

Severe open bite and crowding case treated by a new passive self-ligating lingual bracket with square slots

Abstract

A 19-year-8-month male presented with a Class III/II asymmetric malocclusion complicated by severe crowding, anterior open bite, lingually ectopic eruption of the maxillary lateral incisors, steep mandibular plane, and facial asymmetry. The treatment began by using a trans-palatal arch and a mini-screw to intrude maxillary molars for a counter-clockwise rotation of the mandible. Two upper first premolars and one lower right first premolar were extracted, and the malocclusion was treated with passive self-ligating (PSL) lingual brackets with .018x.018" square slots. After 27 months of treatment, a dramatic improvement in both tooth alignment and occlusal function was achieved. (*Int J Orthod Implantol* 2016;42:108-119)

Key words:

Lingual appliance, passive self-ligating appliance, square slot, severe crowding, open bite, asymmetric Class III malocclusion, mini-screw

Introduction

Camouflaged orthodontic treatment are often requested by adult patients whose conditions indicate orthognathic surgery but prefer non-surgical treatment. The case report presents a conservative lingual orthodontic treatment for a skeletal open bite malocclusion with severe crowding. Satisfactory results were achieved after 27 months of treatment.

Diagnosis

A 19-year-8-month old man presented with severe crowding and anterior open bite. This case was given a nickname, **Shark**, because of his crooked teeth. The medical history revealed the patient had allergic rhinitis combined with mouth breathing and tongue thrusting habits.

Pretreatment photographs indicate a slight mandibular shift to the left side and a straight profile (*Fig. 1*). When the patient smiled, the low position of the tongue and severe anterior open bite were observed. The intra-oral examination showed the molar relationship was Class III on the right side and Class II with crossbite on the left side. The overbite was -7mm and the overjet was +3mm. In the upper arch, diastema, severe anterior crowding with lateral incisors displaced lingually were noted. Upper left and right third molars had

Kyoto Takemoto,

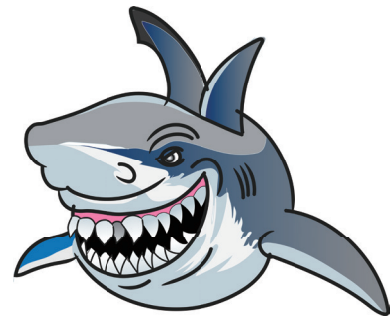
Director, E-Line Orthodontic Clinic in Tokyo, Japan (Left)

Yui Takemoto,

Lingual specialist, E-Line Orthodontic Clinic in Tokyo, Japan (Center)

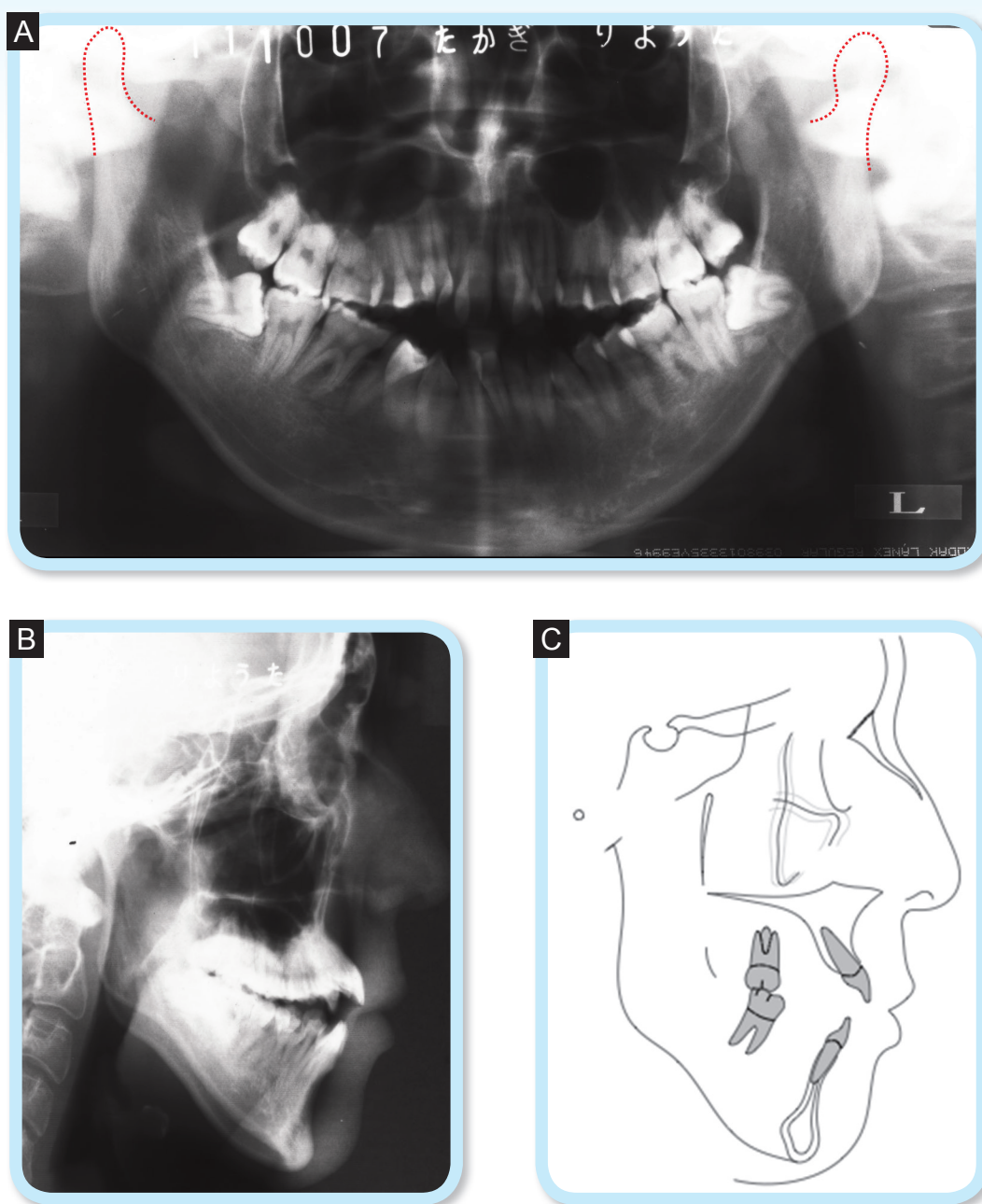
Aya Takemoto,

Lingual specialist, E-Line Orthodontic Clinic in Tokyo, Japan (Right)



■ Fig. 1:

Pre-treatment facial photographs indicate a slight mandibular shift to the left side and a straight profile. Intra-oral photographs show a Class III/II asymmetric malocclusion complicated by severe crowding, diastema, anterior open bite, lingually ectopic eruption of the maxillary lateral incisors. This case was nicknamed as **Shark**.



■ Fig. 2: Pre-treatment radiographs and tracing:
A. panoramic radiograph
B. lateral cephalogram
C. cephalometric tracing

erupted with buccal tipping conditions. In the lower arch, anterior and posterior crowding was observed. 2nd premolars was lingually-tipping, and 1st and 2nd molars were mesially-tilting (Fig. 1).

The upper arch length discrepancy was -13mm and -8mm for the lower arch. The upper arch was V-shaped while the lower was ovoid-shaped.

The panoramic x-ray (Fig. 2A) revealed upper third molars were erupted, but lower third molars were impacted. No abnormalities were observed in the roots or alveolar bone level. Condyle degeneration was observed bilaterally. The lateral cephalometric radiograph and tracing (Figs. 2B,C) indicated a skeletal Class I relationship ($SNA\ 77^\circ$, $SNB\ 75^\circ$, $ANB\ 2^\circ$) with a steep mandibular plane angle ($SN-MP\ 49^\circ$). The maxillary incisors were proclined ($U1-SN\ 114^\circ$) while the mandibular incisors were retroclined ($L1-MP\ 77^\circ$). The summary of cephalometric measurements was provided in Table 1.

Treatment Plan

Although severe skeletal open-bite and excessive crowding indicate orthognathic surgery as an ideal treatment option, the patient refused surgery and preferred camouflaged lingual orthodontic treatment instead.

Asymmetric extraction treatment with passive self-ligating (PSL) lingual fixed brackets and intruding mechanics were planned to close anterior open bite,

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	77°	77°	0°
SNB°	75°	76°	1°
ANB°	2°	1°	1°
$SN-MP^\circ$	49°	47°	2°
FMA°	40°	38°	2°
DENTAL ANALYSIS			
U1 TO NA mm	5 mm	3 mm	2 mm
$U1\ TO\ SN^\circ$	114°	104°	10°
L1 TO NB mm	3 mm	4 mm	1 mm
$L1\ TO\ MP^\circ$	77°	80°	3°
FACIAL ANALYSIS			
E-LINE UL	-2 mm	-2 mm	0 mm
E-LINE LL	1 mm	2 mm	1 mm

■ Table 1: Cephalometric summary

relieve anterior crowding and align the dentition. Intruding mechanics was consisted of a trans-palatal arch (TPA) and a 1.8x8mm mini-screw (*Induce MS-II*°, *ORTHOLY, Japan*). Upper left and right 1st premolars and lower right 1st premolar were planned to be extracted. In addition, extraction of upper and lower 3rd molars were scheduled before the start of orthodontic treatment.

In the manual setup of the final occlusion, right 1st molar was finished in the Class I occlusion, while left 1st molar was finished in the Class II relationship after inter-proximal reduction (IPR) therapy. Setup models were also used for the indirect bonding of the lingual brackets (Fig. 3).^{4,5}



■ Fig. 3: Manual setup for indirect bonding of lingual brackets. Note: The main archwire is straight without mushroom bends.

Treatment Progress

A TPA was attached, and a mini-screw (*Induce MS-II*®, 1.8x8mm, ORTHOLY, Japan) was inserted 1mm away from the mid-palatal suture to intrude the upper molars Fig 4.

In the 4th month of treatment, the TPA was removed. A full fixed, .018x.018" square slot, Alias® PSL lingual appliance (*Ormco, Glendora, CA*) was then bonded with an indirect bonding technique on both arches. Levelling was initiated by using .013" CuNiTi wires on both arches. To make space for upper central incisors, a NiTi coil spring was inserted between the upper lateral incisors (*Fig. 5*).

In the 6th month, a bracket was bonded on the upper right central incisor. On the lower arch, a .016x.016" CuNiTi wire was used to continue levelling.

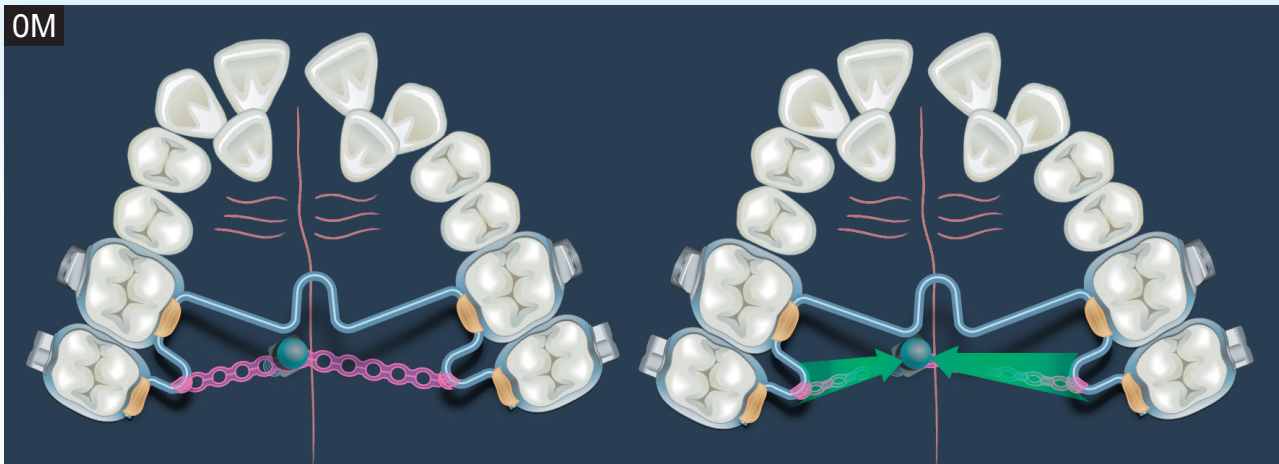
In the 8th month, a .016" CuNiTi wire was used on the upper arch Fig 6.

In the 11th month, a .016x.016" CuNiTi wire was used on the upper arch for continued levelling. A .018x.018" CuNiTi wire was used on the lower arch to start the establishment of torque.

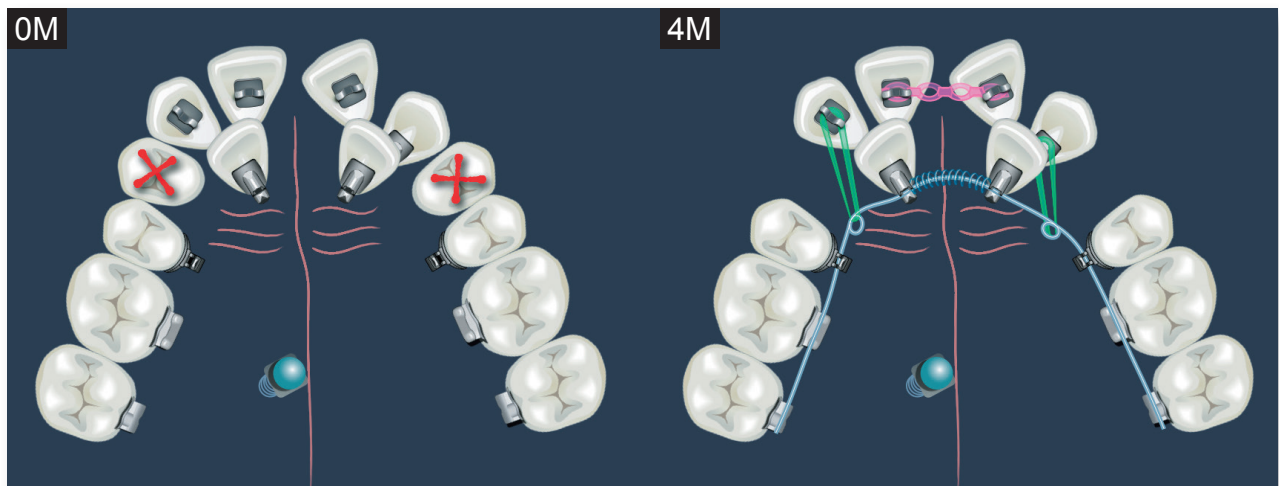
In the 14th month, .018x.018" stainless steel wires were used on the lower arches for space closure. Up and down elastics were started on the anterior segment.

In the 16th month, a .018x.018" CuNiTi wire was used on the upper arch to continue torque establishment.

In the 19th month, a .0175x.0175" TMA wire was used on the lower arch for detailing.



■ Fig. 4:
The drawing illustrates the intrusive forces generated by power chains applied from the molar bars of TPA to the mini-screw.



■ Fig. 5:
Left: The maxillary first premolars were extracted to relieve anterior crowding.
Right: A .013" CuNiTi wire was engaged in the maxillary arch. Power chains were used on two central incisors to close the diastema space. A NiTi coil spring was inserted between two lateral incisors to create space for central incisors. Two power chains were used from right and left maxillary canines respectively to the loops of the main archwire to distalize the canines.

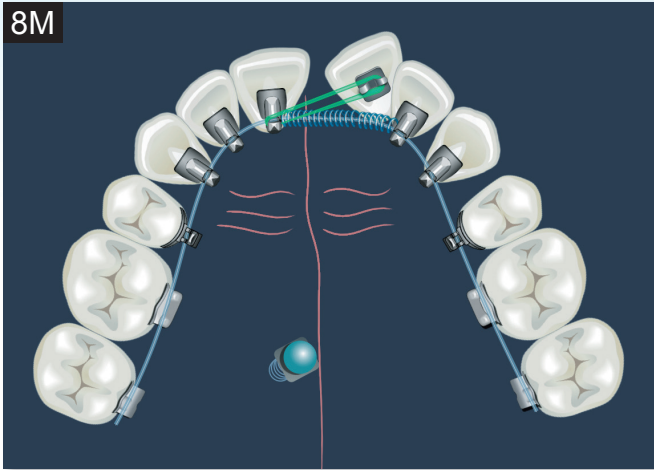


Fig. 6: .016 Cu-NiTi was engaged in the maxillary arch. A NiTi coil spring was inserted between right central incisor and left lateral incisor to keep the space for left central incisor. A power chain was hooked between two central incisors to align left central incisor.

In the 21st month, a .0175x.0175" TMA wire was used for detailing on the upper arch.

After 27 months of active treatment, all appliances were removed. Figs. 7, 8 included intra-oral photographs documenting the entire treatment sequence.

Retention

Clear retainers were delivered on both arches initially after debonding. 6 months later, clear retainers were replaced by a QCM (Quick-Change-Methods) retainer on the upper arch and a spring retainer on the lower arch.

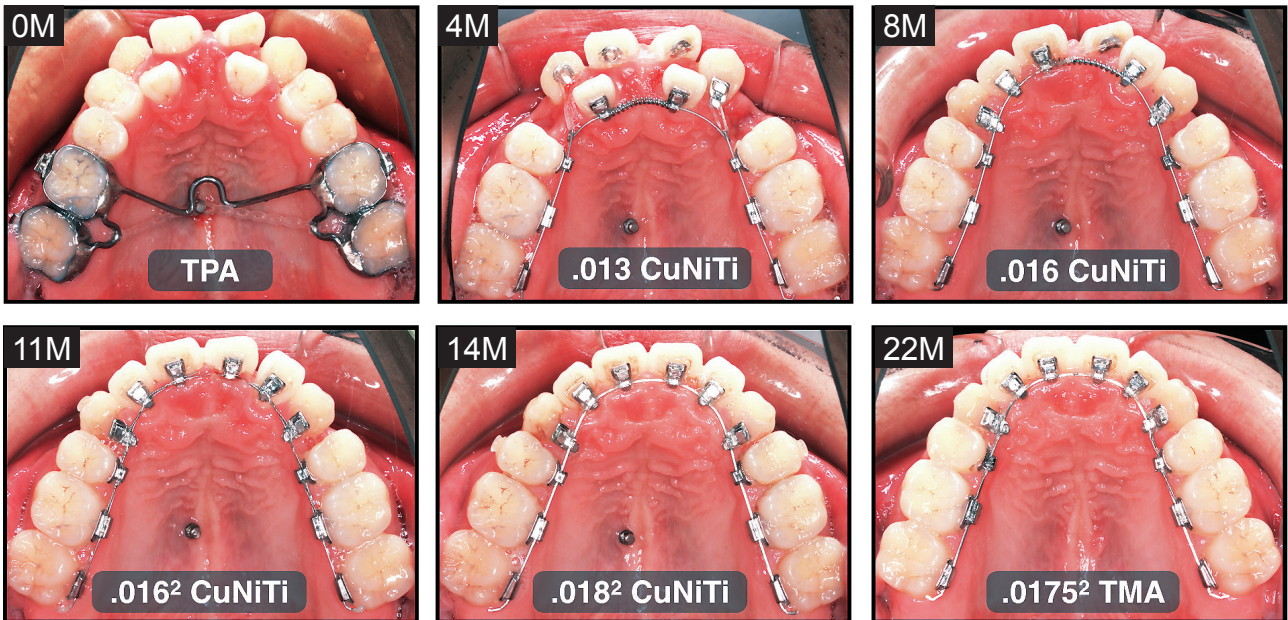
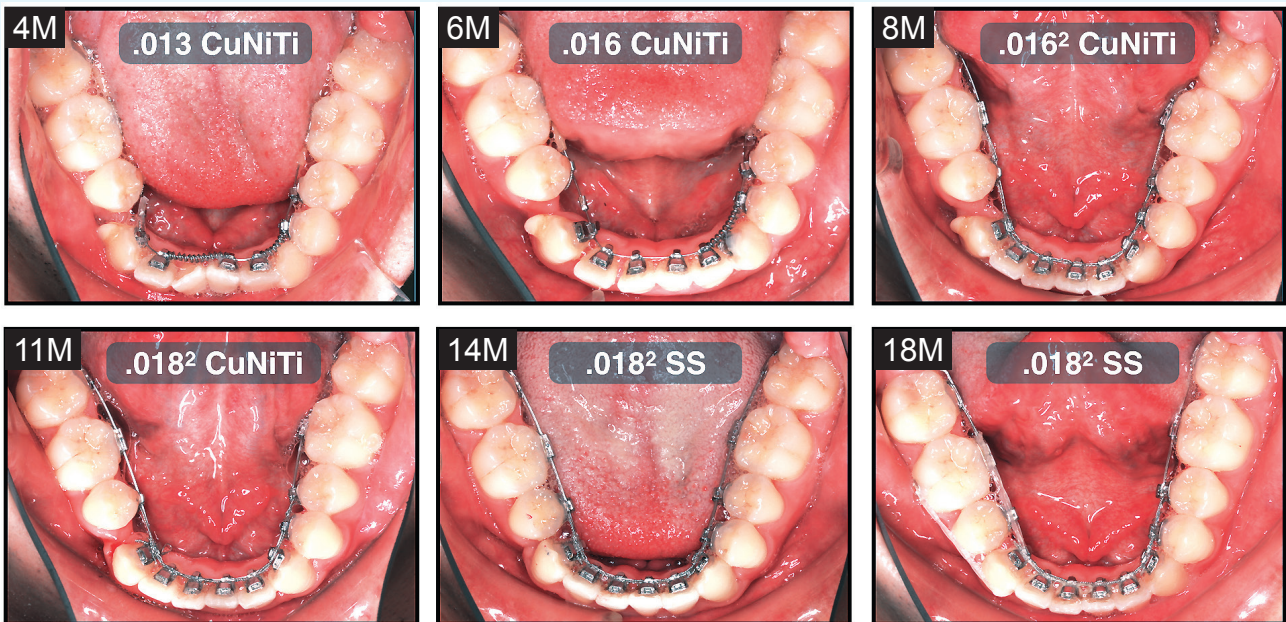


Fig. 7: The maxillary occlusal view of the treatment sequence (upper left to lower right). The appliance or archwire is shown in the black box in the lower center of each photograph.



■ Fig. 8:

The mandibular occlusal view of the treatment sequences (upper left to lower right). The archwire is indicated in the black box in the upper center of each photograph.

Treatment Results

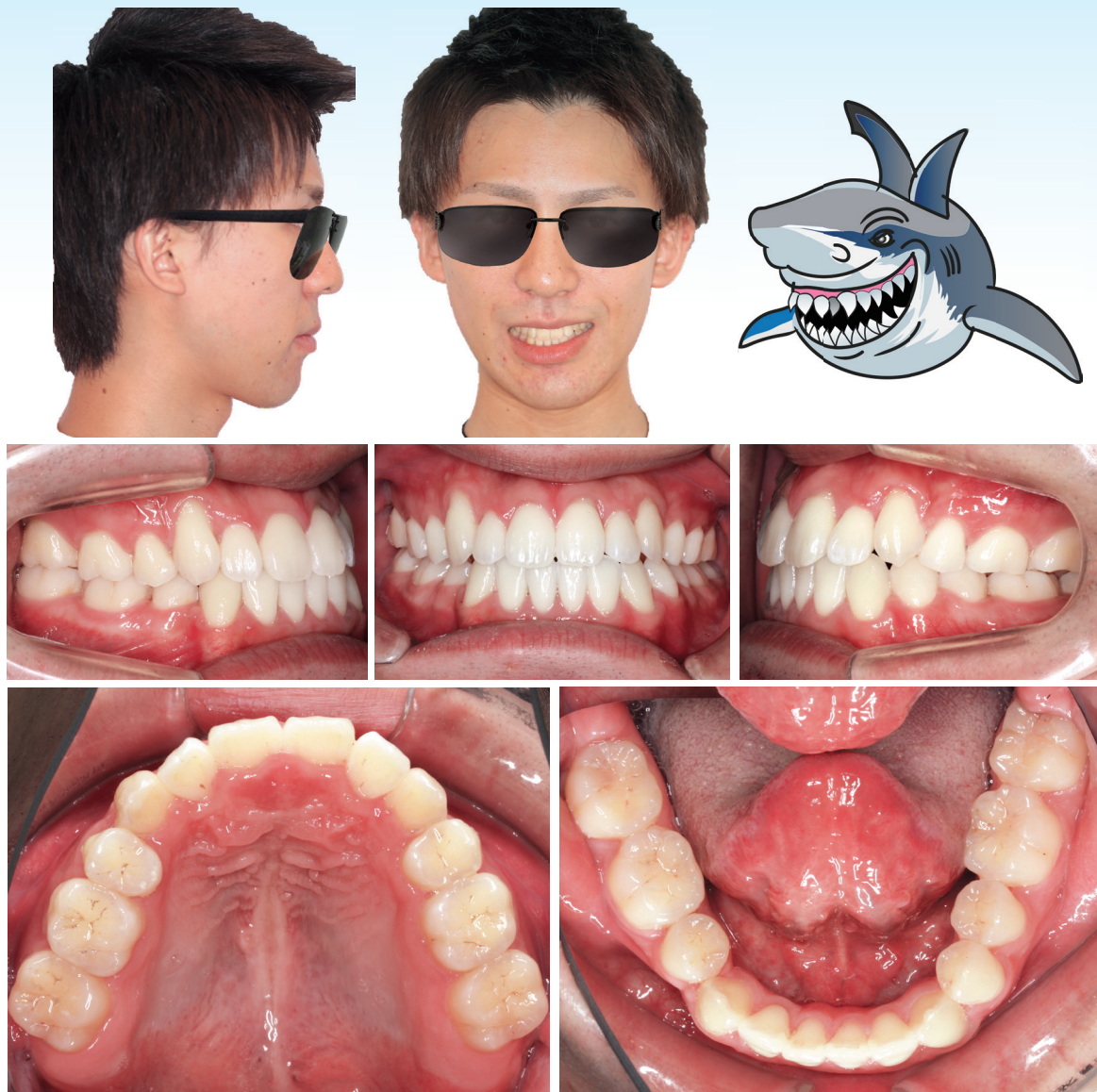
Dramatic improvement in alignment and occlusal functions can be observed in the extra-oral and intra-oral photographs (Fig. 9). Further post-treatment documentation is provided with a post-treatment radiograph, cephalometric tracing (Fig. 10) and a summary of cephalometric measurements (Table 1). Superimposed tracings (Fig. 11) indicate no skeletal growth. The mandible has been counter-clockwise rotated. The maxillary incisors have been retracted, extruded and uprighted. The mandibular incisors have been protruded, extruded and flared. The overjet has been improved from 6mm to 0mm, and overbite has been improved from -7mm to 3mm. The lower lip has been protruded.

Satisfactory results were achieved with a Class II

relationship on the left, and a Class I occlusion on the right. Both upper and lower midlines coincide (Fig. 9).

Discussion

Severe crowding and anterior open bite commonly indicates surgical treatment. However, when conservative camouflaged orthodontic treatment was requested, applying intrusive forces to posterior teeth and planned extractions with a PSL appliance are possible options to close open bite, relieve crowding and align the dentitions. In this case as the mandible was rotated backwards and downward by the intruding mechanics from TPA and miniscrews, lingual orthodontic treatment could then further relieve the crowding and achieve alignment. The

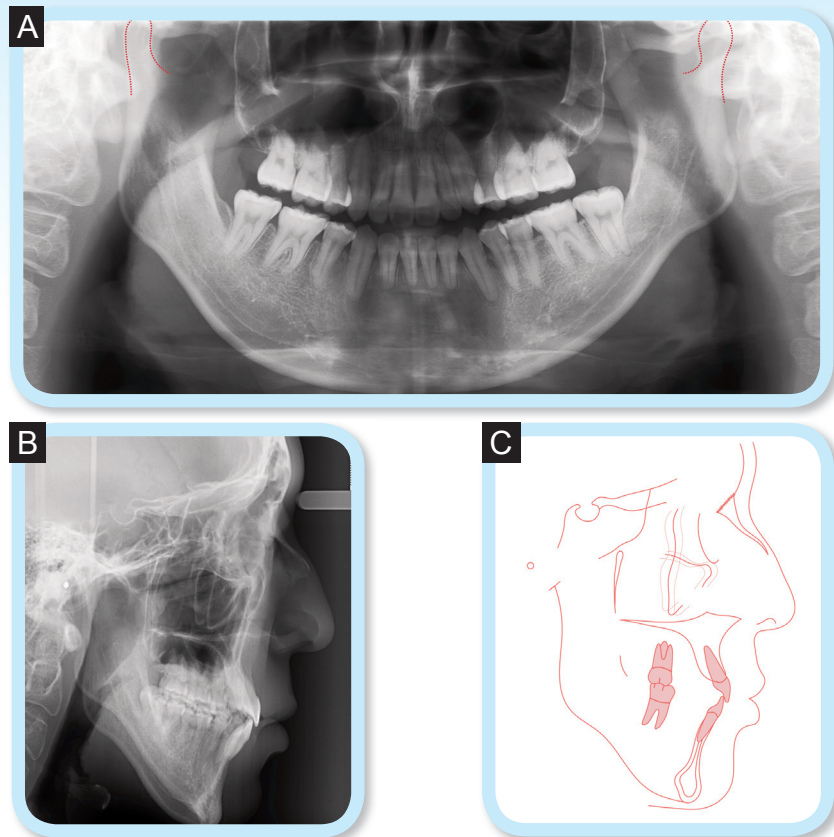


■ Fig. 9:

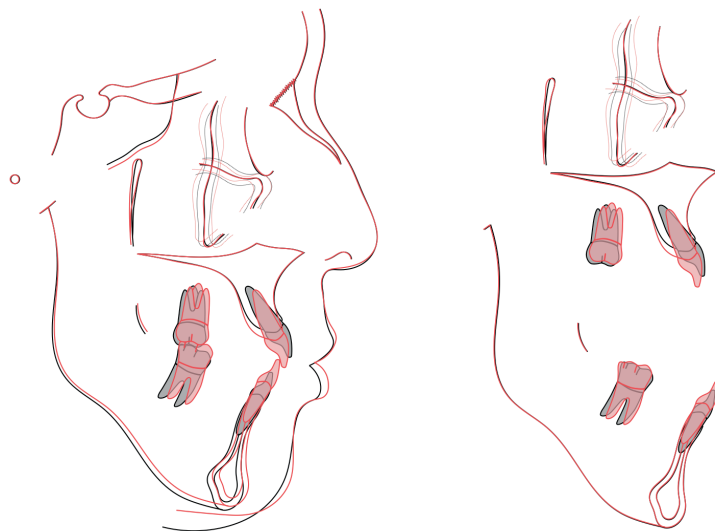
Post-treatment facial and intra-oral photographs show satisfactory results were achieved with a Class II relationship on the left, and a Class I occlusion on the right. Both upper and lower midlines coincide.

intruding mechanics were consisted by connecting both left and right maxillary molars with a TPA and molar bars. Furthermore a power chain was attached from the molar bars to a mini-screw, placed 1mm away from the mid-palatal suture to intrude the maxillary molars. By superimposition, the maxillary molars were impacted by 1.5mm (Fig. 11). As the maxillary molars were intruded and moved mesially, the mandible was slightly rotated in a counter-clockwise direction. Up and down elastics were used to help increase the depth of the anterior bite.

Due to the lower midline shift to the left, a Class II molar relationship was found on the left side. Asymmetric extraction by extracting the maxillary left and right premolars and the mandibular right premolar only was



■ Fig. 10: Post-treatment radiographs and tracing: A, panoramic radiograph B, lateral cephalogram C, cephalometric tracing



■ Fig. 11:

Cephalometric tracing documents the dental and skeletal changes during treatment. The pre-treatment (black) and post-treatment (red) are superimposed on the anterior cranial base (left), and on the stable landmarks of the maxilla (upper right), and mandible (lower right). The mandible has been counter-clockwise rotated. The maxillary incisors have been retracted, extruded and uprighted. The mandibular incisors have been protruded, extruded and flared.

planned, and left side class II finish was intentionally designed for midline-correction and mandible shift.

From the computed tomography (CT) view (Fig. 12), the maxillary left sinus was large, and the canine root was hitting the cortical bone, making distal root tipping difficult to achieve. It was decided to keep the maxillary left canine root mesially inclined.

Lingual orthodontic treatment has been considered one of the more aesthetic treatment options. However, a major drawback, that the ligation is often complex, time consuming and technique sensitive, has deterred many clinicians. Furthermore the difficulty in controlling rotation and torque of teeth and irritation are common critiques of lingual treatment.

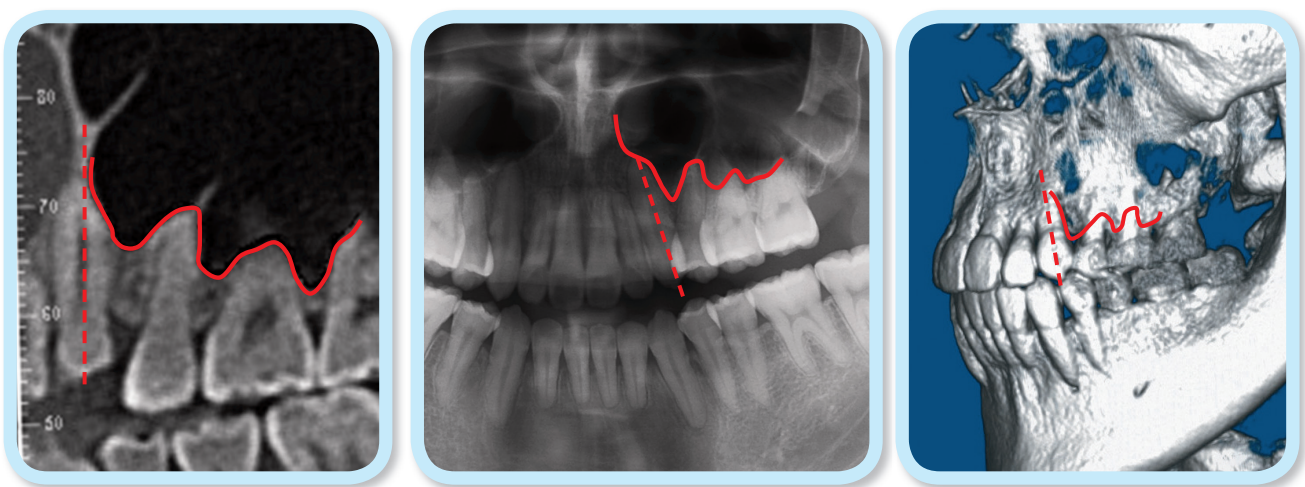
The indirect bonding technique and a smaller bracket profile make the operation more efficient and easier to maneuver and increase patient comfort.

In addition, this new straight wire PSL system allows for full-size engagement of high-tech, soft, fine wires which can provide lighter forces than traditional rectangular slot brackets, due to its smaller bracket profile and square slot design. These features also indicate less play between the slot and wire and more precise tooth control (Fig. 13).¹⁻³

Mushroom arch wires, typically used in conventional lingual orthodontic treatment, have been replaced by straight wires in recent years. In this lingual straight wire system, the operation is simplified and more consistent due to the elimination of complicated wire bending.^{4,5}

Conclusions

TPA and mini-screws are effective to intrude posterior molars and close anterior open bite. Planned asymmetric extractions can relieve severe crowding while preventing further mandibular shift



■ Fig. 12:

The maxillary left canine was left distally inclined. However the CT indicates the maxillary left sinus was large, and the tooth root hit the cortical bone. Therefore, tooth root control was deemed impossible.



■ Fig. 13:

The .018x.018" slot PSL bracket has less play between the slot and the wire. The force of the wire can be applied more precisely, and tooth control can be performed with appropriate orthodontic forces.

to one side and achieve satisfactory camouflaged treatment results. Conventional lingual orthodontic treatment is often critiqued as uncomfortable, time consuming and skill sensitive. However, this new PSL lingual bracket's smaller profile and square slot can increase patient comfort and minimise friction. Full size engagement of archwires provides precise control of rotation and torque and improve efficiency. The straight wire feature, furthermore, makes the operation easier to manage due to the elimination of complicated wire bending.

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Illustrated by Dr. Rungsi Thavarungkul