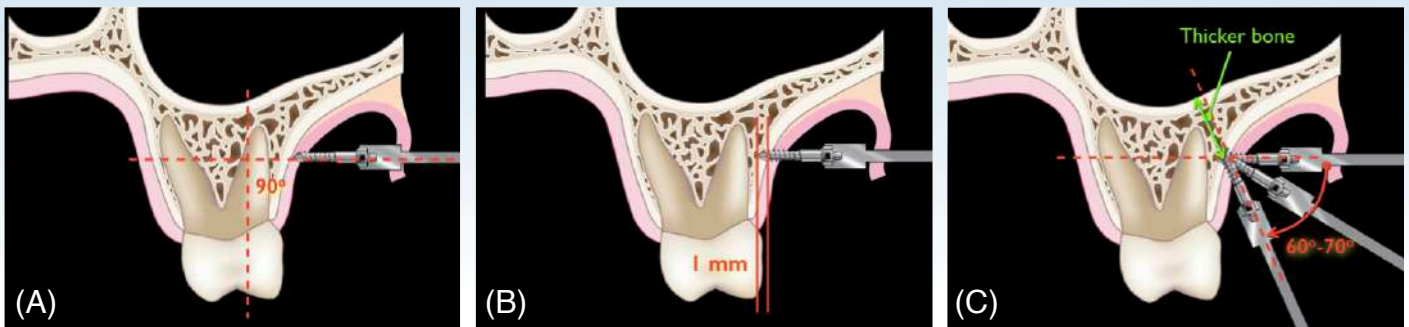
The precise positioning of TSADs can sometimes lead to inadvertent contact with tooth roots,

posing a risk of root resorption. Vigilance in preventing root damage is of utmost importance in orthodontic practices. TSAD insertion sites are generally categorized into two locations: inter-radicular (I-R) and extra-alveolar (E-A). I-R TSADs are typically placed within the alveolar process between tooth roots, a common clinical choice (Fig. 2). However, when TSADs are situated in the path of root movement, they may interfere and potentially damage the periodontal ligament or induce root



■ **Fig. 2:**

TSAD insertion sites are generally categorized into two locations: Inter-radicular (I-R) and Extra-alveolar (E-A). I-R TSADs are typically placed within the alveolar process between tooth roots, E-A TSADs are installed away from the root structures. Both the mandibular buccal shelf (MBS) and infra-zygomatic crest (IZC) have become well-established E-A sites for TSADs insertion. These locations offer broader and more abundant bone, allowing for the placement of thicker screws (2 mm in diameter), thus reducing the risk of screw fracture and enhancing stability for effective anchorage.



■ **Fig. 3:**

Illustrations by Dr. Runsi Thavarungkul of a 2x12-mm miniscrew inserted into the IZC as skeletal anchorage. (A) Initial insertion of the tip is perpendicular to the bone surface. (B) After the screw tip has engaged, (C) continue inserting whilst gradually changing the angle to 60-70 degrees so the screw can engage in the thicker bone away from the roots.

resorption. Research has indicated that root resorption may be stimulated when the mini-implant is positioned less than 0.6 mm to the root.<sup>7</sup>

### Management and Prevention:

Upon detecting hard tissue damage, such as root resorption, it is advisable to promptly remove the bone screw and explore alternative placement locations. To reduce the risk of interference-related



■ **Fig. 4:**

Interference between the bracket and the screw occurred when the screw was placed too close to the dental arch.

problems or to facilitate relocation, E-A bone screws have emerged as an attractive option. Unlike I-R TSADs, which are inserted between roots, E-A screws are installed away from the root structures. Both the mandibular buccal shelf (MBS) and the infra-zygomatic crest (IZC) have become well-established E-A sites for TSADs insertion. These locations offer broader and more abundant bone, allowing for the placement of thicker screws (2 mm in diameter), thus reducing the risk of screw fracture and enhancing anchorage (Fig. 2).<sup>8,9</sup> Furthermore, E-A TSADs anchorage helps circumvent interference with the path of tooth movement, minimizing the risk of dental hard tissue damage.

Orthodontists should carefully assess the angle and location for TSADs installation to minimize the risk of damaging adjacent hard tissue structures. Given that E-A TSADs are designed to minimize damage to the periodontal ligament and root structures, careful consideration of screw insertion orientation is essential throughout the orthodontic process. The optimal angle for an IZC bone screw is approximately 60 degrees below a perpendicular

line along the long axis of the first molar root (Fig. 3).<sup>10</sup> Complications arise when a MBS screw is positioned too closely to the molars. While placing the screw closer to the dental arch may offer distalization forces with a reduced horizontal component, there is a risk of interference between brackets and the screw during posterior movement (Fig. 4). If such interference occurs, placing another screw may be necessary, which subjects the patient to additional surgery. However, this can be avoided by positioning the MBS bone screw approximately 5 mm lateral to the interproximal area between the lower first and second molars.

### 3. Screw Fracture

#### Causes:

Screw fracture is a critical risk that neither the patients nor the clinicians want to encounter. It was reported that maximum cross-sectional stress often occurred at the cervical or apical part of the screw as it penetrates cortical bone. Fracture often occurred at this point.<sup>11</sup> Screw fracture may occur during both insertion and removal, and excessive insertion torque during TSAD placement or removal was documented to be closely related to screw fractures.<sup>1,12</sup> Different designs and internal diameter may also affect the possibility of such incidence. Furthermore, drastic angle changes during TSAD insertion may bring the screw under the impact of excessive torsional forces. Bone thickness and insertion site are also factors that cause screw breakage. Insertion in the mandible appeared to have higher rate of screw fracture since the bone is thicker than in the maxilla.<sup>13</sup> Therefore, clinicians'

experiences play a vital role in controlling and avoiding such issues.

#### Management and Prevention:

##### (a) Surgical Removal

In cases of screw fracture, surgical removal is often necessary to prevent further complications. Surgical procedure details are as follows:

1. **Identification:** Accurate identification of the fracture's extent and location is paramount. This involves a meticulous examination, complemented by radiographs. This step ensures a comprehensive understanding of the fracture's scope and aids in planning the removal procedure effectively.
2. **Anesthesia for patient comfort:** To ensure the utmost comfort for the patient during the procedure, it is imperative to administer adequate anesthesia. This not only minimizes discomfort but also allows for a smoother and more controlled operation.
3. **Vertical or flap incision:** A vertical or flap incision is strategically made at the site of the fracture. This incision provides access to the fractured miniscrew and facilitates its safe removal. Careful planning of the incision site is crucial for minimizing tissue trauma and enhancing the healing process.
4. **Fragment exposure and bone removal:** To expose the fractured miniscrew fragments fully, the surrounding bone is delicately removed. This



step extends access to the fracture tip for better grasp. It is imperative to exercise caution during bone removal to avoid any damage to nearby dental roots, ensuring the preservation of overall dental health.

5. **Utilizing Weingart plier for removal:** A specialized instrument, such as a Weingart plier, is employed to grasp and securely hold the exposed fragment. With precision, the broken tip is gently unscrewed and removed. This step requires a steady hand and a cautious approach to ensure complete removal of the fractured miniscrew while safeguarding adjacent structures.

By following these surgical steps, orthodontists can effectively address miniscrew fractures, while ensuring patient comfort and minimal impact on surrounding dental structures. This meticulous approach not only resolves complications but also promotes successful orthodontic treatment outcomes.

### (b) Evaluation for Removal

Depending on the extent of fracture and clinical circumstances, some orthodontists may consider leaving a fractured portion of the screw in place or opt for delayed removal after radiographic examination. For instance, if a patient needs crown lengthening surgery at the end of treatment, a fractured screw remnant can be removed at that time.

To prevent screw fractures, orthodontists should adhere to adequate torque limits during TSAD placement.<sup>14</sup> It is crucial to maintain a consistent angle and avoid abrupt angle changes during TSAD

insertion, to minimize the risk of screw fractures. Additionally, the screwdriver should be turned slowly. Clinical experience plays a pivotal role in reducing the fracture rate. In the unfortunate event of a screw fracture, clinicians must consider the risks and benefits of surgical removal. Retention may be a viable option in some cases.

## Conclusions

Orthodontic mini screws (or TSADs) are valuable tools in modern orthodontics, but they are not without complications. Soft tissue damage, hard tissue damage, and screw fractures can occur in the absence of careful planning and precise execution. Preventive measures, such as thoughtful TSAD placement and torque control, can significantly reduce the occurrence of these complications. Additionally, early detection and appropriate management are essential when complications arise to ensure successful completion of orthodontic treatment.

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\*\* The overall success rate of 93.7% indicates that both SS and TiA are clinically acceptable for IZC BSs.

Reference: Failure rates for stainless steel versus titanium alloy infrazygomatic crest bone screws: A single-center, randomized double-blind clinical trial (Angle Orthod 2019;89(1):40-46)



## Screws & Aligners

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**Dr. Chris Chang**

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

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

## Course Schedule

DAY

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DAY

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<b>Recommend</b>	The Gold Standard Best for IDS	Optimal Simplification Steps for Total-Etch	Aesthetic with Harmonize Composite	Best with NX3 Cement for BPR



# 2024 一年一度 Damon Master Program



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

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

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

## Module 1 - 3/28

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

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

## Module 2 - 4/11

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

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

## Module 3 - 4/25

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

Practice: Cephal tracing (金牛頓工程師)

## Module 4 - 5/16

1. Excellent finishing
2. Retention & relapse

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

## Module 5 - 5/30

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

Practice: Case report demo (陳俊宏醫師)

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

## Module 6 - 6/20

1. Class III correction
2. Class II correction

Topic: Early orthodontic treatment (曾淑萍醫師)

## Module 7 - 6/27

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

Topic: Modified VISTA (蘇笠瑋醫師)

## Module 8 - 7/11

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

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

## Module 9 - 7/25

1. Implant-ortho combined treatment
2. Asymmetry

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

## Module 10 - 8/29

1. Minor surgeries in orthodontics
2. Digital orthodontics

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

## Module 11 - 9/19

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

Topic: Pre-aligner treatment (林詩詠醫師)

▲ Special lecture: 1:30-2:30 pm

時間：週四全天 (9 am - 5 pm)

地點：金牛頓藝術科技 (新竹市建中一路 25 號 2 樓)

費用含課程視訊\*、iPad、課程電子書與材料。

\*贈送之課程視訊提供兩年時間串流觀看。

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# NEW DESIGN Stainless Steel Mirror 2.0

全新不鏽鋼口鏡曲線設計更舒適亦方便握持，一支即可拍攝全口照片，提供照相最廣可視範圍。

專利設計

咬合面拍攝



鏡面改良

側面拍攝



成像清晰

加倍舒適

無鍍膜的**不鏽鋼拋光鏡面**，可增加影像清晰度、色澤穩定度。**多道修邊工序**，可適應不同大小的口腔環境，增加患者口腔舒適感。

圓滑邊角

新品上市特惠價，詳情請洽金牛頓



這個鏡子最厲害的是頰側鏡的長度，拍頰側面不會因為鏡面長度不夠，切到前牙的影像（坊間其他這種一邊頰側鏡一邊咬合鏡的拍照鏡大多都有這個問題）。



桃園 宗醫師



它牌口鏡



不鏽鋼口鏡2.0





# Dr. Marius Steigmann Hands-On Courses in Taiwan

## Module 1

2024 MAY.31(Fri) - JUN.02(Sun)

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## Module 2

2024 JUN.05(Wed) - JUN.07(Fri)

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## Module 3 + Module 4

2024 NOV.01(Fri) - NOV.03(Sun)



Organized and Curated by

 **YONG CHIEH**

Together with

 **HuFriedyGroup**  **STIEGMANN**

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# Non-Extraction Treatment and Correction of Generalized Interdental Spacing and Protrusive Anterior Teeth in an Adolescent

## Abstract

**Introduction:** A 10-year-11-month-old female was brought by her mother to seek orthodontic consultation, with a chief complaint of a protrusive lower lip.

**Diagnosis:** Cephalometric analysis revealed a skeletal Class I relationship (SNA, 83°; SNB, 81°, ANB, 2°), protrusive lower lip, as well as proclined upper and lower incisors. An intraoral assessment revealed mild Class II canine relation on the right side. There were slight generalized spaces in the upper and lower dentition. The Discrepancy Index (DI) was 10.

**Treatment:** The treatment plan was a non-extraction treatment using Damon® brackets anchored with infrazygomatic crest (IZC) bone screws bilaterally to retract the upper and lower dentitions. The active treatment time was 23 months.

**Results:** Improved dentofacial esthetics and a better occlusal function were achieved after treatment. The Cast-Radiograph Evaluation (CRE) was 13, and Pink and White esthetics score was 9. The patient was well satisfied with the final outcome.

**Conclusions:** IZC bone screw serve as an excellent anchorage in the treatment which molar protraction is undesirable. (*J Digital Orthod* 2024;74:18-30)

**Key words:**

lower lip protrusion, generalized spacing, IZC screws, anchorage

## Introduction

This 10-year-old girl was brought to the clinic seeking a solution to fix her profile problem, the flared upper and lower incisors, and protrusive lower lip (Fig. 1).

- Smile: *acceptable*
- Symmetry: *WNL*

## Diagnosis

### Facial

- Lower lip protrusive to E-line (Fig. 1)
- Facial convexity: *profile* ( $G-Sn-Pg'=10^\circ$ ) was within normal limits (*WNL*)

### Skeletal

- Intermaxillary relationship: *Skeletal Class I relationship* (SNA, 83°; SNB, 81°; ANB 2°) (Fig. 2; Table 1)
- Mandibular Plane: *WNL*
- Symmetry: *WNL*

**Ping-Hsuan Yeh,**  
Training Resident, Beethoven Orthodontic Center (Left)  
**Chris H. Chang,**  
Founder, Beethoven Orthodontic Center  
Publisher, Journal of Digital Orthodontics (Center)  
**W. Eugene Roberts,**  
Editor-in-Chief, Journal of Digital Orthodontics (Right)



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

Dental

- Classification: Class I molar relationship bilaterally, Canine relationship mild Class II on the right and Class I on the left (Fig. 1)
- Overbite: 2 mm
- Overjet: 3 mm
- Missing: none



■ **Fig. 2:** Pre-treatment cephalometric radiograph



■ **Fig. 3:** Pre-treatment panoramic film

- Spacing: 8 mm in the maxillary arch from bicuspid to bicuspid, and 8 mm in the mandibular arch from bicuspid to bicuspid.

The ABO Discrepancy Index (DI)<sup>1,2</sup> was 13 as shown in Worksheet 1 at the end of this report.

### Treatment Objectives

The treatment objectives were to:

CEPHALOMETRIC SUMMARY			
	PRE-TX	POST-TX	DIFF.
<b>SKELETAL ANALYSIS</b>			
SNA° (82° ±4)	83°	84°	1°
SNB° (80° ±4)	81°	81°	0°
ANB° (2° ±4)	2°	3°	1°
SN-MP° (32° ±6)	28°	27°	1°
FMA° (25° ±6)	23°	22°	1°
<b>DENTAL ANALYSIS</b>			
U1 TO NA mm (4mm ±3)	9	2	7
U1 TO SN° (104° ±4)	121°	104°	17°
L1 TO NB mm (4mm ±3)	8	5	3
L1 TO MP° (90° ±4)	103°	94°	9°
<b>FACIAL ANALYSIS</b>			
E-LINE UL (-1mm ±2)	0	-2	2
E-LINE LL (0mm ±2)	2	-2	4
%FH: Na-ANS-Gn (53% ±3)	53%	55%	2%
Convexity:G-Sn-Pg' (13°)	6°	10°	4°

■ **Table 1:** Cephalometric Summary

1. Correct the flared upper incisors and lower incisors.
2. Close space between bilateral bicuspid.
3. Coincide the upper and lower dental midlines to the facial midline.

### 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: *Retract incisors, and maintain molars.*
- Vertical: *Intrude incisors.*
- Transverse: *Maintain.*

**Mandibular Dentition:**

- A-P: *Retract the incisors.*
- Vertical: *Maintain.*
- Transverse: *Maintain.*

**Facial Esthetics:**

- Improve lower lip position, and reduce dentoalveolar protrusion.

**Treatment Alternatives**

To correct the protrusiveness of the dentition and the lower lip, retracting the anteriors in both arches was necessary. Possible treatment options are listed below.

Option A: Retraction by extracting both upper and lower first premolars.

Option B: Non-extraction treatment with the use of OrthoBoneScrew® (OBS) (2x12-mm, iNewton dental Inc., Hsinchu, Taiwan) on the buccal surface of each upper first molar as anchorage and retract both arches.

The patient and her family were informed about the pros and cons of each approach, and Option B was selected.

**Treatment Progress**

A set of 0.022" slot Damon Q low torque brackets (U1, +2°; U2, -5°; U3, -9°) were selected and bonded on the maxillary and mandibular permanent teeth. The initial archwires were 0.014 CuNiTi. The patient was instructed to practice "lip seal exercise" to help correct the flaring of the anterior teeth.

During the 6<sup>th</sup> month of treatment, two bite turbos were bonded on the palatal side of both upper central incisors (Fig. 4). Spaces were redistributed to locate between canines and first premolars in both arches using power chain and figure-eight ligation. Class II elastics (Parrot 5/16-in, 2 oz, Ormco,



**Fig. 4:** In the 6<sup>th</sup> month, palatal bite turbos were bonded on the maxillary central incisors.



■ **Fig.5** : Intraoral photographs taken in the 12<sup>th</sup> month

Glendora,CA) were used to correct the A-P discrepancy. The sequence for the upper and lower archwires were 0.014-in CuNiTi, 0.014x0.025-in CuNiTi, 0.017x0.025-in TMA, and 0.016x0.025-in SS.

In the 10<sup>th</sup> month of treatment, two OBSs (2x12-mm) were installed buccal to the upper first molars in the infrazygomatic crest (IZC) bilaterally (Fig. 5). Upper arch retraction was initiated by a chain of elastic from both maxillary OBSs to the corresponding lower canine; while lower arch retraction was initiated by elastics (Monkey, 3/8", 3.5 oz, Ormco, Glendora,CA) from the OBS miniscrews to the lower canines.

After 8 months of retraction, the spaces were nearly closed (Fig. 6). However, as the lower dental midline was shifted to the left about 1 mm, the patient was instructed to wear only one elastic on the right side to correct the discrepancy.

After 21 months of treatment, Class I canine and molar relationships were achieved bilaterally, and the upper and lower dental midlines were coincided. After another two months for stabilizing, all brackets were debonded, and retainers were provided for retention (Fig. 7).

## 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: *Retracted*
- Vertical: *Maintained*
- Transverse: *slightly increased*

### Mandibular Dentition:

- A-P: *Retracted*



■ **Fig. 6:** In the 18<sup>th</sup> month, spaces were closed. Lower midline shifted to the left about 1 mm.

- Vertical: *Maintained*
- Transverse: *slightly increased*

#### Facial Esthetics:

- Both upper and lower lips were retracted to improve facial balance.
- Marked improvement in overall facial esthetics

#### Retention

Fixed lingual retainers were bonded on the mandibular anteriors. The patient was instructed to wear the upper and lower clear overlay retainers full time for the first 3 months and nights only thereafter. Home care and retainer maintenance instructions were provided.

#### Final Evaluation of Treatment

Superimposition of the cephalometric tracings before and after treatment reveals excellent anchorage provided by the OBS miniscrews. The upper and lower molars had little protraction during the retraction of both arches (Fig. 10). The inclination of upper and lower incisors had improved by 17° and 9° respectively (Fig. 8; Table 1). Overjet and overbite were ideal. The protrusive lips were reduced, improving facial convexity. The patient and her mother were both very satisfied with the outcome. The final Cast-Radiograph Evaluation (CRE) score was 13 points. The major discrepancies are alignment/rotations (1 point), buccal/lingual inclination (3 points), occlusal contacts (3 points), and occlusal relationship (6 points).



■ **Fig.7** : Posttreatment intra-oral photographs immediately after all appliances were removed

## Discussion

### 1. Spacing

Interproximal spacing is an arch length discrepancy characterized by interdental spaces and lack of contact points between teeth. When spacing involves both anterior and posterior teeth it is generalized while localized spacing usually involves only two or four teeth. The causes of generalized

spacing may be inherited, developmental, or even functional, whereas localized spacing is usually associated with local factors, such as missing, supernumerary or small teeth, sucking habits, over-retained primary teeth, periodontal disease and/or hypertrophic upper lip frenum. Furthermore, a dentition with generalized spaces may be considered a normal occlusion with a prevalence of about 50% in a reported sample.<sup>3</sup> According to the present patient, who had generalized spacing, she





■ **Fig. 8** : Posttreatment cephalometric radiograph



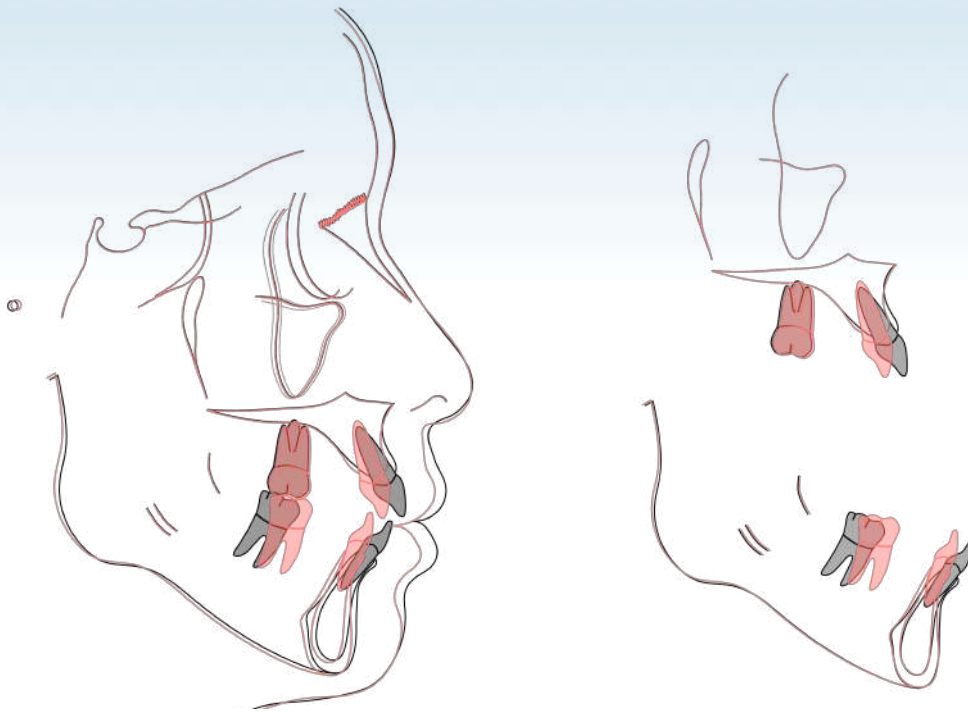
■ **Fig. 9** : Posttreatment panoramic radiograph

had none of the contributing habits nor other factors described above. Therefore, in this case, her dentition with spaces and malocclusion was considered normal. Orthodontic treatment is suitable for space closure in the permanent dentition period. As for retention, the safest way to ensure satisfactory arch alignment and to prevent

relapse is to use fixed or removable retainer for a long time, most likely for life.<sup>4</sup>

## 2. IZC screws for anchorage and retraction

To improve dental-facial profile of a Class I occlusion with protrusion using conservative method has been challenging to orthodontists. The strategy here is to retract the anteriors without protracting the molars. Hence, anchorage control is the key. The introduction of skeletal anchorage in orthodontics using a fixture (temporary skeletal anchorage devices (TSADs) that is installed in the bone may serve as an absolute anchorage and has extended the possibilities of orthodontic tooth movement.<sup>5</sup> It has been demonstrated that skeletal anchorage can be a substitution for extraoral anchorage with headgear, and its greatest strength is incisor retraction as a non-compliant alternative.<sup>6</sup> Furthermore, placing TSADs extra-alveolarly, for instance, in the infrazygomatic crest (IZC) may facilitate maxillary retraction without interfering with tooth movement.<sup>7</sup> The TSADs used in this case are 2 OrthoBoneScrews® (OBS, 2.0x12-mm, iNewton Dental, Inc., Hsinchu City, Taiwan), which have a much higher survival rate compared to previous interradicular and IZC titanium alloy miniscrews (< 1.6 mm diameter) (~95 vs <80%).<sup>8</sup> Although our patient (age 10) had thinner buccal plate of cortical bone in the posterior maxillary region compared to those aged 19-27 years, the prevalence of sinus perforation is directly related to sinus volume. Additionally, the success rate for IZC TSADs in adults is not compromised by sinus perforation whereas the bone quality compensates for the decreased quantity at the TSAD interface.<sup>8</sup> In this case, power



■ **Fig.10 :**

*Superimposed pretreatment (black) and posttreatment (red) cephalometric tracings show that the occlusion was finished at Class I and both maxillary and mandibular incisors were retracted. Little to no movement of upper molars was noted.*

chains were applied from TSADs to upper canines, and elastics were applied from TSADs to lower canines to retract upper and lower anteriors (Fig. 6). As a result, cephalometric superimpositions reveal absolute anchorage provided by OBS miniscrews, and the incisors in both arches were retracted. The upper molars had little to no protraction during the retraction of both arches.

### 3. Lip seal exercise

Lip incompetence may have negative impacts such as articulation defects, periodontal issues, and development of different malocclusion types, for example, open bite or maxillary protrusion. Lip competence plays an important role in craniofacial complex growth and development. Hence, there are

many different lip training methods or apparatuses aiming to establish normal function and health in orofacial musculature, as well as to facilitate the development and growth of the normal occlusion.<sup>9</sup> In this case, lip seal exercises were introduced to help control maxillary incisor flaring. The belief that exercise of the muscle involved in lip closure could help establish muscular balance, and also indicates that the closing force of the upper lip has great influence on maxillary incisor angulation.<sup>10</sup>

### Conclusions

Dentists treat patient with protrusive profile or large overjet on a daily basis. For the present case, anterior-posterior correction without bicuspid

extraction is challenging. Without extraction, absolute anchorage must be applied. With the help of OrthoBoneScrew®, anchorage control is simpler and the mechanics are straightforward.

## References

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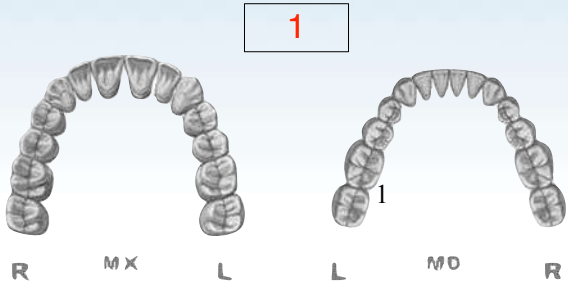




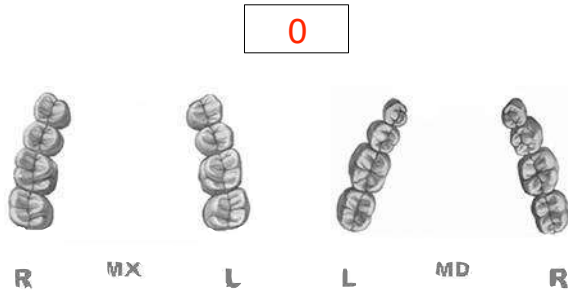
# Cast-Radiograph Evaluation

Total Score: 13

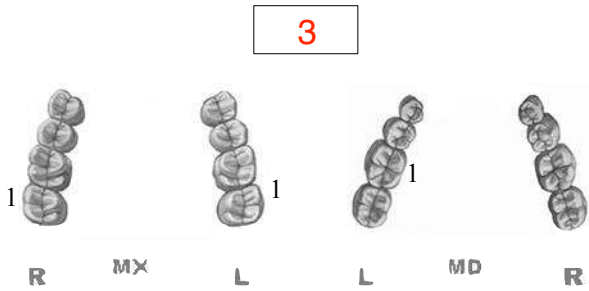
## Alignment/Rotations



## Marginal Ridges



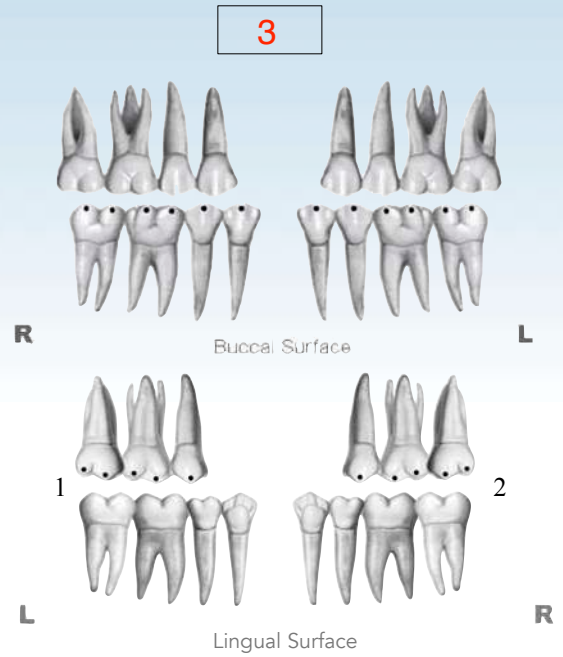
## Buccolingual Inclination



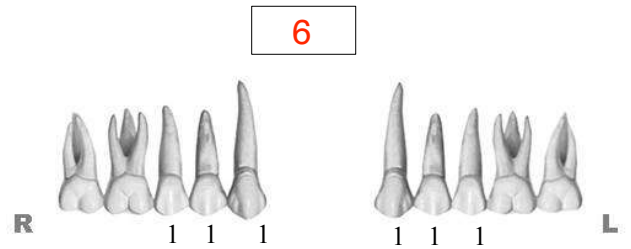
## Overjet



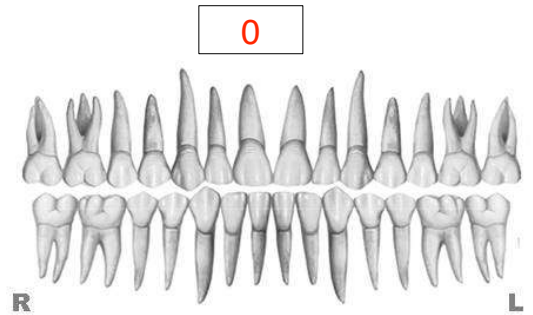
## Occlusal Contacts



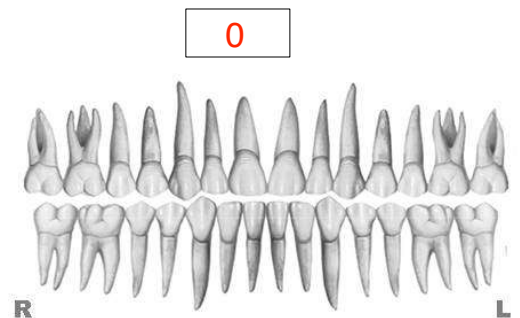
## Occlusal Relationships



## Interproximal Contacts



## Root Angulation

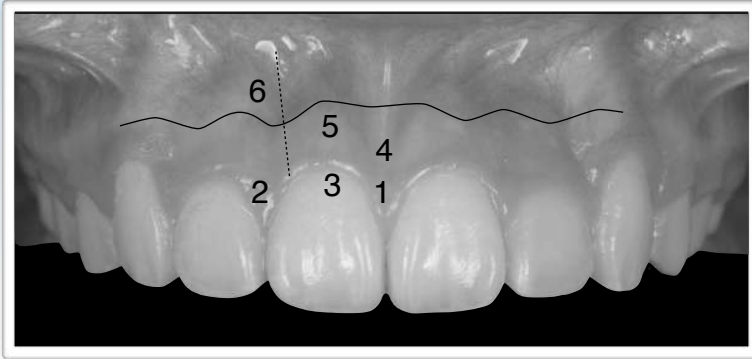


**INSTRUCTIONS:** Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

# IBOI Pink & White Esthetic Score

Total Score = 9

## 1. Pink Esthetic Score

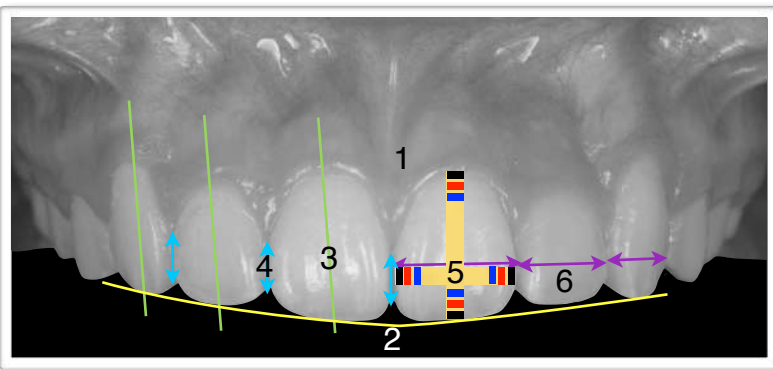


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity ( Torque )	0	1	2
6. Scar Formation	0	1	2

Total = 7

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

## 2. White Esthetic Score (for Micro-esthetic)



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

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	0	1	2
6. Tooth to Tooth Proportion	0	1	2

# 2024-2025 第十六年度 貝多芬 矯正精修班

時間：週二上午 09:00-12:00

地點：金牛頓教育中心（新竹市建中一路 25 號 2 樓）



## 上課日期：

2024 4/16、5/21、6/18、7/9、8/13、9/10、10/22、11/5、12/10

2025 1/14、2/18

- ▶ 09:00 ~ 10:00 精選文獻分析
- ▶ 10:00 ~ 10:30 精緻完工案例
- ▶ 10:50 ~ 12:00 臨床技巧及常犯錯誤分享

全新的第十五年度 2024-25 貝多芬精修班，是由國際知名講師張慧男醫師主持，並偕同貝多芬牙醫團隊住院醫師群共同主講。

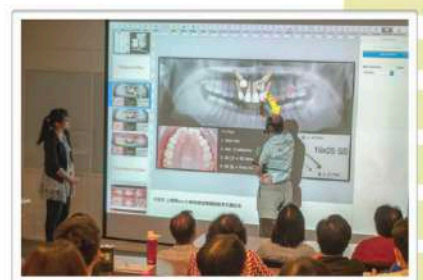
每月一次的課程之中，包含了：

1. 精選矯正權威期刊 AJODO 的文章做文獻分析與評讀。
2. 精緻完工 ABO 案例報告，其中因應數位矯正的世界趨勢，Insignia 與 Invisalign 病例為課程探討的主要內容之一。
3. 分享臨床上常犯的錯誤以及解決方法。

2024-25 貝多芬精修班內容豐富精彩，讓您經由每個月一次的課程，在面對各式的臨床案例時，更能游刃有餘、得心應手。

## 學習目的：

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



報名專線：03-5735676 #218 陳小姐



International Association for Orthodontists & Implantologists

# Join the **iAOI** the future of dentistry!

## About our association-iAOI

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

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

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

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

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4 pts

Dr. 呂詩薇  
Julie Lu



4 pts

# 2025 张慧男正畸大师班

第四届



全新重启的 2025 贝多芬张慧男正畸大师系列课程是由国际知名讲师张慧男医师亲自规划及授课，课程特色强调由临床病例带动诊断、分析、治疗计划拟定与执行技巧。

本年度特别新增两天的课程，加入最新的隐形牙套内容，让学员可以物超所值地学习最新正畸趋势！透过数位视频反覆观看，课堂助教协助实操，让学员在短时间能快速上手，感染“热爱正畸学，热爱学正畸”的热情。

名额有限，一年仅有一次机会完整体验正畸大师课程，错过只能等明年喽！

2024/12月课程地点：五星级厦门五缘湾凯悦酒店（厦门，湖里区，湖里区日圆二里五号）  
(后续课程地点待公布)

## 课程 1 - 6/1, 12/22('24)

1. 如何选择第一个病例:建立自信
2. 精准的托槽定位法
3. 高效正畸治疗“四步法”
4. 病例总结和讨论
5. 托槽粘结+BT(合垫)+头影测量

练习：临床摄影技术

## 课程 2 - 6/2, 12/23('24)

1. 简单高效的支抗系统的运用
2. 拔牙与否的诊断分析
3. 病例总结和讨论
4. 实操：微种植支抗系统 + 间隙关闭法 + 牵引钩的使用 + 弹簧的使用

练习：头影测量；完成患者照片记录（模板）

## 课程 3 - 6/22

1. 戴蒙系统的诊断与微调
2. 正畸完成后的效果评判
3. 病例总结和讨论
4. 实操：弓丝的弯制和固定保持器的制作

练习：指导患者拍照记录（用自己的时间）；修图技术

## 课程 4 - 6/23

1. 完美的结束：病例演示
2. 保持和复发：病例演示
3. 病例总结和讨论
4. 实操：演讲演示

练习：演示病例报告

## 课程 5 - 7/20

1. 正畸中生物力学的诊断分析
2. 正畸中软组织和硬组织的诊断分析
3. 青少年与成人正畸的诊断分析
4. 病例总结和讨论

练习：病例报告

## 课程 6 - 7/21

1. 对于拥挤病例拔牙与否的诊断分析
2. 如何实现上颌的压入
3. 如何实现下颌的压入
4. 病例总结和讨论

文献探讨：托槽的定位；埋伏尖牙的正畸

## 第三届学员补课日期：

2024/12/22-23

(第三届学员可参加本届实体课程，需事先登记以利教室准备。)

## 本届学员方案二选一：

1. 参加 2024/12/22-23 实操课程，2025/6/1-2 可现场听课复习不实操
2. 参加 2025/6/1-2 现场实操课程

## 课程 7 - 9/14

1. 缺失牙的正畸分析：前牙缺失 vs. 后牙缺失
2. 反合的正畸分析：前牙反合 vs. 后牙反合
3. 病例总结和讨论

文献探讨：尖牙替代缺失的侧切牙的正畸分析

## 课程 8 - 9/15

1. 高角开合与低角深覆合病例的诊断分析
2. 美国正畸协会，DI CRE 分值测量实操
3. 病例总结和讨论

文献探讨：DI & CRE 文献

## 课程 9 - 10/12

1. 如何改善露龈笑；矫治器拆除的注意事项
2. 正畸结束时的微调
3. 病例总结和讨论

文献探讨：完美的正畸效果（良好的咬合；前牙的美学效果）

## 课程 10 - 10/13

1. 联合种植支抗的正畸治疗
2. 多学科联合治疗成人复杂病例
3. 病例总结和讨论

文献探讨：IDT

## 课程 11 - 11/16

1. 隐形牙套正畸
2. 隐形牙套及其挑战

文献探讨：隐形正畸前置治疗

## 课程 12 - 11/17

1. 隐形牙套结合支抗钉治疗
2. 隐形牙套力学

文献探讨：（待公布）

课程含案例互动与模型实操，并赠课程电子书讲义、课程视讯。  
(赠送之课程视讯提供两年时间串流观看)



报名专线

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## Dental Products

Must-Have Secret Weapons

Autoclavable

### Double Retractors 2.0

Double Retractors x2, Black Board x2

While keeping the same lip & cheek two-way design, the new Double Retractors 2.0 is upgraded to medical grade PPSU.

**NEW**

### Stainless Steel Mirror 2.0

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



### Bite Turbo 3.0

Handle x1, BT molds x6, BT extended molds x6, Button molds x6  
Designed by Dr. Chris Chang, the new Bite Turbo 3.0 allows you to solve all kinds of deep bite and large horizontal overjet. A simple and powerful tool you should add to your kit!

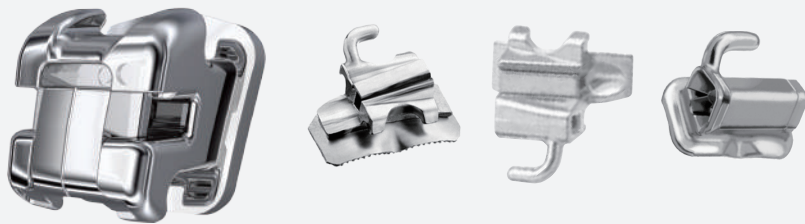


# DAMON™ 2

## Damon Q2 Brackets

### Bondable Tube

.022 (G/O, Accent, Peerless)



- A Damon Copper Ni-Ti Wire**  
size .014 / .014 x .025
- B Damon Stainless Steel Wire**  
size .016 x .025
- C Damon TMA Low-Friction Wire**  
size .017 x .025



- Brackets x 200個
- Tubes x 80個
- Archwires A x 40條, B x 20條, C x 20條

**10人份套組 特價NT\$149,999/組**

- Brackets x 600個
- Tubes x 240個
- Archwires A x 120條, B x 60條, C x 60條

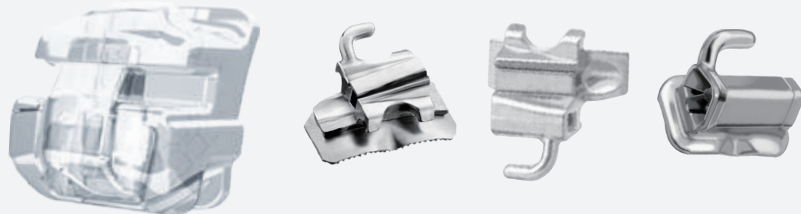
**30人份套組 特價NT\$369,999/組**

# DAMON™ CLEAR 2

## Damon Clear2 / Clear Brackets

### Bondable Tube

.022 (G/O, Accent, Peerless)



- A Damon Copper Ni-Ti Wire**  
size .014 / .014 x .025
- B Damon Stainless Steel Wire**  
size .016 x .025
- C Damon TMA Low-Friction Wire**  
size .017 x .025



- Brackets x 200個
- Tubes x 80個
- Archwires A x 40條, B x 20條, C x 20條

**10人份套組 特價NT\$189,999/組**

- Brackets x 600個
- Tubes x 240個
- Archwires A x 120條, B x 60條, C x 60條

**30人份套組 特價NT\$459,999/組**



PACKAGES

Zoo Pack Elastics

Intraoral Elastics

Power Chain

Generation II  
(open / close / wide)

套組內容

- Zoo Pack Elastics x 5盒
- Power Chain x 5卷



定價NT\$30,000/組 | 套組價NT\$16,500/組

Enlight Sample Kit

Enlight Syringe Refill

Highly Filled Light-Cure Adhesive

套組內容

- Enlight Syringe x 4支
- Ortho Solo x 2瓶



定價NT\$14,600/組 | 套組價NT\$7,600/組

ARCHWIRES

Damon Copper Ni-Ti

size .014 / .014 x .025



定價NT\$3,300/盒 | 買3送1 | 買10送6

Damon TMA Low-Friction

size .016 x .025 / .017 x .025  
Non-Colored



定價NT\$6,900/盒 | 買3送1 | 買10送6

Damon Stainless Steel

size .016 x .025 / .019 x .025



定價NT\$2,700/盒 | 買3送1 | 買10送6

Broad Copper Ni-Ti

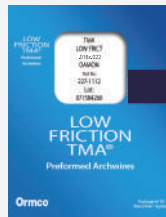
size .016 / .016 x .022



定價NT\$3,300/盒 | 買3送1 | 買10送6

Broad TMA Low-Friction

size .016 x .022



定價NT\$6,500/盒 | 買3送1 | 買10送6

Broad Ni-Ti

size .016 x .022



定價NT\$3,100/盒 | 買3送1 | 買10送6

TUBES

BONDABLE TUBE

.018 / .022, G/O



定價NT\$400/個 | 買20人份送20人份

BONDABLE TUBE

.018 / .022, Accent



定價NT\$400/個 | 買20人份送20人份

BONDABLE TUBE

.018 / .022, Peerless



定價NT\$420/個 | 買20人份送20人份

# Non-Extraction Treatment of a Class II Openbite with Amelogenesis Imperfecta

## Abstract

**Introduction:** A 15 year-7 month-old female with a history of amelogenesis imperfecta (AI) presented with chief complaints of poor dental esthetics and anterior openbite.

**History and Etiology:** AI is a hereditary disorder that is usually manifested as an autosomal dominant trait involving defective ENAM gene(s). For the present patient, deficient enamel resulted in decreased biologic width of the epithelial attachment, in addition to dental attrition that reduced the heights of clinical crowns. Selective crown lengthening and complete provisional restoration were required. Habitual interdental tongue posture, which may reflect a history of airway compromise, resulted in an anterior openbite that induced posterior mandibular rotation to produce a long face.

**Diagnosis:** AI-related enamel deficiency has compromised the periodontium and dentition. Facial form was convex ( $12^\circ$ ) with increased lower facial height (59.5%) and a steep mandibular plane angle (FMA,  $37.5^\circ$ ). Cephalometrics revealed a protrusive maxilla (SNA,  $84.5^\circ$ ), retrusive mandible ( $77.5^\circ$ ), and an intermaxillary discrepancy of  $7^\circ$  (ANB). The bilateral Class II malocclusion was complicated with anterior openbite, canted occlusal plane, and mandibular deviation to the left. The Discrepancy Index (DI) was 62.

**Treatment:** Crown lengthening surgery and revised provisional restorations established a healthy periodontium in preparation for orthodontics treatment. A fixed passive self-ligating appliance, with high torque brackets in the upper anterior segment, was bonded on both arches. Anchorage to intrude upper molars was provided with bilateral infra-zygomatic crest (IZC) bone screws. After initial orthodontic alignment, interproximal space was increased as needed with elastic separators to prepare gingival margins, and a new set of optimized provisional restorations was fabricated. Orthodontic finishing was accomplished with the same fixed appliance.

**Results:** Crown lengthening produced healthy periodontium with proper biological width in preparation for full provisional restoration and orthodontic alignment. As upper molars were intruded, the mandible rotated anteriorly, and the lower facial height decreased as lip and chin protrusion increased. This challenging openbite malocclusion, with a Discrepancy Index (DI) of 62, was treated in 22 months to an excellent outcome: Cast-Radiography Evaluation (CRE) score of 11 and Pink & White dental esthetic score of 1. An upper removable retainer was provided for night-time wear.

**Conclusions:** A patient with AI and an anterior openbite malocclusion was treated to a stable occlusion with a passive self-ligating fixed appliance and IZC bone screw anchorage. Interdisciplinary treatment with periodontics and prosthodontics was required before and after orthodontic therapy to appropriately restore dentofacial esthetics and function. (*J Digital Orthod* 2024;74:38-58; reprinted from *J Digital Orthod* 2020;57:4-23)

### Key words:

Class II, openbite, occlusal cant, bimaxillary protrusion, molar intrusion, infrazygomatic crest screw, amelogenesis imperfecta, therapeutic provisional restoration

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Director, Jin-Jong Lin Orthodontic Clinic (Lower left)*

**W. Eugene Roberts,**

*Editor-in-chief, Journal of Digital Orthodontics (Lower right)*



## History and Etiology

A 15 year-7 month-old (15y7m) female with a history of amelogenesis imperfecta (AI) presented with a Class II malocclusion, crowding,

asymmetric anterior open bite, enamel deficiency, periodontal impairment, and compromised provisional crowns (Figs. 1-4). Clinical and radiographic evaluation revealed a long face,



■ **Fig. 1:** Pre-treatment facial and intraoral photographs, 15y7m of age



■ **Fig. 2:** Facial and intraoral photographs after the initial periodontal and restorative treatment, 17y4m of age

protrusive lips, excessive mentalis strain, and excessive maxillary gingival exposure (gummy smile). An occlusal cant and mandibular deviation to the left were also noted (Table 1; Figs. 2, 4 and 6). The patient had additional concerns about tooth sensitivity, poor dental esthetics, and unclear pronunciation of the sounds [s] and [z]. Panoramic radiography was consistent with AI: reduced thickness and radio-opacity of enamel, as well as tight proximal contacts in the posterior region, pulpal calcification, and root anomalies.

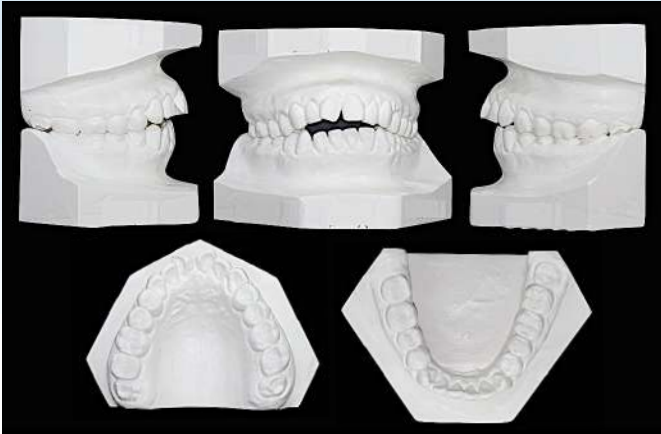
## Diagnosis

Clinical examination, photography, casts, radiographs and cephalometrics (Figs. 1-6; Table 1) documented the following:

Facial:

- Length: *Long face (LHF, 59.5%), relatively short upper lip, incompetent lip*





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

- Protrusion: Facial convexity (12°), hypermentalistic strain for lip closure, flat chin, and relatively protrusive lips (1mm U, 3mm L to the E-Line).
- Symmetry: Maxillary dental midline, canted occlusal plane, and mandibular deviation to the left (Fig. 2)
- Smile: Excessive gingival exposure with an anterior openbite

Skeletal:

- Intermaxillary Relationship: Protrusive maxilla (SNA, 84.5°), retrusive mandible (SNB, 77.5°) and intermaxillary skeletal discrepancy (ANB, 7°)
- Mandibular Plane: Excessive (SN-MP, 45°, FMA, 37.5°)
- Vertical Dimension of Occlusion (VDO): Excessive ANS-Gn segment (59.5% of the Na-ANS-Gn dimension)
- Symmetry: Maxilla deviated to the left with a 4° counterclockwise occlusal cant



■ Fig. 4: Pre-treatment panoramic radiograph

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA° (82°)	84.5°	84.5°	0°
SNB° (80°)	77.5°	78.5°	1°
ANB° (2°)	7°	6°	1°
SN-MP° (32°)	45°	44°	1°
FMA° (25°)	37.5°	36.5°	1°
DENTAL ANALYSIS			
U1 TO NA mm (4 mm)	6.5	4.5	2
U1 TO SN° (110°)	108.5°	102°	6.5°
L1 TO NB mm (4 mm)	10	11	1
L1 TO MP° (90°)	85.5°	86°	0.5°
FACIAL ANALYSIS			
E-LINE UL (-1mm)	1	-0.5	1.5
E-LINE LL (0 mm)	3	2	1
%FH: Na-ANS-Gn (53%)	59.5%	59%	0.5%
Convexity: G-Sn-Pg' (13°)	12°	5°	7°

■ Table 1: Cephalometric summary

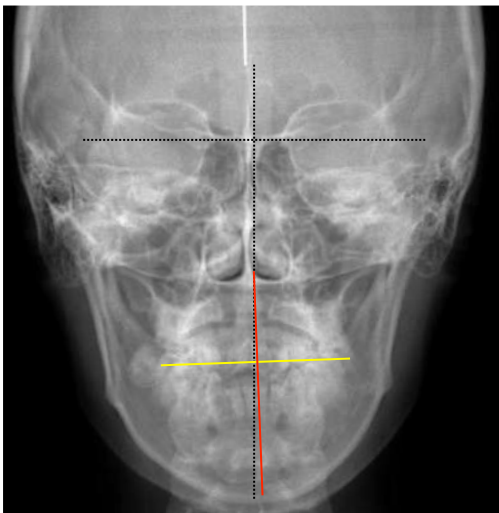


■ Fig. 5: Pre-treatment cephalometric radiograph

- Missing/Unerupted/Impacted: *Impacted LR8 (Fig. 4)*
- Morphology: *Enamel hypoplasia and hypomineralization*
- Symmetry: *Upper midline deviated 1mm to the right with a 4° occlusal cant*
- ABO Discrepancy Index (DI) of 62, as documented in Worksheet 3

Facial Esthetics:

- Convex with incompetent lips
- Protrusive upper and lower lips (1 and 3 mm to the E-Line, respectively)



■ Fig. 6: An anterior-posterior cephalometric radiograph documents facial asymmetry, occlusal canting and mandibular deviation.

Treatment Alternatives

Females over 15 years of age are usually skeletally mature, so treatment options are similar to other non-growing adults. The anterior open bite could be corrected with fixed appliances and two-jaw orthognathic surgery: (1) 3-piece Le Fort I maxillary advancement osteotomy for expansion of the posterior segments, (2) down-fracture of the maxillary anterior segment, and (3) bilateral sagittal split osteotomy for autorotation of the mandible. Another approach is orthodontic treatment with extraction of four premolars to upright maxillary incisors, close spaces, and retract anterior segments to close the anterior open bite and reduce protrusion. An alternate form of camouflage treatment is a non-extraction orthodontic treatment combined with bone screws to intrude the posterior teeth, increase the overbite, and

Dental:

- Classification: *Class II buccal segments (6 mm bilaterally)*
- Overbite: *-5 mm*
- Overjet: *2 mm*

improve the open bite.<sup>1,2</sup> The treatment options as illustrated in Fig. 7 are summarized bellow:

- Option 1: Initial dental alignment, orthognathic surgical correction, and finishing
- Option 2: Extract four first premolars, place fixed appliances, and close extraction spaces. Bone screws can be used as supplemental anchorage.<sup>1,2</sup>
- Option 3: Use infra-zygomatic crest (IZC) bone screws to intrude the posterior maxillary dentition and retract the anterior segment.<sup>3</sup>

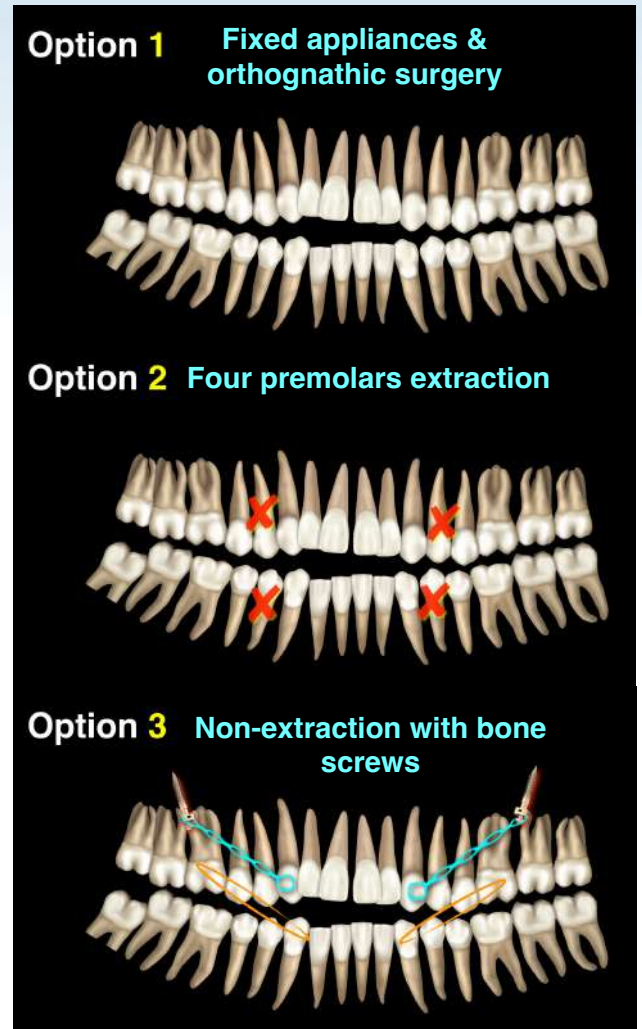
The patient chose the third option because it was deemed the least invasive.

### Specific Objectives of Treatment

1. Expand both arches.
2. Align and level.
3. Correct the anterior openbite.
4. Improve facial and lip protrusion.

### Treatment Progress

Prior to orthodontics, periodontal crown lengthening was performed to correct biologic width as needed. An optimal soft tissue response was achieved in 21 months by combining periodontal and prosthetic treatment, and then orthodontic therapy commenced. A 0.022-in slot Damon Q® fixed appliance system (Ormco, Glendora, CA) with passive self-ligating (PSL) brackets was bonded on both arches. A standard torque appliance was utilized except for high torque brackets in the maxillary anterior segment. The maxillary arch was bonded



■ **Fig. 7:**  
Three treatment options are illustrated in panoramic drawings.

first, and a 0.013-in copper-nickel-titanium (CuNiTi) archwire was placed (Figs. 8-9). The lower molars were separated on the mesial and distal surfaces (Fig. 10) to provide space for banding. Ten days later, a standard torque appliance was bonded on the entire lower arch, and a 0.013-in CuNiTi archwire was placed (Fig. 11). One month later (2M), the brackets on UR1, UR3, UL1 and LL3 were repositioned, and a 0.016-in CuNiTi archwire was inserted in the lower arch. The following month



■ **Fig. 8:** A progressive sequence of occlusal photographs show treatment progress from 1-7 months (M).

(3M), the UR2 bracket was repositioned, and the patient was referred for third molar extraction. One month later (4M), an intra elastic (Fox 1/4-in, 3.5-oz) was placed from UR3 to UL3. Provisional restoration on LR3 was defective (Fig. 12), so the patient was referred for restorative care. Five months (5M) into treatment, a 0.014x0.025-in CuNiTi upper archwire was inserted, and IZC bone screws were placed to initiate retraction of the upper arch (Fig. 13).<sup>4</sup>

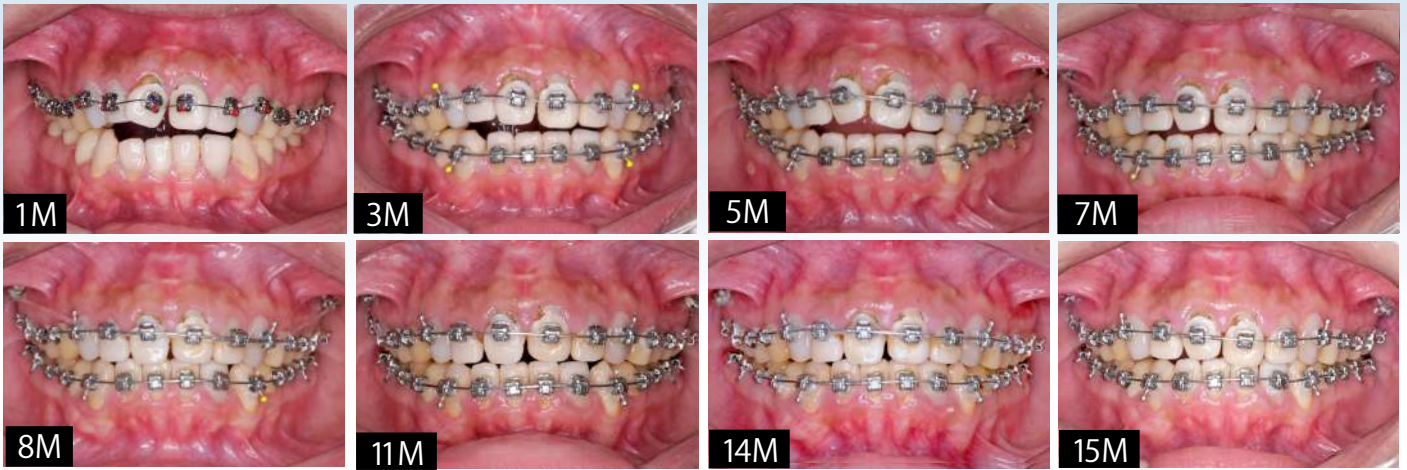
Two months later (7M), the upper archwire was increased to 0.018-in CuNiTi, and a 0.014x0.025-in CuNiTi was placed in the lower arch. To close anterior interproximal spaces, elastic chains were placed from canine to canine in both arches. In addition, anterior horizontal elastics (Fox 1/4-in, 3.5-oz) were utilized from canine to canine.

One month later (8M), archwires were changed to a 0.014x0.025-in and 0.018-in CuNiTi in the lower and upper arches, respectively. Interproximal reduction (IPR) of enamel thickness was performed in the lower anterior segment. Two months later (10M), the brackets on UR5, UR2, UR1 and LL2 were repositioned, and both arches were engaged with 0.014x0.025-in CuNiTi archwires. Elastic chains were utilized to consolidate both arches, and Class II elastics were placed. In the 14<sup>th</sup> month (14M) of

treatment, anterior horizontal elastics (Fox 1/4-in, 3.5-oz) were applied to complete openbite correction.<sup>5</sup> Fifteen months (15M) into treatment, the provisional restorations were replaced and rebonded with similar PSL brackets (Figs. 14 and 15). Seven months later (22M), fixed appliances were removed, and an upper removable retainer was delivered. The archwires and treatment sequence are summarized in Table 2.

## Results Achieved

After 22 months of active treatment, the periodontally and restoratively compromised malocclusion (DI of 62, Worksheet 1) was corrected to a near ideal result: cast-radiograph evaluation (CRE) of 11 (Worksheet 2),<sup>6</sup> and a Pink & White esthetic score of 1 (Worksheet 3).<sup>7</sup> Non-extraction alignment and IZC bone screw anchorage reduced facial height (0.5°), convexity (5°), and the MPA (1°) (Table 1). Consistent with conservative correction of anterior openbite,<sup>8,9</sup> the axial inclination of maxillary incisors was decreased 6.5° to 102° (Fig. 16). Excessively upright upper incisors were masked with restorative veneers at the end of treatment (Fig. 17). As shown in Figs. 18-23 and Table 1, outcomes for specific treatment objectives<sup>6</sup> are outlined below:



■ **Fig. 9:** A progressive sequence of frontal intraoral photographs document treatment progress from 1-15 months (M).

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: Incisors and molars retracted
- Vertical: Molars intruded/Incisors maintained
- Inter-molar/Inter-canine Width: Maintained/Expanded

Mandibular Dentition:

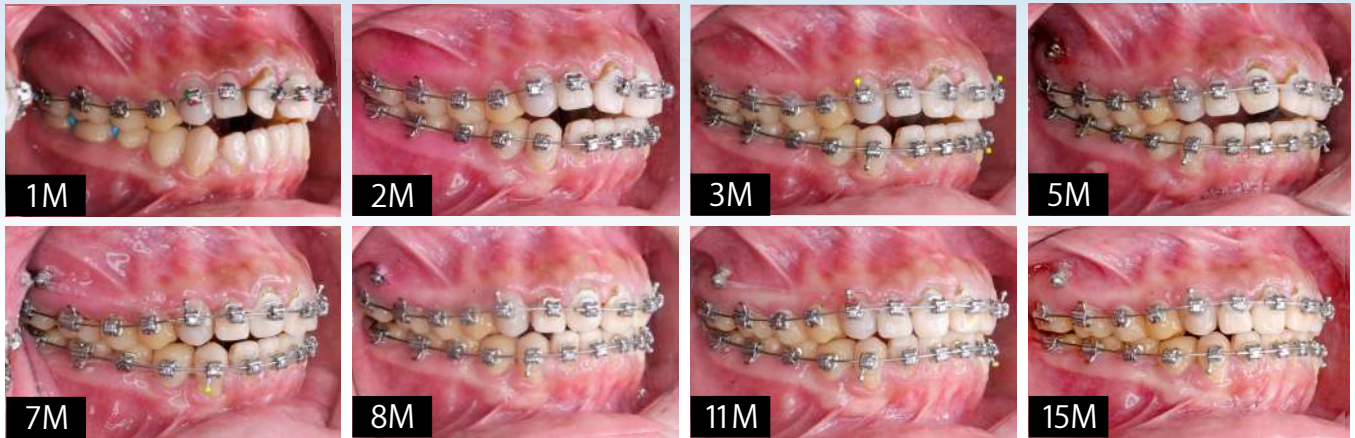
- A-P: Retracted
- Vertical: Intruded
- Inter-Molar/Inter-Canine Width: Expanded

Facial Esthetics:

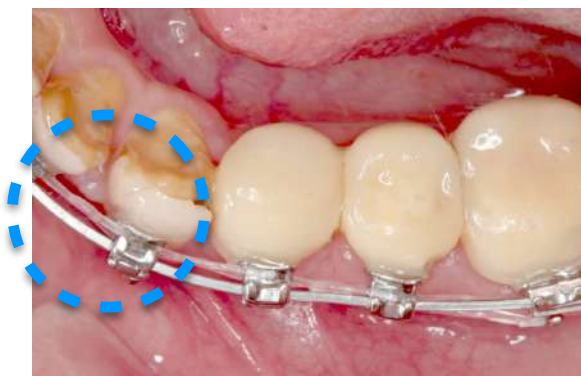
- Both upper and lower lips were retracted



■ **Fig. 10:** Blue elastic separators are placed mesial and distal to the lower first molars to prepare restorative margins for provisional restorations. Later bonding of lower first molars was successful. No bands were used.



■ **Fig. 11:** A progressive sequence of right buccal photographs document treatment progress from 1-15 months (M).



■ **Fig. 12:** The provisional veneer on LR3 was cracked and displaced.



■ **Fig. 13:** IZC bone screws were placed buccally to the upper molars.

## Discussion

Etiology of anterior openbite is an interdental tongue posture that often reflects a past or present airway compromise. Swallowing requires a tongue thrust to seal the oral cavity. The tongue thrust is commonly thought to be the proximal cause of the openbite, but Proffit et al.<sup>10</sup> have clearly shown that the constant force of soft tissue *posture* is more efficient than the intermittent force of a tongue thrust for producing openbite malocclusion. Anterior openbite is often associated with increased FMA, reduced inter-incisal angle, increased lower facial height, and incompetent lips.<sup>8,9</sup> This morphologic pattern compromises both dentofacial esthetics and functional occlusion. Affected individuals experience difficulty incising food, and articulating the normal sounds of speech. Repetitive mechanical loading of a tongue thrust may contribute to periodontal compromise.<sup>10</sup>

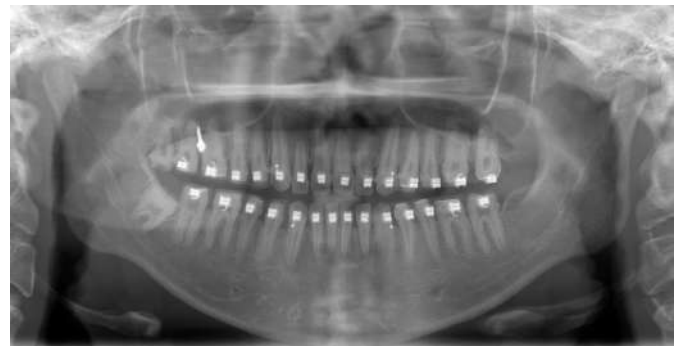
There are many treatment options for correcting anterior openbite: fixed appliances with/without extractions, multi-loop edgewise archwires,

functional appliances, high-pull headgear and/or bite blocks. Some malocclusions are exacerbated with growth. Severe openbite may require a combination of orthodontics and orthognathic surgery. The most common surgical procedure is a Le Fort I osteotomy with posterior maxillary impaction and/or bimaxillary osteotomy.<sup>8,9</sup> Orthognathic surgery for openbite correction may be unstable. Proffit et al.<sup>10</sup> found maxillary impaction was less prone to relapse (7% overbite decrease) compared to two-jaw surgeries (12% overbite decrease). Teittinen et al.<sup>11</sup> compared maxillary impaction and mandibular rotation to close anterior openbite. The maxilla tends to relapse vertically, but the mandible experienced both vertical and sagittal changes, particularly with two-jaw procedures. Furthermore, Frey et al.<sup>12</sup> described a greater relapse tendency for counter-clockwise rotation of the mandible. Overbite relapse is a statistically significant problem following orthognathic surgery.<sup>13</sup> In the past decade, skeletal anchorage devices have evolved to intrude molars for achieving improvement in occlusion, facial height and lateral profile.<sup>14-17</sup> Bone screws and miniplates are stationary osseous anchorage for retraction and intrusion of the dentition. The surgical procedure for miniplate placement is more invasive and relatively complicated, compared to self-drilling screws that penetrate the soft tissue. The latter are inserted directly into cortical bone and have a very high rate of success.<sup>17,18</sup> No surgical flap or pilot drilling are necessary. Avoiding the trauma and pain of more extensive surgery is an attractive feature, and an additional advantage is the simple removal of the screw without anesthesia after treatment.

The extra-alveolar location of the bone screw permits selective retraction and intrusion of the

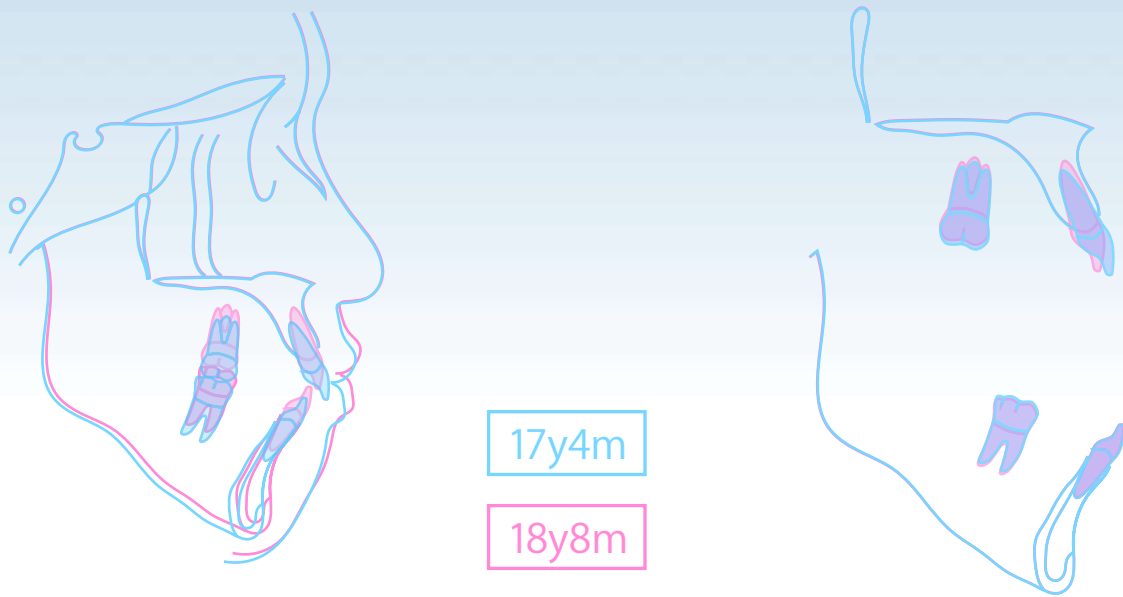


**Fig. 14:**  
Progress cephalometric radiograph at 14 months shows dentofacial changes.



**Fig. 15:**  
Progress panoramic radiograph at 14 months documents initial orthodontic alignment.

dentition.<sup>18,19</sup> When combined with the Damon PSL appliance, a light force can expand (develop) a narrow arch without periodontal compromise.<sup>20</sup> Sequential or simultaneous correction in three planes of space with bone screw anchorage is more effective than routine fixed appliance therapy,



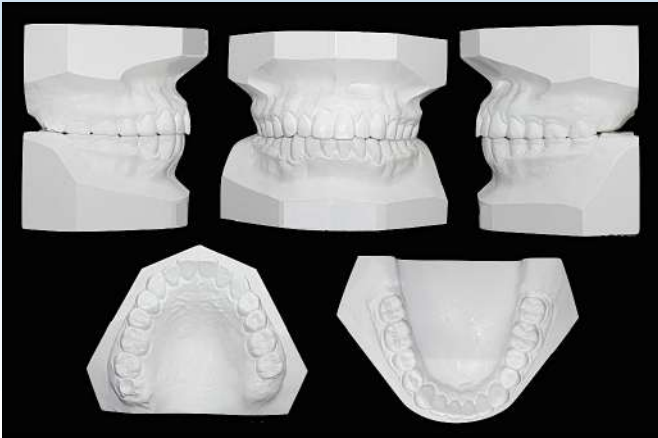
■ **Fig. 16:**

*Superimposition of cephalometric tracings (17y4m and 18y8m) reveals 16 months of progress. Note that the mandible has rotated anteriorly (counter-clockwise). See text for details.*



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





■ **Fig. 18:** Post-treatment dental models (casts)

and is much less traumatic compared to orthognathic surgery.<sup>18-20</sup>

Amelogenesis imperfecta (AI) is usually an autosomal dominant trait affecting all teeth.<sup>10</sup> Lack of enamel may result in dental attrition and compromise of the epithelial attachment. Crown lengthening and extensive restorative dentistry are often required prior to orthodontics (Figs. 24 and 25).<sup>21,22</sup> Periodontal and radiographic evaluation suggested that a passive eruption mechanism contributes to the compromised gingival and osseous relationships.<sup>23</sup> For the current patient, the periodontium presented with a wider band of keratinized tissue and osseous crest at about the same level as the cemento-enamel junction (CEJ). The periodontal surgical procedure included thinning of both soft and hard tissue to minimize rebound of the apically repositioned gingiva soft tissue. The improved periodontal contours facilitate oral hygiene and result in a more esthetic outcome prior to orthodontic treatment.<sup>24</sup>

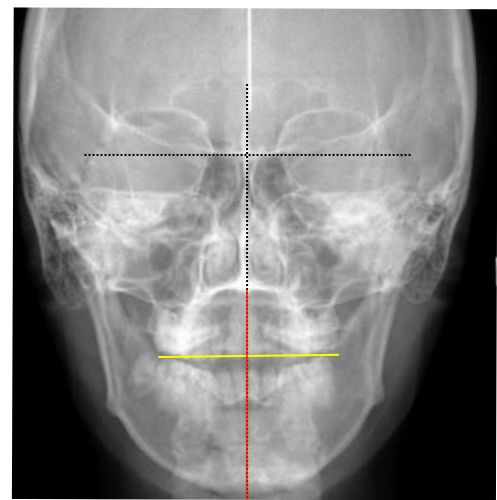
The crown lengthening procedure apically repositioned the gingiva on an osseous base that was reduced to provide for adequate biologic width.



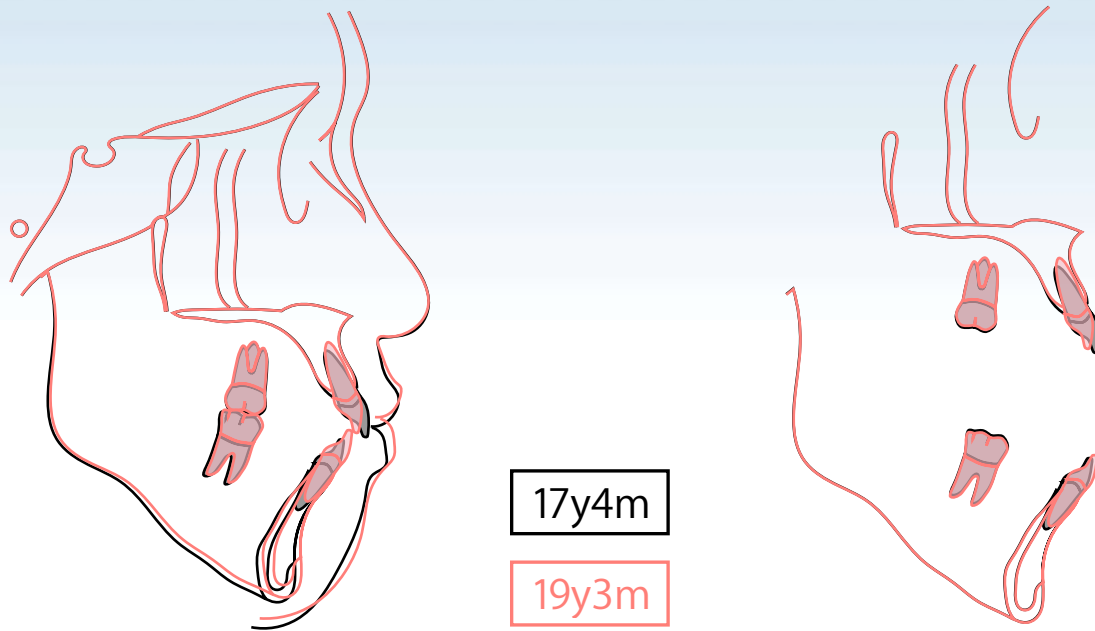
■ **Fig. 19:** Post-treatment panoramic radiograph



■ **Fig. 20:** Post-treatment cephalometric radiograph



■ **Fig. 21:** A post-treatment anteroposterior cephalometric radiograph with superimposed reference lines shows a near ideal dentofacial symmetry. Compare to Fig. 6, and see text for details.

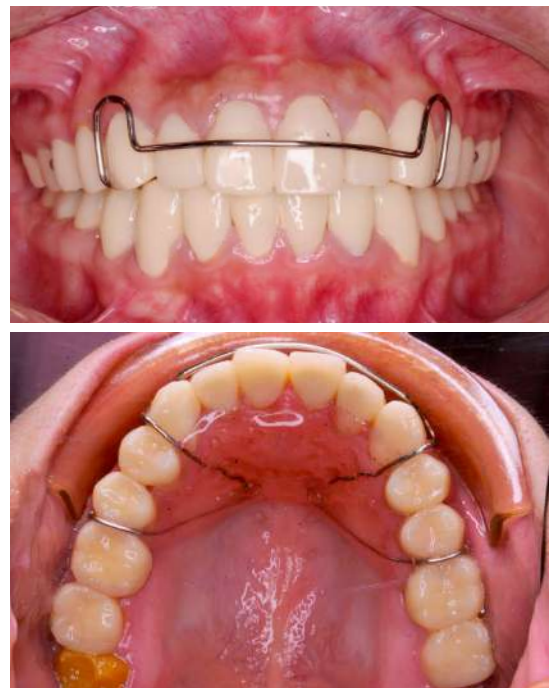


■ **Fig. 22:**

*Cephalometric tracings superimposed on the anterior cranial base (left), maxilla (upper right), and mandible (lower right) show dentofacial changes during active orthodontic treatment. The black tracing at 17y4m is the start, and the red tracing at 19y3m is the finish. See text for details.*

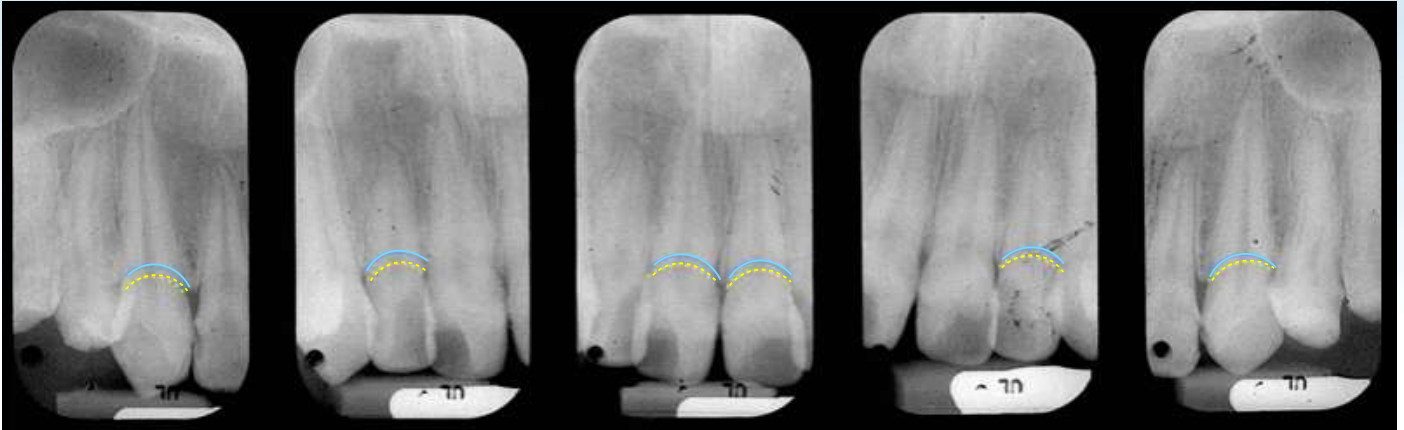
Under local anesthesia, the location of the anatomical CEJ and alveolar bone crest were determined using a periodontal probe. Sub-marginal parabolic incisions corresponding to the anatomical CEJ reproduced the natural scalloping of a gingival margin (Fig. 26). After full-thickness gingival flap elevation, an osteotomy was performed to provide at least 3mm clearance between the bone crest and the desired level of gingival margin. Vertical grooving and radicular blending of bone created a physiological morphology with appropriate root prominence (Fig. 27). The flap was closed with dissolvable sutures and covered with a periodontal dressing.

Crown lengthening exposed the margins of defective restorations and rough enamel surfaces (Fig. 28). It is important to correct the biologic,



■ **Fig. 23:**

*Orthodontic correction was maintained with an upper removable retainer. See text for details.*



■ Fig. 24:

*Intraoral radiographs prior to treatment were used to assess the morphology of the anatomical cemento-enamel junction (aCEJ) and alveolar bone crest (ABC). The blue lines mark the ABC, and the yellow dotted lines mark the aCEJ. Note the distance (ABC-aCEJ) is less than 2mm, which is a biologic width violation that induces inflammation. See text for details.*

functional, and esthetic deficits prior to initiating orthodontics (Fig. 2).<sup>25</sup> Health of the periodontium was maintained with provisional restorations that had physiologic contours and gingival embrasures.<sup>26</sup> Auto polymerized polymethyl methacrylate [PMMA] was the restorative material of choice because of adequate strength and good color stability. An indirect-direct technique with a provisional shell was used to produce the provisional prostheses.

A previously fabricated custom shell for each tooth was relined intra-orally immediately after tooth preparation was completed. The indirect-direct procedure reduced chair time. It is important to adequately seat the shell during the reline procedure to decrease adjustments as well as to control heat generation and chemical irritation. The indirect approach with PMMA as a reline material reduces polymerization shrinkage compared with the direct technique. After the reline and

adjustment procedures, the surface of the provisional crowns were polished to facilitate soft tissue healing along the desired cervical contours.<sup>27</sup> This method is well suited for helping resolve anterior openbite restoratively.<sup>28</sup> After fourteen months of orthodontic alignment, a second set of provisional restorations was constructed. Each tooth was restored as ideally as possible to facilitate the final interdigitation, overjet, and overbite during orthodontic finishing (Fig. 16). The provisional restorations were adjusted as desired by the patient, so they could serve as the pattern for the permanent restorations. This approach fulfilled the patient's needs for a harmonious and healthy dentition.

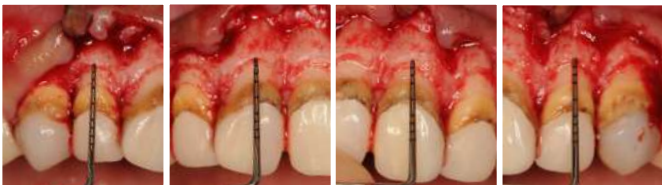
In interpreting Figure 22, it is important to understand that the mandible was rotated clockwise due with thick posterior provisional restorations to provide adequate strength. Future permanent crowns will have thinner occlusal



**Fig. 25:**  
Initial photographs of the maxillary anterior segment show the swelling and inflamed gingiva that is characteristic of an inadequate biologic width. See text for details. (Courtesy of Dr. Po-Jan Kuo)



**Fig. 26:**  
A surgical flap is raised with an internal bevel incision between the line angles of each tooth. See text for details.



**Fig. 27:**  
Reduction osteotomy of the alveolar crest in the maxillary anterior segment increases the distance from ABC to aCEJ to  $\leq 3$  mm for each tooth. See text for details.



**Fig. 28:**  
Left view shows healing 2 weeks post-operatively, and the right view documents pink, healthy gingiva 4 weeks after surgery.

surfaces, so the mandible will rotate anteriorly (counter-clockwise) to improve the facial profile.

## Conclusions

An AI compromised dentition developed into a complex malocclusion that required interdisciplinary treatment to achieve an optimal esthetic and functional outcome. Provisional restorations supported by healthy periodontium were the prerequisite for orthodontic alignment. A passive self-ligating appliance with IZC bone screw anchorage achieved optimal dentofacial form and function. To facilitate optimal finishing, a new set of provisional restorations was constructed after 14 months of orthodontic alignment. Carefully coordinated periodontal, restorative and orthodontic treatments were required to achieve a near ideal outcome.

## Acknowledgment

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### Archwire Sequence Chart

Clinicians: Dr. John Jin-Jong Lin

Patient: Miss Lo

Maxillary Archwire Mandibular Archwire

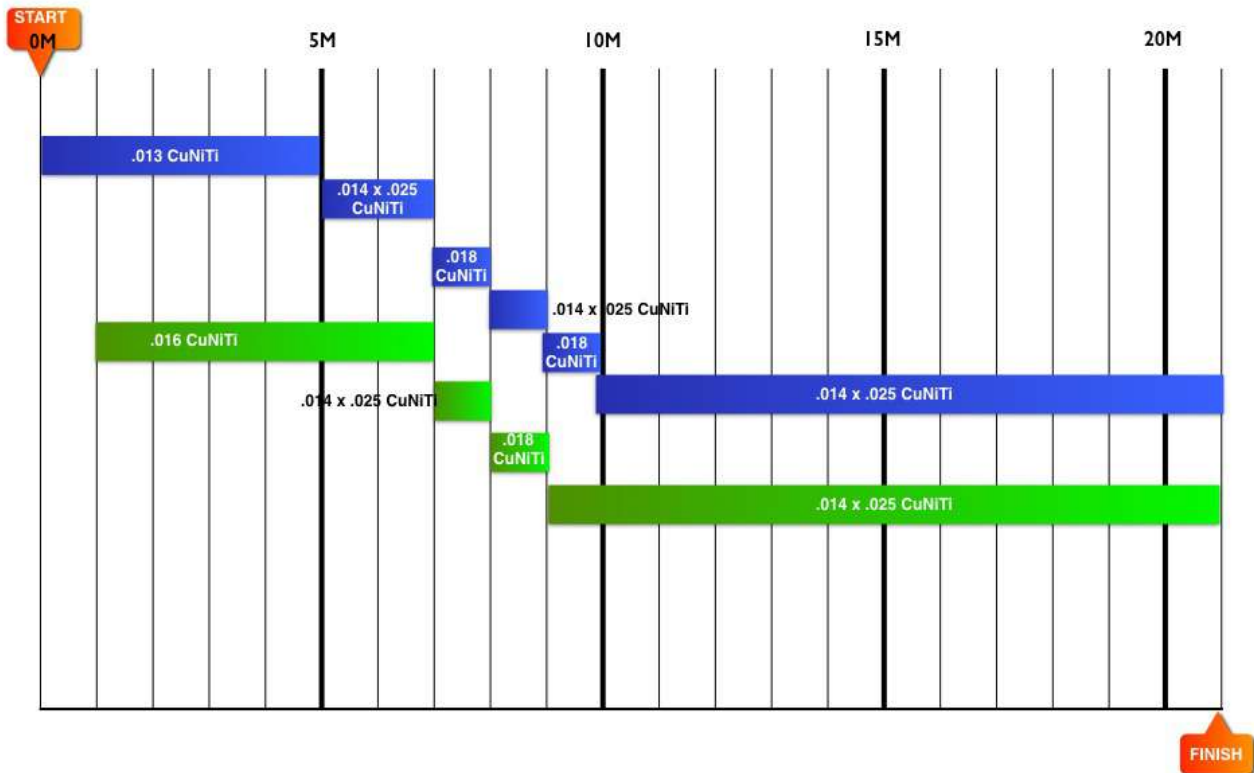


Table 2: Archwire sequence chart: timing of the mechanics for both arches

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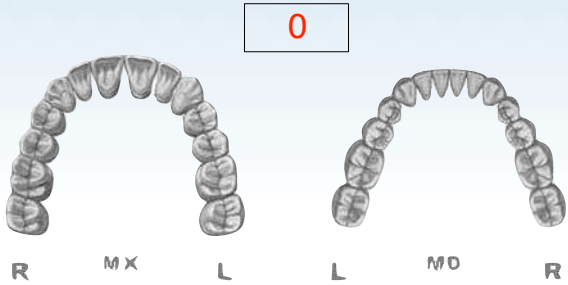




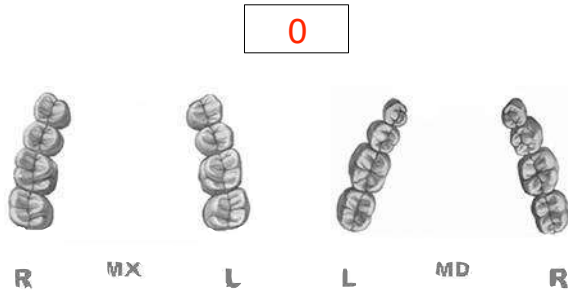
# Cast-Radiograph Evaluation

Total Score: 11

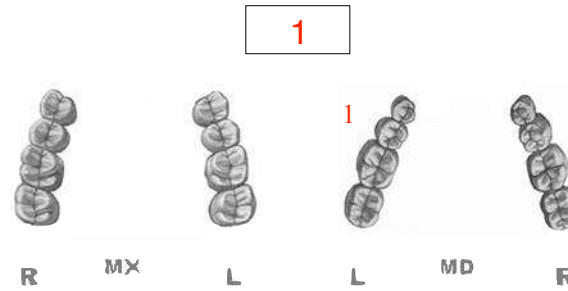
## Alignment/Rotations



## Marginal Ridges



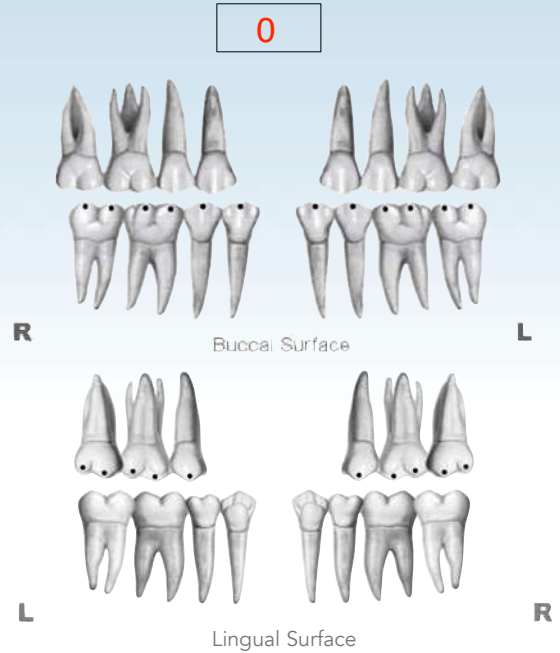
## Buccolingual Inclination



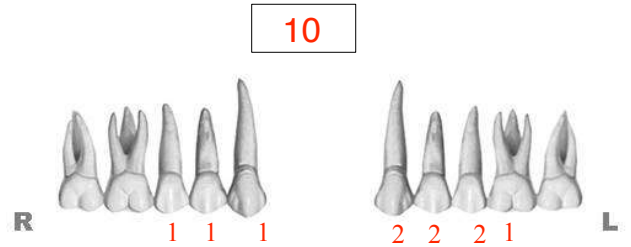
## Overjet



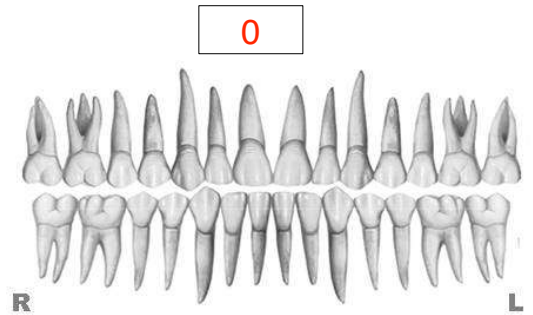
## Occlusal Contacts



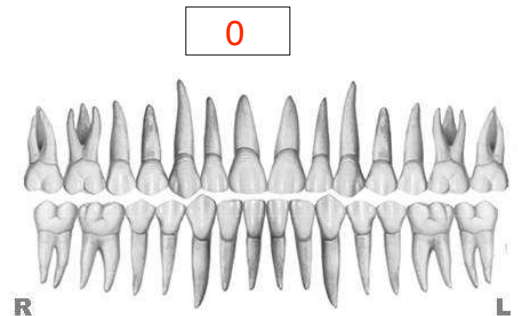
## Occlusal Relationships



## Interproximal Contacts



## Root Angulation

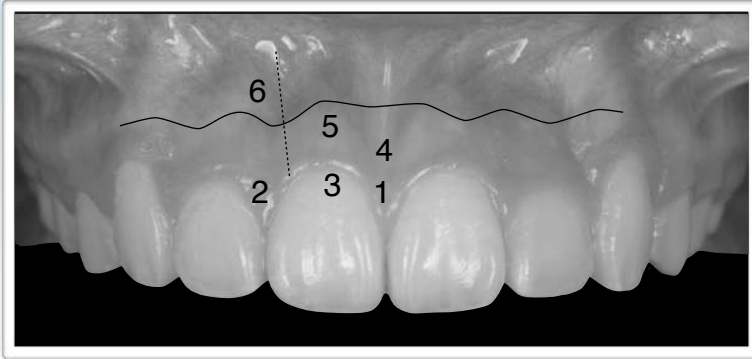


**INSTRUCTIONS:** Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

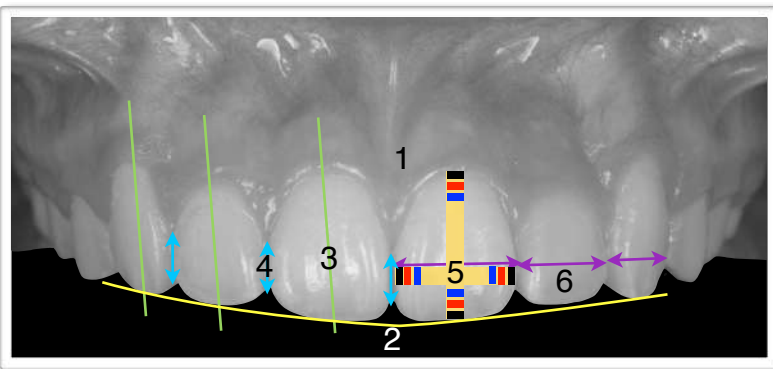
# IBOI Pink & White Esthetic Score

Total Score = 1

## 1. Pink Esthetic Score



## 2. White Esthetic Score (for Micro-esthetic)



Total = 1

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

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

Total = 0

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

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

Key Opinion Leader

**Dr. Rino Burkhardt**

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Dr. Rino Burkhardt



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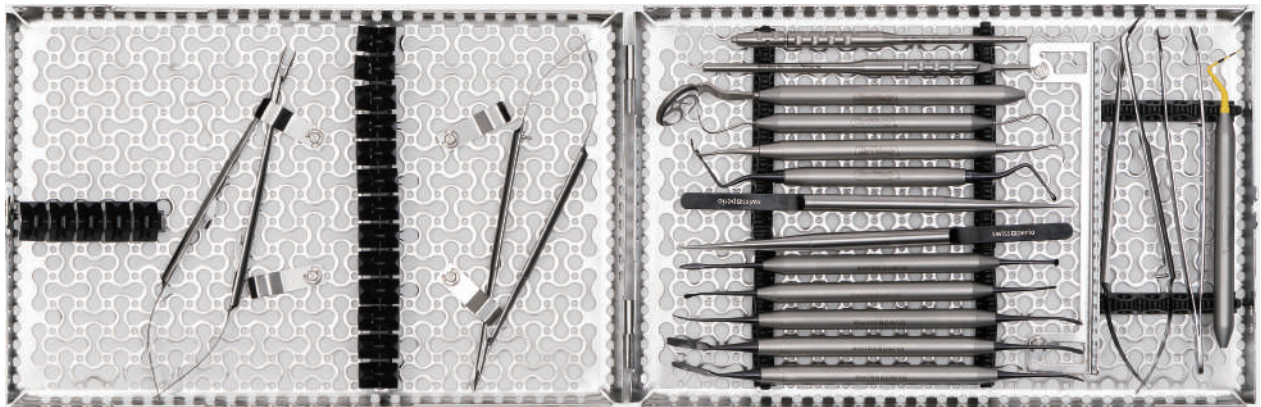
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- Ultimate manufacturing tolerances for precise handling.
- Easy to clean.

### BLACK INSTRUMENTS / BLACK LINE EXTENSION

- More contrast between the instrument and the tissue.
- Avoid light reflection.
- More sharpened than standard.

### BALANCED WEIGHT

More control and precision in specific and delicate microsurgery procedures.



### SPKITUS

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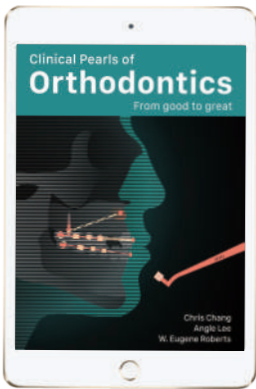
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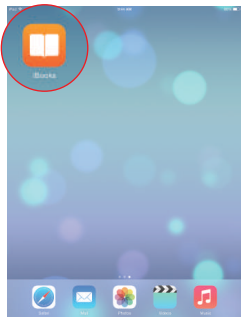
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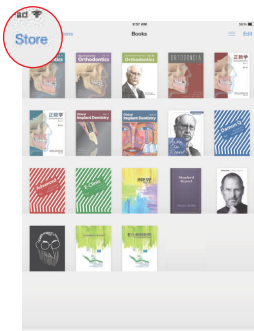
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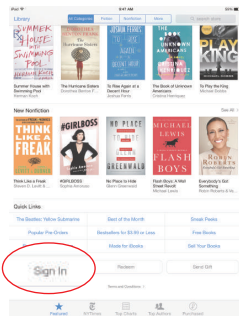
## Step-by-step Instructions



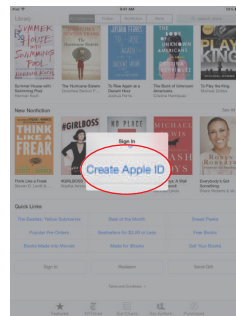
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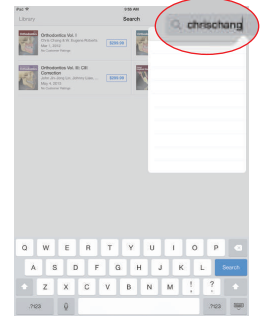
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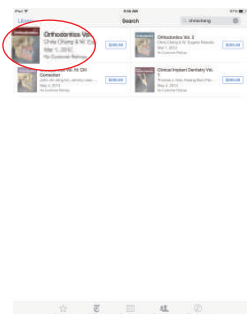
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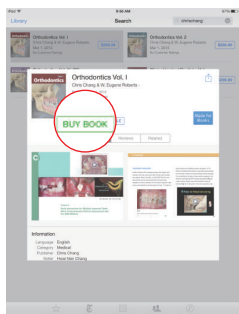
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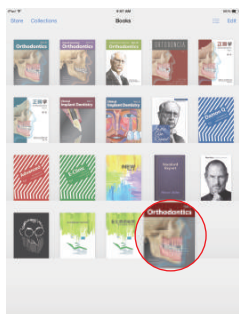
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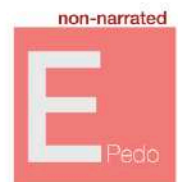
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*During the visit to Florida for the 2024 Annual Meeting of Angle Midwest, Dr. Chang got to enjoy a golf game after leading a panel discussion, and was thrilled to win the first place trophy by scoring 75 strokes.*