Anterior Crowding with a Block-in Peg-shaped Lateral Incisor

History and Etiology

A 15-year-8-month female came to ask for full mouth evaluation because of the crooked display of her teeth when she smiled. After intraoral examination, both arches showed anterior crowding. A palatally malposed maxillary lateral incisor was noted (*Fig. 9*). There was no systemic diseases and known drug allergy. Her oral hygiene was acceptable. She received operative dental treatment in the past. There was no history of dental trauma or oral habits, and no significant signs and symptoms of temporomandibular dysfunction.

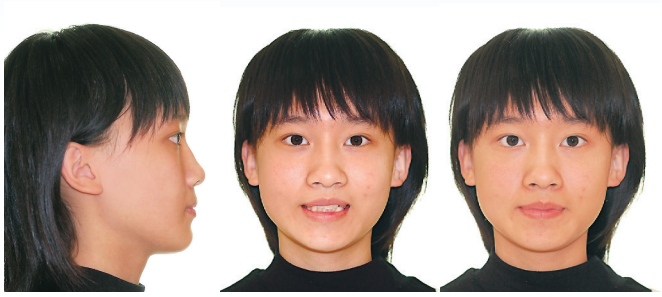


Fig. 1: Pretreatment facial photographs

Fig. 2: Pretreatment intraoral photographs

Fig. 3: Pretreatment study models

Diagnosis

Skeletal:

Skeletal Class I (*SNA 80°, SNB 77°, ANB 3°*).

Dental:

Bilateral Class I molar relationship.

Severe crowding in both upper and lower arches. The lower dental midline shift 3 mm to left of the facial midline.

Block-out of #6, 11, 22, 27.

Anterior crossbite of #7, 27

Anomalous morphology of #7

Facial:

Straight profile with acceptable lip position. Acceptable vertical proportion.

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

Fig. 4: Posttreatment facial photographs

Fig. 5: Posttreatment intraoral photographs

Fig. 6: Posttreatment study models

Specific Objectives of Treatment

Maxilla (*all three planes*):

- A - P: Maintain.
- Vertical: Maintain a normal growth pattern
- Transverse: Maintain.

Mandible (*all three planes*):

- A - P: Maintain.
- Vertical: Allow normal expression of growth
- Transverse: Maintain.

Dentition :

- Maintain Class I molar relationship.
- Level both upper and lower dentition
- Correct #7, 27 crossbite
- Restore the morphology of #7

Facial Esthetics: Maintain straight profile.

Treatment Plan

For a straight profile with crowding dentition, extraction is often considered as an appropriate treatment option. In our present case, extraction of four bicuspids to create space was indicated. Considering significant amalgam fillings on the occlusal surface of #4 and #29, four second premolars were decided to be extracted and keep the relatively healthy and intact four first premolars. Besides, extraction of four second premolars could prevent a dish-in profile. In order to create space for #7 and solve the crossbite of #7 and #27, open coil springs

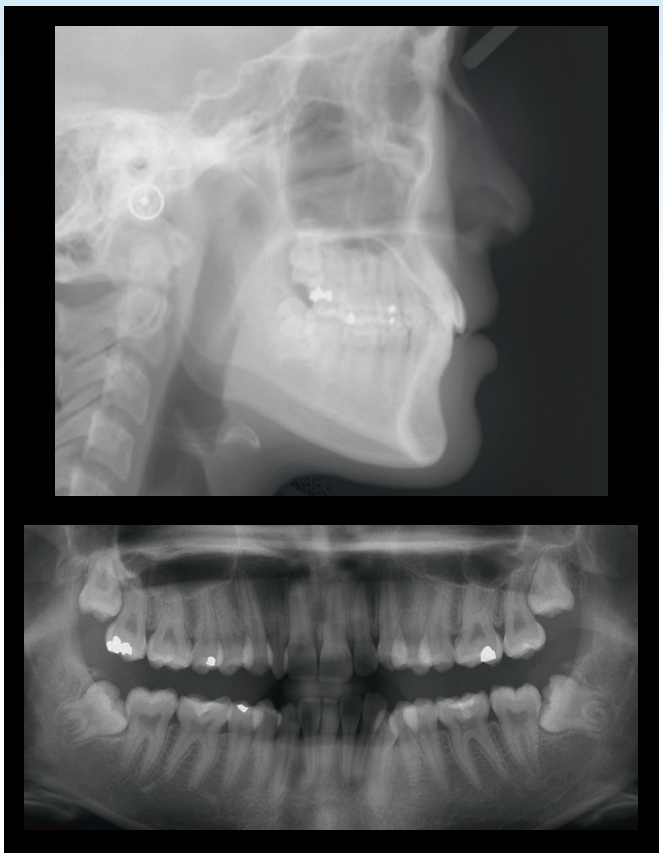


Fig.7: Pretreatment pano and ceph radiographs

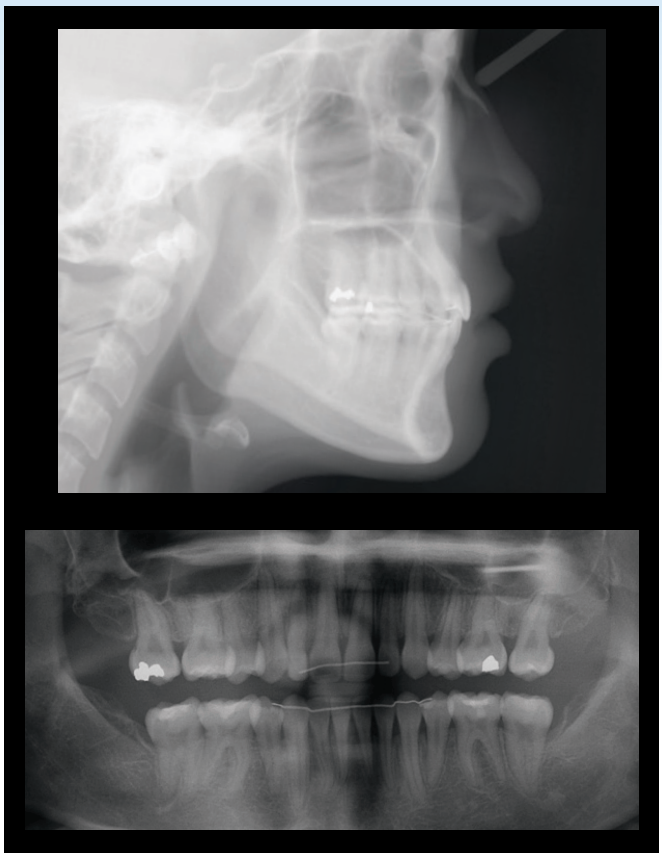


Fig. 8: Posttreatment pano and ceph radiographs

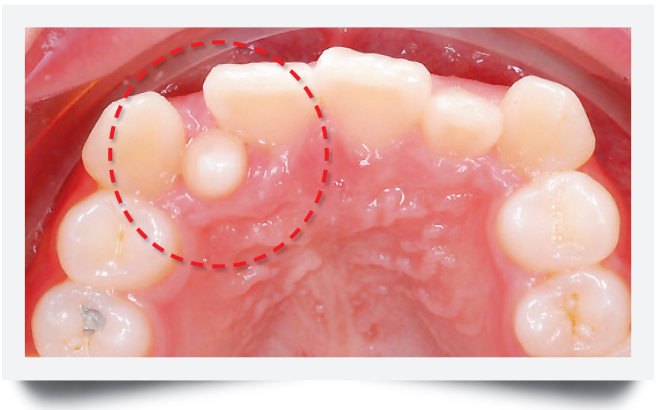


Fig. 9:

A maxillary peg lateral incisor was noted, which needed to create enough space for alignment and to be restored into a normal morphology.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	80°	79.5°	0.5°
SNB°	77°	76.5°	0.5°
ANB°	3°	3°	0°
SN-MP°	36°	37°	1°
FMA°	26°	27°	1°
DENTAL ANALYSIS			
U1 TO NA mm	2 mm	3 mm	1 mm
U1 TO SN°	103°	105°	2°
L1 TO NB mm	1 mm	2 mm	8 mm
L1 TO MP°	77°	85°	-1°
FACIAL ANALYSIS			
Upper lip to E-LINE	-2 mm	-1 mm	1 mm
Lower lip to E-LINE	-0.5 mm	1 mm	1.5 mm

Table. Cephalometric summary

and anterior bite turbos were used. Class II elastics were applied for retracting anterior teeth and resolve occlusal discrepancy. The esthetics of #7 was also an important issue. Restoration can be achieved by direct bonding composite resin, veneer, or a full coverage crown. After finishing the treatment, fixed appliances were removed and the corrected dentition was retained with fixed anterior retainers on both upper and lower arch, and a clear retainer overlay on the upper arch. Four third molars could be extracted before, during, or after the orthodontic treatment.

Appliances and Treatment Progress

After four second premolars were extracted, .022" Damon MX® bracket (*Ormco*) were bonded on both arches, and .014" CuNiTi wires were placed to align the dentition. Meanwhile, an open coil spring was inserted in the upper arch to create space for #7. In the 7th month of the treatment,, #7 received gingivectomy for a better bonding position. In the 8th month of the treatment, the arch wire were changed to .017×.025" low friction TMA in the upper arch and .014×.025" CuNiTi wire was placed in the lower arch. In the 11th month, #7 was restored with composite resin and the bracket position was changed again. In the 17th month .016×.025 SS wire and .019×.025" SS wire were used on the lower and upper archwire respectively. Power tubes were used to close the remaining space, followed by extraction of four third molars. The appliance was removed in the 27th month of the treatment. Fixed anterior retainers on both upper and lower arch, and a clear, overlay retainer on the upper arch, were delivered. Gingivoplasty was performed on both upper lateral incisors, and central incisors, with diode laser to improve the crown length-to-width proportion.

Final Evaluation of Treatment

The IBOI Cast-Radiograph Evaluation scored at 28 points, which was deemed to qualify as a board case report.

Major problems include more buccal tipping of both upper second molar, resulting in discrepancies in alignment, marginal ridge, buccal-lingual inclination, overjet, and occlusal contacts. In the meantime, the root angulation of eight teeth, #5, 7, 18, 21, 26, 28, 30 and #31, were not precisely parallel as indicated in the panorex. It was suspected that the mesial side of the bracket were bonded more gingivally than the distal side, and it resulted in distal tilting the second molars. Therefore, the long axis of the root could not be parallel, because both upper and lower molar bracket pad were designed to have a buccal groove with it. Dr. Tom Pitts suggested that the bracket placement protocol for maxillary first molar is to fit the buccal groove region of the pad into the buccal groove of the tooth in a mesio-distal(*M-D*) position, and keep the occlusal edge of the first molar tube on the M-D contact line. The M-D positioning for the maxillary second molar tube is the same as the first molar. In terms of occlusogingival (*O-G*) positioning, the bracket is 1.5 mm more occlusally than the first molar. For lower first and second molars, the buccal groove of the molar tube were centered to the buccal groove of the tooth in M-D positioning while occlusogingivally, the bracket molar pads were 0.5 mm gingivally to M-D contact line. In addition, the first and the second molar bracket were at the same height. Fig. 11 illustrantes the ideal bracket placement of maxillary and mandibular molars.[1]

Her straight profile and the proportion of the face were maintained. Dental midline was corrected. Both side of the molar relationship was Class I. Tooth display of anterior region was improved.

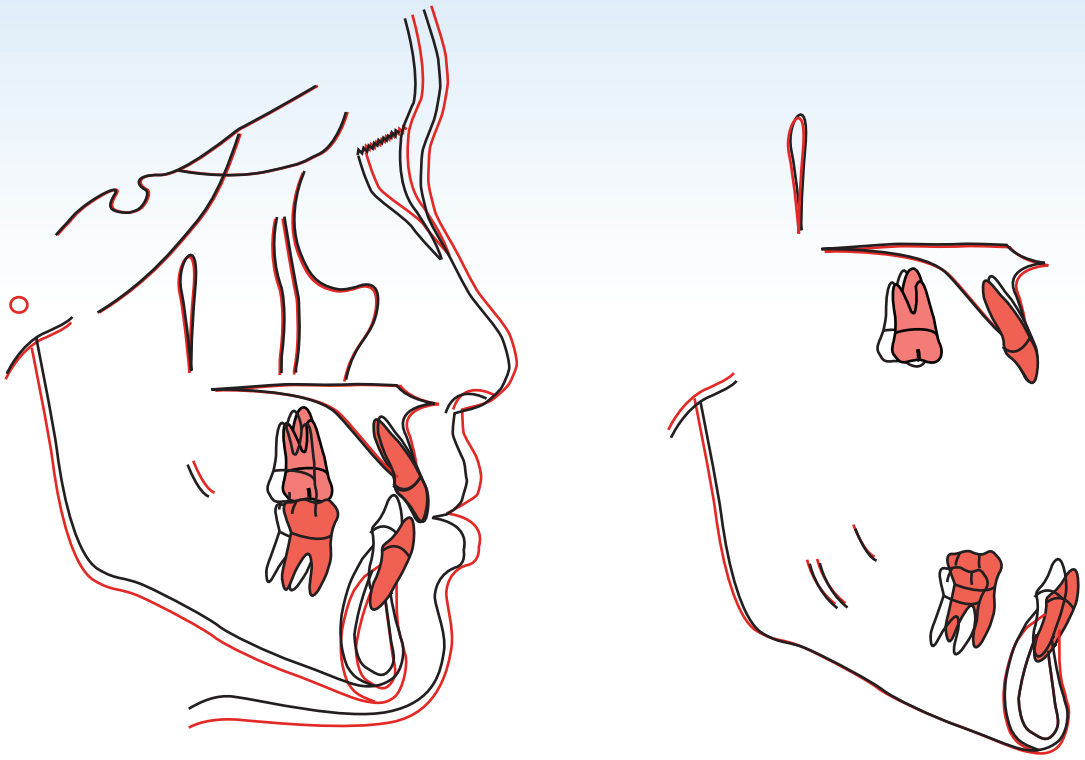
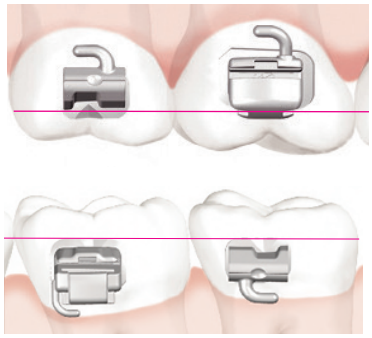


Fig. 10:

Superimposed tracings:

Class I molar relationship was retained. The ramus and the body of the mandible kept growing throughout the treatment. The roots of upper incisors torqued palatally slightly; the crown of lower incisors tipped labially. Mild deepbite was improved and the straight profile was maintained. Maxillary and mandibular 1st molars were protracted to close the excessive space



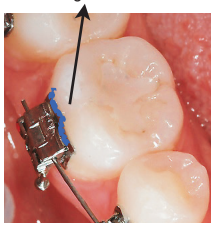
	M-D	O-G
Maxillary 1st molar	Center buccal tip of the tube pad over buccal groove of tooth. 	Position occlusal edge of tooth pad at M-D contact line.
Maxillary 2nd molar		Position occlusal edge of tooth pad 1.5 mm more occlusally than 1st molar.
Mandibular 1st molar		Position occlusal edge of tooth pad 0.5 mm gingivally to M-D contact line.
Mandibular 2nd molar		The same as Md. 1st molar.

Fig. 11:

Bracket Placement of maxillary and mandibular molars (Dr. Tom Pitt's presentation)

Discussion

Maxillary lateral incisors vary in forms more than any other tooth in the mouth except the third molars.[2] A peg-shaped lateral incisor could be defined as a developmental anomaly of the maxillary lateral incisor that result in a small peg in shape.[3] Peg shaped lateral incisors occur in approximately from 2% to 5% of the general population, and women show a slightly higher frequency than men.[4-6] There is no significant difference between the occurrence rate in Peg-shaped anomalies presented in right or left, uni- or bilaterally. In this case report, this is a female with a unilateral peg-shaped lateral incisor.[3]

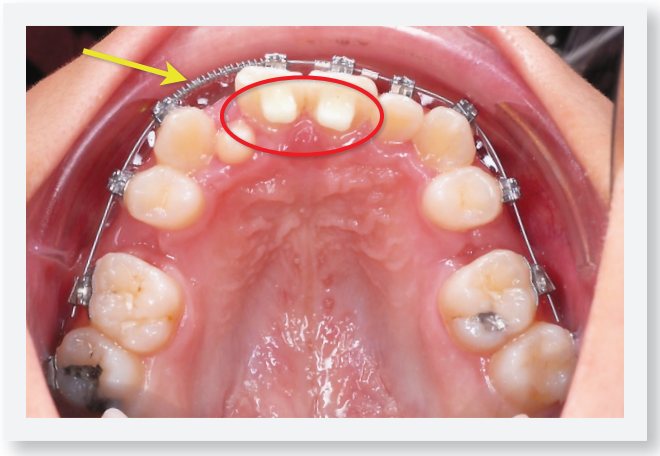


Fig. 12:

The 1st month. An open coil spring(yellow arrow) was inserted to create enough space for the peg lateral incisor. Bite turbos(blue circle) were applied to correct anterior crossbite.

Fig. 13:

The 4th month. When space was created for the lateral incisor, it was bonded with a bracket. In addition, a power tube was used and banded together with the archwire to move the tooth more buccally.

Fig.14:

The 7th month. Lateral incisor was aligned, and sufficient space was created to restore it into a normal shape.

Fig. 15:

The 18th month. Lateral incisor was restored with composite resin. A power tube was used to close the excessive space.

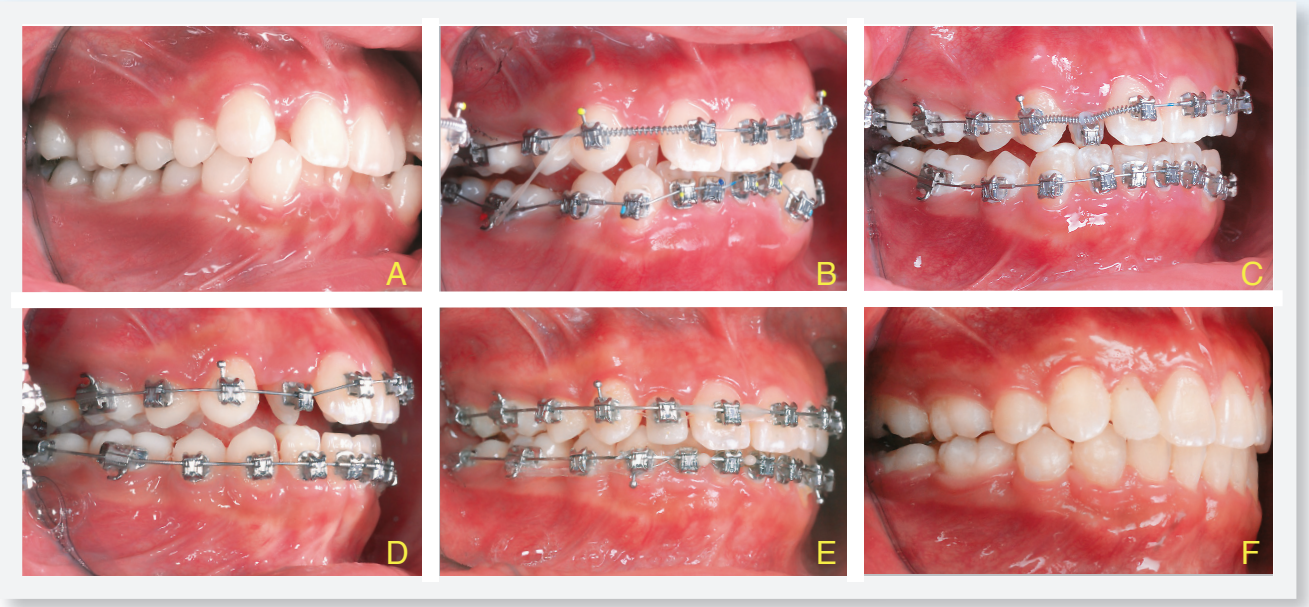


Fig. 16:

Lateral view. The peg lateral incisor was behind the lower canine before treatment. Open coil springs and bite turbos were used to obtain the space between maxillary central incisor and canine, then the lateral incisor could move buccally and correct the crossbite. Moreover, the space provided the peg lateral incisor to be restored into a normal shape. Finally, the lateral incisor was aligned and the excessive space was closed by the power tube.

A: pre-treatment; B: 1st month; C: 4th month; D: 7th month; E: 18th month; F: post-treatment

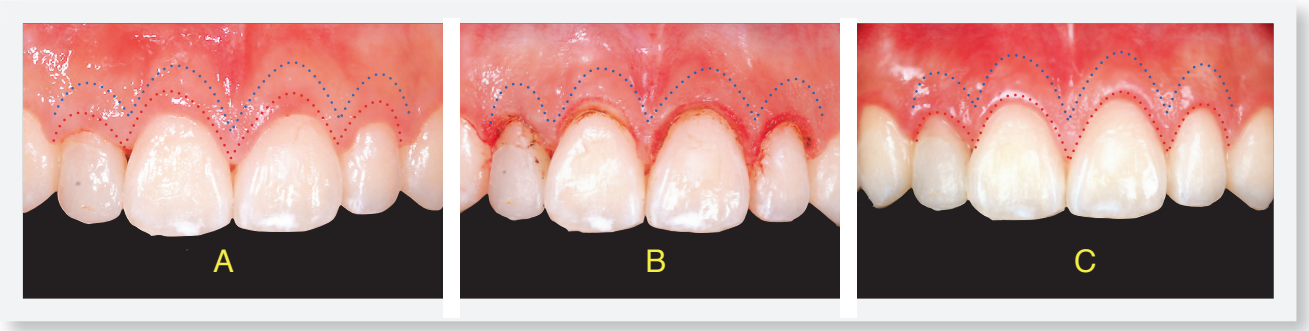


Fig. 17:

Gingivoplasty was performed for a better crown length-to-width proportion.
The blue line imitates the bone level of the teeth; the red line marks the ideal gingival height.
A: before gingivoplasty; B: probing depth and marking the ideal gingival height, and thus diode laser was used;
C: 1 month follow-up after treatment.

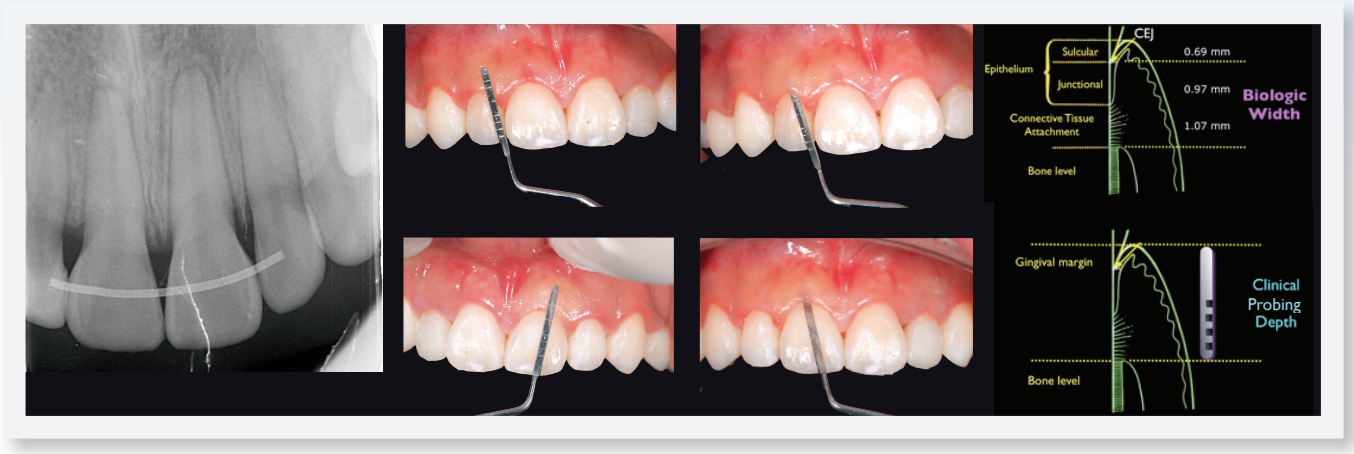


Fig. 18:

After the ideal gingival height was estimated, X-ray was reviewed to evaluate the bone level and probed depth with an explorer. Due to equal bone level and mild excessive free gingiva, gingivoplasty was performed and the biological width was maintained.

Peg lateral is usually associated with other dental anomalies, such as tooth agenesis,[4,7,8] maxillary canine-first premolar transposition,[5] palatal displacement of one or both maxillary canine,[7] buccal displacement of maxillary canine,[9,14] and mandibular lateral incisor-canine trans- position.[10] In cases of concomitant dental anomalies, the prevalence suffers significant increase from normal prevalence.[9-11] In this case combined with anterior crowding, the block-out of right upper and lower canines, and the crossbite between right upper lateral incisor and lower canine might be associated with this dental anomaly.

There are several treatment options for malformed lateral incisors. A periapical film should be taken to evaluate if the lateral incisor could be preserved. Treatment planning may include extraction and non-extraction of the lateral incisor.[3,12,13]

1. Extraction of lateral incisor:[14-17]

A. Canine substitution:

To move adjacent maxillary canines forward, one can reshape them to simulate the extracted malformed lateral incisors. However, it is only suitable for the following situations, such as Class II molar relationship with excess overjet, Class I molar relationship with lower arch crowding which extraction is an indication, protrusive face, and the shape and color of the canine could match with the adjacent central incisor;

B. Implant placement:

Nowadays, implant placement is a common way to replace a missing tooth. Considering not only the high success rates, this type of restoration could also prevent injuries to the adjacent teeth. To achieve a stable esthetic and healthy outcome with dental implants, the effects on the surrounding hard and soft tissues should be take into consideration.

C. Resin-bonded fixed partial denture(*FTP*), cantilever FTP, or conventional full coverage bridge:

Resin-bonded FTP, the so-called Maryland bridge, is the most conservative technique among tooth-supported restorations. But there are some limits for placing this kind of restoration. Patients with no history of bruxism, immobile abutment, and shallow overbite would decrease its failure rate.

Due to sufficient root length and crown dimensions, canine is an ideal abutment for Cantilever FTP. For long-term success of a cantilevered bridge, avoid pontic contact in excursive movements. In case eccentric contact remains on the pontic, it increases the risks of loosening of the bridge, migration of the abutment, and fracture.

The least conservative of all tooth-supported restorations is a conventional full-coverage FPD. Therefore, this kind of treatment option is only considered when the adjacent teeth require restoration for structural reasons such as caries or fracture.

2. Non-extraction of lateral incisor:

To stand the canines in a Class I relationship and to restore the tooth structure and morphology of a peg-shaped lateral incisor

A. Direct composite resin filling:

It is the most conservative technique to restore the lateral incisor into a normal shape. It could be applied within one dental visit and is more economic than other restorations. However, composite resin would discolor, or failure if the tooth structure provides insufficient retention and resistance.

B. Ceramic veneer:

Ceramic veneers are ideal restorations for peg lateral incisors in adult patents, since the gingival level might change in young patients. Tooth preparation is minimal in depth, virtually insuring an enamel substrate will remain. Furthermore, ceramic veneers possess greater clinical appearance than composite resin fillings, and also they are stain-resistant. If the peg lateral incisor were extremely small in size, or lack of the sufficient amount of enamel to provide the major bonding strength for the veneers, a full coverage crown might be an optimal restoration.

C. Full coverage crown:

A full coverage crown increases the size of the tooth both mesiodistally and buccolingualy. Due to better retention and resistance, the risk of bonding failure and fracture is lower than veneers. The amount of the ferrule remaining

on the tooth should be evaluated before preparation.

The non-extraction way is more conservative if the situation is allowed, especially for young patients. Most of these cases need to receive orthodontic treatment in the first place to align the teeth, then create adequate space for the reshaped lateral incisor. Some cases are complicated by combineing canine transposition or crossbite.[18,19] Finally, gingivoplasty may be necessary for better gingival display and more structure for increasing retention when bonding to composite resin.[20]

This case report details the treatment of a single unilateral peg-shaped maxillary lateral incisor along with the conservative treatment proposed.

A open coil spring was used to create space for lateral incisor in the beginning of the treatment. When the space was available, the bracket was bonded to lateral incisor for initial alignment. Then gingivectomy was performed to facilitate a proper bonding position. Afterwards, #7 was restored in a normal shape by composite resin to restore its shape. Moreover, a bite-turbo was bonded to help correct anterior crossbite. After all fixed appliances were removed, the esthetics of soft and hard tissue were re-evaluated. Consideration of soft tissue management should include: 1. oral hygiene; 2. X-ray taking; 3. probing; 4. attached gingiva.[21] The ideal gingival height was marked, and the bone level was detected by probing depth. It revealed shorter crown length and mild excessive free gingival tissue of four upper incisors surrounded by equal bone level. Gingivoplasty by diode laser was arranged to achieve more ideal crown length-to-width proportion and maintain the biological width.[22] Table 2. compares the consideration for soft tissue management that help achieve esthetic requirements.

Gingiva Health	○	○
Attached Gingiva	○	○
Probing	Equal Bone Level	Bony Descrepency
Operation	Gingivectomy	Surgical Crown Lengthening

■ Table 2. Consideration of soft tissue operation

Conclusion

Peg lateral incisors are common problems in our daily practice. They also have a huge impact on esthetics. It is important for orthodontists to develop an efficient routine to solve this problem. Specific considerations should include the followings:

1. There are several treatment options for managing peg lateral incisors, including extraction and non-extraction methods. Each of the treatment option should consider the conditions of the lateral incisor and adjacent teeth.
2. Should the teeth be restored before, during, or after orthodontic treatment are based on the treatment planning.
3. Orthodontists play an important role in providing sufficient coronal and apical space for future restoration or implant placement.

Acknowledgements

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DISCREPANCY INDEX WORKSHEET

CASE # [ ] PATIENT

TOTAL D.I. SCORE **21**

EXAM YEAR
ID#

OVERJET

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

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

Total = 2

OVERBITE

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

Total = 5

ANTERIOR OPEN BITE

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

Total = 3

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 = 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	1 x 2 pts. =	2
Impaction (except 3rd molars)	_____ x 2 pts. =	_____
Midline discrepancy (≥3mm)	@ 2 pts. =	2
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 = 4

Exam Year
ABO ID#

Examiners will verify measurements in each parameter.

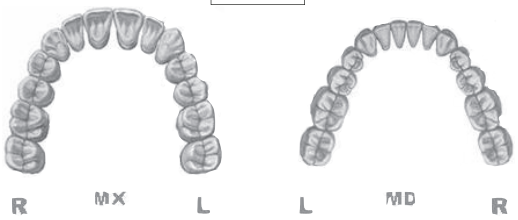
ABO Cast-Radiograph Evaluation (Rev.6-1-08)

Case # **Patient**

Total Score: 28

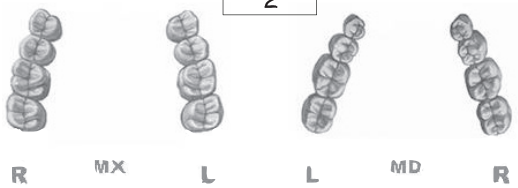
Alignment/Rotations

7



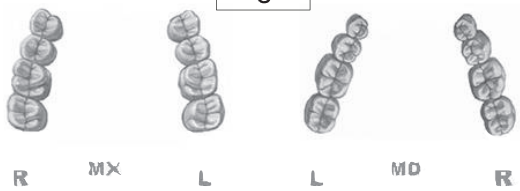
Marginal Ridges

2



Buccolingual Inclination

3

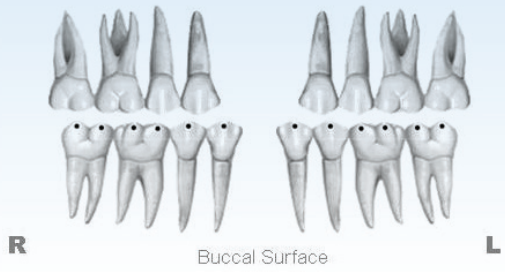


Overjet

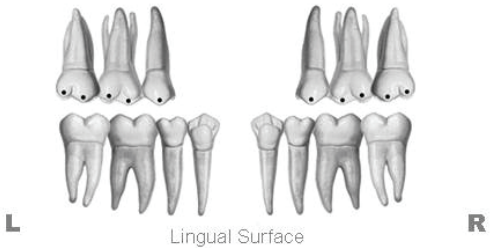
5

Occlusal Contacts

3



Buccal Surface



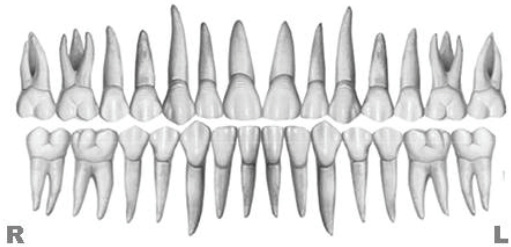
Lingual Surface

Occlusal Relationships

0

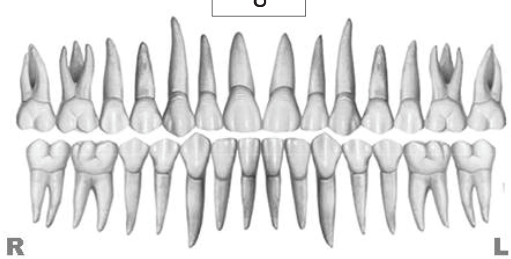
Interproximal Contacts

0



Root Angulation

8



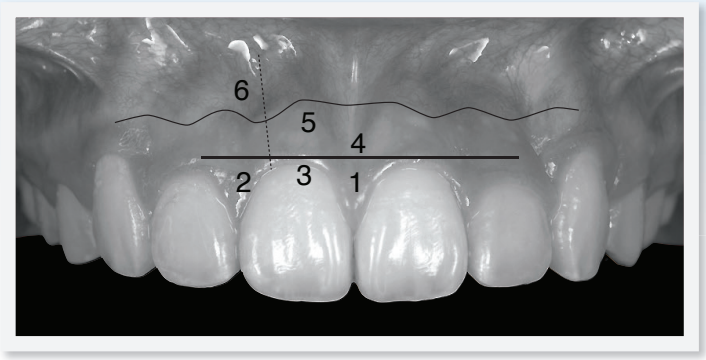
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 2

1. Pink Esthetic Score

Total = 1

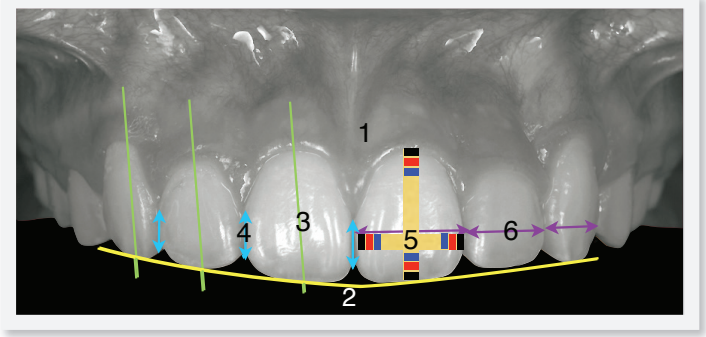


1. Mesial Papilla	0	1	2
2. Distal Papilla	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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 = 1



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