Class II Crowded Malocclusion Treated Conservatively with a Passive Self Ligating Appliance: Expansion, Stability and Adaptation

Abstract

A 10-year-old female presented with a retrusive mandible (SNB 76°), Class I molars and Class II canines due to the delayed eruption of the maxillary second premolars. There was 7mm overjet, 5mm overbite, 7mm of lower arch crowding, steep mandibular plane angle (FMA 32°), and increased axial inclination of the lower incisors to the mandibular plane (102°). The Discrepancy Index (DI) was 21. Despite the indication for extraction of premolars, the patient and her parents preferred conservative (noninvasive) treatment with a simple, fixed appliance. The revised treatment plan was to open the bite with posterior bite turbos on lower first molars, expand the arches with a passive self-ligating (PSL) appliance, and correct the sagittal discrepancy with Class II elastics. During 30 months of active treatment there was an unfavorable vertical growth response, resulting in a posterior rotation of the mandible, which was associated with less natural development of arch length. Thus, increased expansion was required to resolve crowding and produce an excellent alignment, documented by a cast-radiograph evaluation (CRE) of 20, with a Pink & White dental esthetics score of 4. Despite the desirable result, there were stability concerns because the lower and upper canines, as well as the molars, were expanded 3-5 and 11-12mm, respectively. Both arches were retained with 3-3 fixed retainers, bonded to each tooth, and overlay appliances. The pleasing result was stable 6 years later indicating that arch expansion to correct crowding is a viable option if there is a commitment to permanent retention. (Int J Orthod Implantol 2017;46:20-37)

Key words:

Arch expansion, posterior and anterior bite turbos, lower facial height, inter-canine and inter-molar widths, fixed retention, passive self-ligating brackets, vertical facial growth, Class II elastics

History and Etiology

A 10yr female presented with her parents for orthodontic consultation. The chief complaint was excessive overjet. Facial evaluation showed a convex profile, hypermentalis activity, 5mm of lip incompetence, and a retrusive mandible (*Fig. 1*). Intra-oral examination revealed retained maxillary primary second molars, relatively narrow arches, and an 7mm overjet (*Fig. 2*). Except for the Class I molars, due to the retained maxillary deciduous molars, the casts were consistent with an end-on Class II, division 1 malocclusion (*Fig. 3*). There was no additional contributing medical or dental history. Conservative orthodontic treatment produced an excellent alignment and a pleasing smile (*Figs. 4-6*). Panoramic and cephalometric radiographs before and after treatment are shown in Figs. 7 and 8, respectively. Fig. 9 documents the dentofacial treatment and the unfavorable vertical growth response with superimposed cephalometric tracings. Cephalometric measurements are presented in Table 1.

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Fig. 1: Pre-treatment facial photographs, 10yr female

Fig. 4: Post-treatment facial photographs, after 30 months of active treatment

Fig. 2: Pre-treatment intraoral photographs

Fig. 5: Post-treatment intraoral photographs

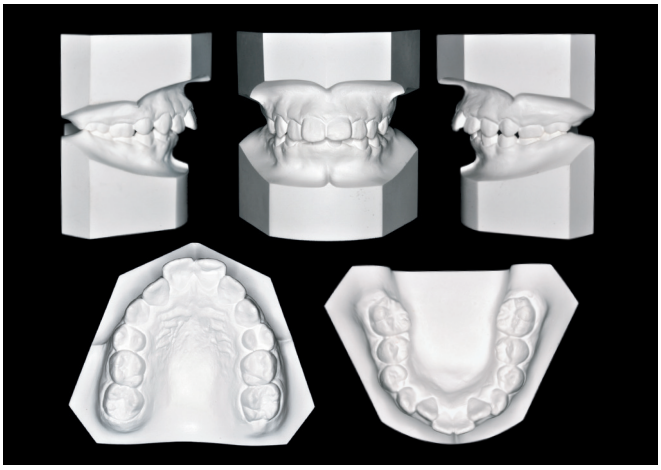


Fig. 3: Pre-treatment study models

Fig. 6: Post-treatment study models

Fig. 7:
Pre-treatment cephalometric and panoramic radiographs document the original dentofacial morphology. The panoramic film reveals that the upper second premolars are erupting.

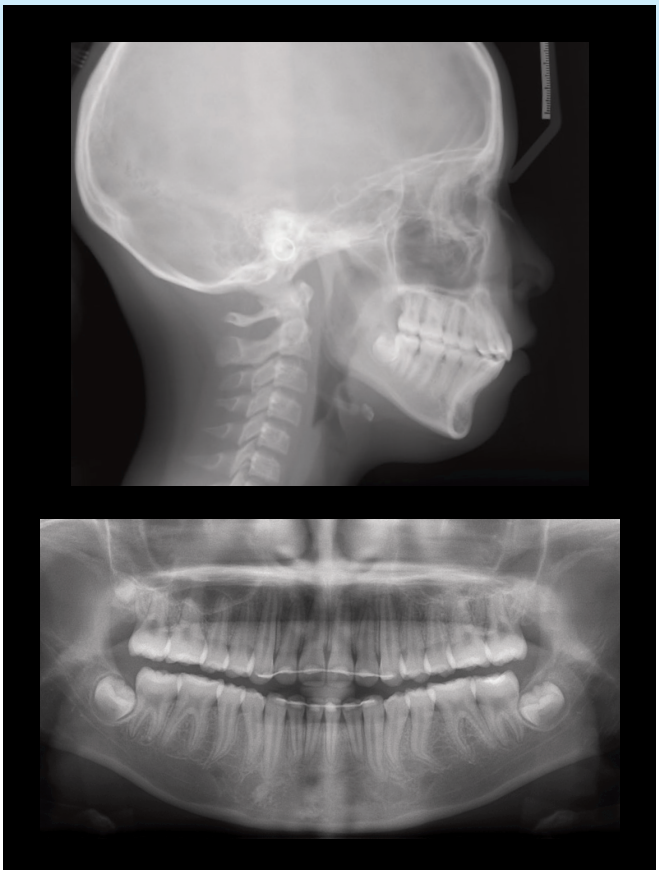


Fig. 8:
Post-treatment cephalometric and panoramic radiographs reveal the dentofacial morphology immediately after fixed appliances are removed.

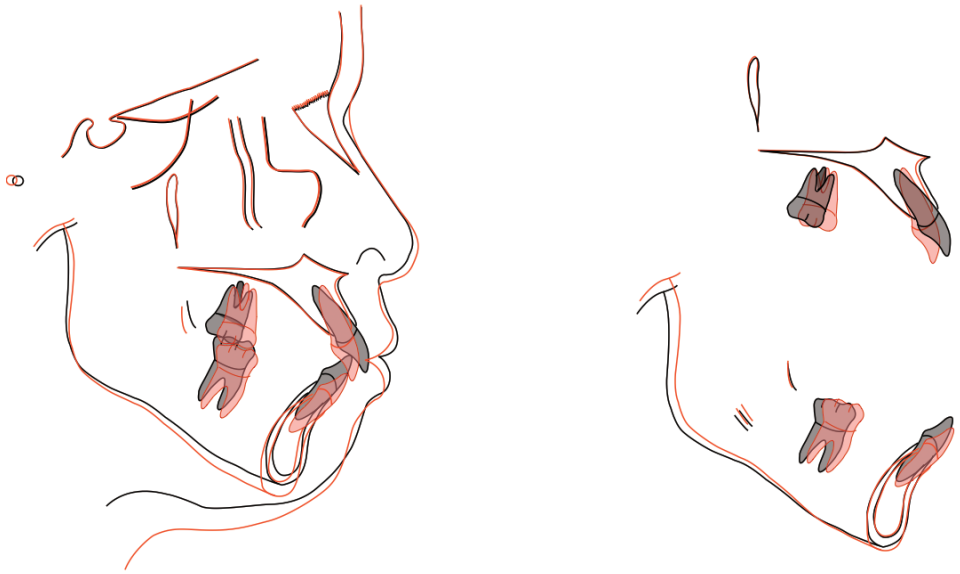


Fig.
Pre- and post-treatment cephalometric tracings are superimposed on the anterior cranial base (left), the maxilla (upper right), and the stable internal structures of the mandible (lower right). Principal changes during treatment were posterior rotation of the mandible, retraction of the maxillary incisors, and decreased lip protrusion. Note the unfavorable vertical growth response does not appear to be associated with excessive lower molar extrusion, due to the Class II elastics.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	81°	80°	1°
SNB° (80°)	77°	76°	1°
ANB° (2°)	4°	4°	0°
SN-MP° (32°)	40°	42°	2°
FMA° (25°)	32°	34°	2°
DENTAL ANALYSIS			
U1 TO NA mm *(4 mm)*	5 mm	2 mm	3 mm
U1 TO SN° (110°)	107°	99°	8°
L1 TO NB mm *(4 mm)*	10 mm	9 mm	1 mm
L1 TO MP° (90°)	102°	102°	0°
FACIAL ANALYSIS			
E-LINE UL *(2-3 mm)*	4 mm	1 mm	3 mm
E-LINE LL *(1-2 mm)*	5 mm	3 mm	2 mm
Convexity: G-Sn-Pg' *(13°)*	53.5%	55%	1.5
%FH: Na-ANS-Gn (53%)	13°	16°	3

Table 1: Cephalometric summary

Diagnosis

Skeletal:

- Retrusive mandible (*SNA 81˚, SNB 77˚, ANB 4˚*)
- High mandibular plane angle (*SN-MP 40˚, FMA 32˚*)

Dental:

- Class II canine bilaterally (*Class II molar is expected when upper 2nd premolars erupt*)
- Excessive overjet: *7mm*
- Deep overbite: *5mm*
- Moderate crowding in the upper and lower arches: *4 and 7mm respectively*

Facial:

- Convex profile with protrusive lips to the A-Pg' line
- Mentalis strain

The ABO Discrepancy Index (*DI*) was 21 as shown in the subsequent worksheet.

Specific Objectives of Treatment

Maxilla (*all three planes*):

- A - P: *Maintain*
- Vertical: *Maintain*
- Transverse: *Expand to correct crowding and occlude with the lower arch*

Mandible (*all three planes*):

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

Maxillary Dentition

- A - P: *Retract the maxillary anterior segment*
- Vertical: *Maintain*
- Inter-molar / Inter-canine Width: *Expand to occlude with expanded lower dentition*

Mandibular Dentition

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

Facial Esthetics: Retract protrusive lips

Treatment Plan

The initial treatment plan was to extract upper first and lower second premolars (*Fig. 10*), and use infrazygomatic crest miniscrews as anchorage to correct the large overjet (*Fig. 11*) as needed. However, the parents refused to have any teeth removed except the remaining primary teeth, and also declined the use of miniscrews. A conservative, non-extraction approach without any temporary anchorage devices was formulated to open the bite with bite turbos, expand the arches with a PSL appliance, and correct the overjet with Class II elastics. The parents and patient were warned that an ideal result with the conservative treatment plan they desired was dependent of a favorable (*forward*) growth response of the mandible. An unfavorable (*vertical*) growth response may result in opening the bite and excessive expansion of the arches, requiring permanent retention. They accepted these limitations and treatment proceeded.

Fig. 10:
The original treatment plan was to extract upper first premolars and lower second premolars. However, the parents desired nonextraction, conservative treatment without miniscrews.

Appliances and Treatment Progress

An 0.022-in slot passive self-ligating (*PSL*) bracket system (*Damon D3MX®, Ormco, Glendora, CA*) was bonded on the lower arch with standard torque brackets in the anterior segment. Bite turbos were constructed by bonding light cured glass ionomer cement on the occlusal surface on both mandibular first molars. The bite was opened ~3mm at the incisors to prevent occlusal contact with brackets. The initial archwire was 0.014-in CuNiTi fitted with resin balls that were bonded on the ends of the archwires to avoid mucosal irritation. The patient was then scheduled to have the upper primary second molars extracted to facilitate the eruption of the permanent second premolars.

Fig. 11:
An inferior view of the large overjet shows that it was ~7mm.

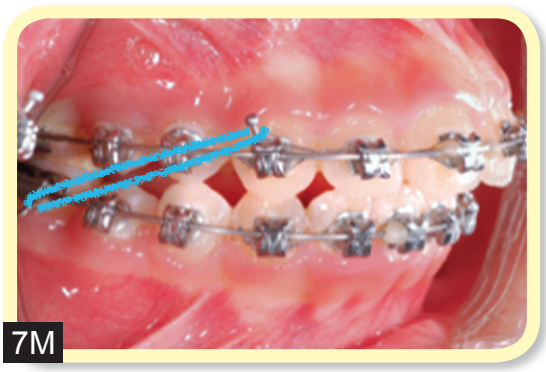
In the 4th month of active treatment, the maxillary permanent second premolars were erupted and the upper arch was bonded using standard torque brackets in the anterior segment. The initial archwire was 0.014-in CuNiTi, with resin balls light cured on the ends of the wire. The lower archwire was changed to 0.014x0.025-in CuNiTi with an expanded arch form to correct crowding (*Fig. 12*).

Three months later, both archwires were changed to 0.017x0.025-in TMA and the anterior segments were ligated with stainless steel in a figure-eight pattern, to maintain firm contact. Two drop-in hooks were fitted into the vertical slots of the maxillary canines for Class II elastics (*Fox 1/4", 3.5-oz*) to correct the sagittal discrepancy as the arches were expanding (*Fig. 13*).

■ *Fig. 12:*
PSL brackets were bonded on the upper arch after the permanent second premolars eruption. The lower arch was previously under treatment for 4 months with an 0.014-in CuNiTi wire and bite turbos on the first molars (below). At this appointment upper 0.014-in and expanded lower 0.014x0.025-in CuNiTi archwires were placed.

In the 15th month, an upper 0.019x0.025-in stainless steel archwire was placed with vertical hooks mesial to the canines, to continue the Class II elastics (*Fox 1/4", 3.5-oz*). Two months later, both mandibular second molars erupted with a lingual inclination. Each second molar was bonded with a buccal bracket and two lingual buttons, and a 0.016-in CuNiT lower archwire was placed, that extended to the tubes of the second molars. The height of the bite turbos on the lower first molars was increased to accommodate posterior cross elastics (*Chipmunk 1/8", 3.5-oz*), which were applied from the buccal hooks of the upper first molars to the lingual buttons of the lower second molars (*Fig. 14*). After one month, the lingually tipped mandibular second molars were corrected, so the bite turbos were removed and a 0.014x0.025-in CuNiTi lower archwire was placed.

In the 21st month of treatment, the maxillary second molars erupted. They were bonded and



■ *Fig. 13:*
Light short Class II elastics (3.5-oz) were applied from the maxillary canine to the mandibular first molar.

Fig.14:
Posterior cross elastics (Chipmunk ⅛", 3.5-oz) which were activated from the buccal hooks of the upper first molars to the lingual buttons of the lower second molars.

Fig.15:
Class II elastics (Fox ¼", 3.5-oz) were supplemented with bilateral triangular elastics: maxillary central incisor and canine and mandibular canine.

a 0.014x0.025-in CuNiTi lower archwire was engaged for the entire upper arch. In the 24th month, additional bite turbos were placed on the palatal surface of the maxillary central incisors to help correct the deep bite. Both archwires were replaced with 0.017x0.025-in TMA. Additional drop-in hooks were inserted into the vertical slots of the maxillary central incisors and mandibular canines to accommodate bilateral triangular elastics (*Fox 1/4", 3.5-oz*): maxillary central incisor and canine to the mandibular canine (*Fig. 15*).

The progression of the arch expansion (*development*) process from 1-24 months is shown in Fig. 16. In the last month of active treatment, up and down (*vertical*) elastics (*Ostrich 3/4", 2-oz*) were used to improve occlusal contacts. After 30 months of active treatment, all fixed appliances were removed (*Table 2 & Fig. 17*).

Results Achieved

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

- A - P : *Decreased*
- Vertical : *Increased with posterior rotation*
- Transverse : *Maintained*

Maxillary Dentition

- A - P : *Maxillary anterior segment was retracted*
- Vertical : *Extruded slightly*
- Inter-molar and Inter-canine Width : *Expanded*

Mandibular Dentition

- A - P : *Maintained*
- Vertical : *Extruded slighlty*
- Inter-molar and Inter-canine Width : *Expanded*

Facial Esthetics : Protrusive lips retracted

Superimpositions: The upper incisors and the protrusive lips were retracted.

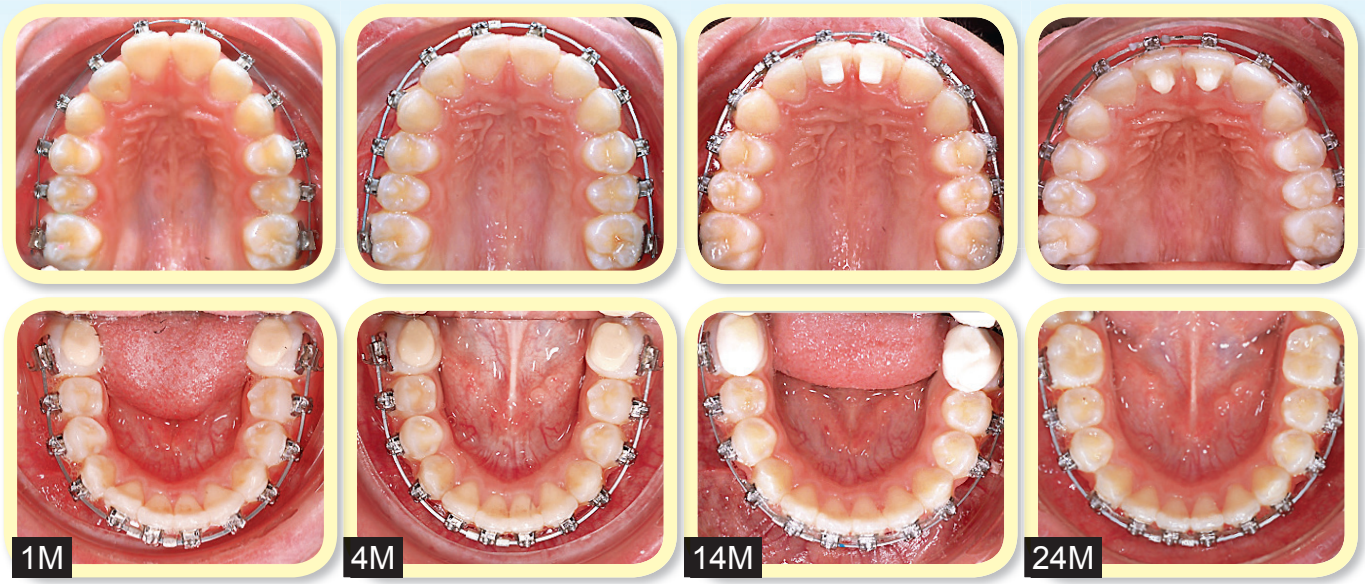


Fig. 16:
The arch expansion process is shown at the following time intervals: 1, 4, 14 and 24 month(s). Note that at about 14m the negative influence of the poor growth response was becoming evident. Retraction of the upper incisors to correct the increasing overjet deepened the bite, requiring bite turbos and more Class II elastics. The side effects of these mechanics required more expansion to achieve ideal buccolingual alignment, as documented in the CRE score.

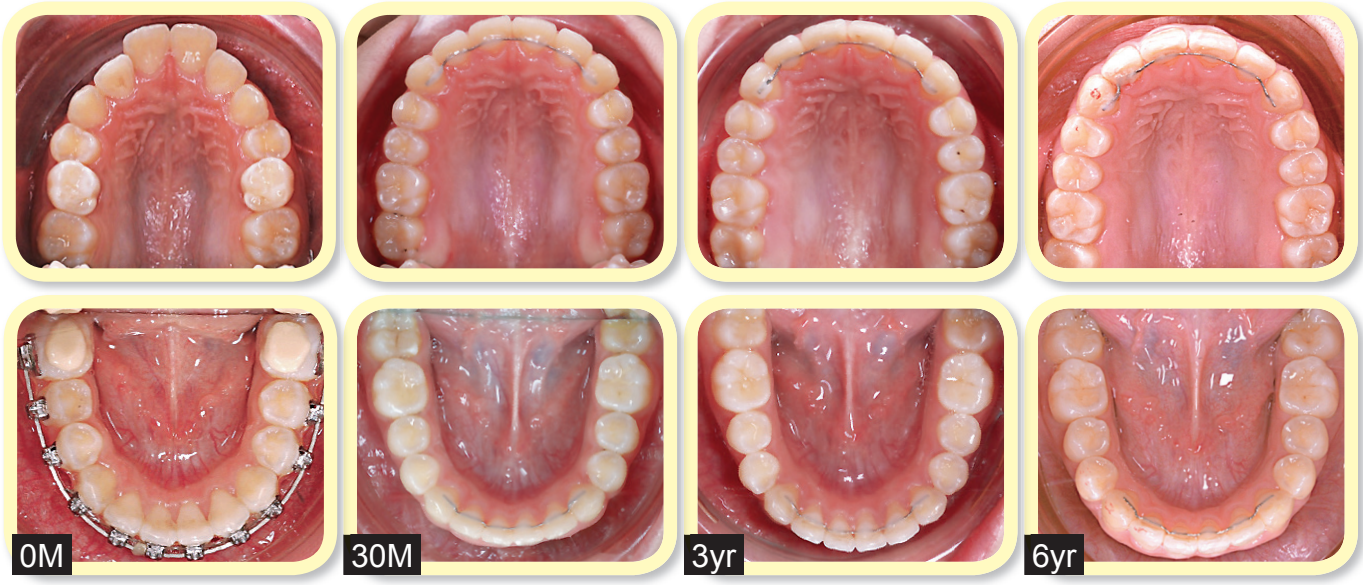


Fig. 17:
Occlusal views of the arch forms is shown immediately prior to maxillary arch treatment (0m), but the lower arch had been in treatment for 4 months. The center images (30m) are arch forms at the end of active treatment and start of retention. Three and six years of post-treatment follow-up (3yr and 6yr) document the stability of the ovoid shaped arches.

Retention

Anterior fixed retainers were bonded on both arches from canine to canine (*3-3*). Removable clear overlay retainers were delivered for both arches, and the patient was instructed to wear them full time for the first 6 months and nights only thereafter.

Instructions were provided for home hygiene and maintenance of the retainers (*Fig. 17*).

Final Evaluation of Treatment

For this challenging malocclusion (*DI=21*), an ABO Cast-Radiograph Evaluation (*CRE*) score of 20 points was achieved, which indicates an excellent intermaxillary alignment. The major residual CRE discrepancy was slight overjet of the anterior teeth (*6 points*). Narrow arches (*Figs. 2 and 3*) were resolved by expanding the upper (*Fig. 18*) and lower dentition (*Fig. 19*). To correct crowding and achieve near ideal buccolingual relationships, it was necessary to expand both arches as documented in Figs. 18 and 19, as the Class II relationship and overjet were resolved (*Fig. 16*).

Discussion

As the parents requested, the treatment approach was a simple appliance that was noninvasive and required minimal cooperation. However, treatment outcomes were mixed. The dentition was well aligned (*CRE 20*) for this challenging malocclusion (*DI 21*), but the mandible rotated posteriorly, apparently due to the unfavorable growth response. If the opening of the mandibular plane angle were due to the effect of the Class II elastics, more lower molar extrusion would be expected than is documented in Fig. 9.

Bimaxillary arch expansion (*development*) was achieved from 10-12.5 years of age with light wires and PSL brackets (*Damon 3MX®*). Although there was a substantial increase maxillary and mandibular arch widths (*Figs. 18 and 19*), the result was the full, broad

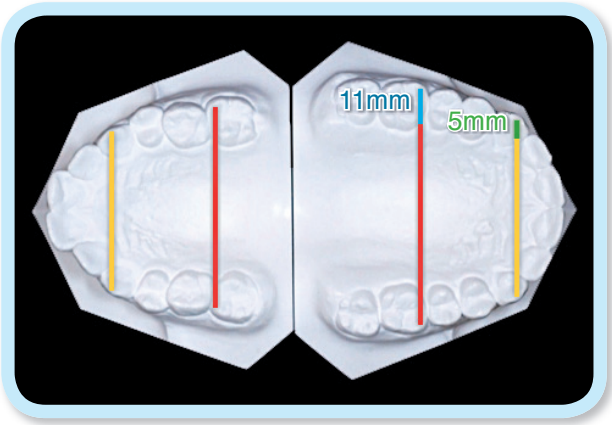


Fig. 18:
The pre-treatment maxillary arch form (left) is compared to the post-treatment result (right). The inter-canine width increased ~5mm (green line) and the inter-molar width increased ~11mm (blue line) at the mesiobuccal cusp.

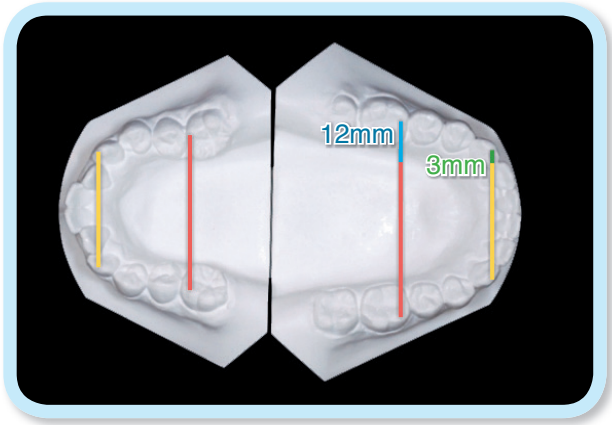


Fig. 19:
The pre-treatment mandibular arch form (left) is compared to the post-treatment result (right). The inter-canine width was increased ~3mm (green line) and the inter-molar width was increased ~12mm (blue line) at the mesiobuccal cusp.

smile which was the objective of the patient and her parents. They realized that it would be necessary to permanently retain both arches with 3-3 fixed and clear overlay retainers at night. Three years after the completion of treatment, the result is stable because it is well retained (*Fig. 17*). Is it possible for the facial musculoskeletal system of a preadolescent to adapt to this degree of expansion or is retention required indefinitely?

Although the arches were narrow at the onset (*Figs. 2 and 3*), resolving ~7mm of lower crowding resulted in 3mm of mandibular canine expansion, which is usually a stability concern. Regarding the stability of arch expansion, many studies have reported that there is a strong tendency for the arch to return to its original shape after appliances have been removed.[1,2] Lee and Kirschen[3] concluded that there is no evidence for longterm stability when the upper first molars are expanded more than 5mm. The results for current patient were quite stable after 3 years (*Fig. 17*), but the desired outcome was permanently retained. Previous stability studies[1-3] used retention for a limited period of time or not at all. It is not physiologically valid to compare stability between patients who are retained and not retained.

The important stability issues for extensive arch development (*expansion*) are the mechanism of expansion, retention, as well as the long-term satisfaction and cooperation of the patient, particularly if removable retainers are involved. The objectives of the patient and parents are important considerations, but all concerned must understand the consequences of their choices. Aligning teeth over the apical base of bone is the best choice for long-term stability if there is no commitment to permanent retention.[1-3] The degree of arch development shown in Figs. 9, 16-19 is the expectation for conservative alignment, when there are no extractions or interproximal enamel reduction (*IPR*). For the present patient (*Figs. 4-6*), the desired result is expected to be stable as long as the permanent retention scheme is maintained.

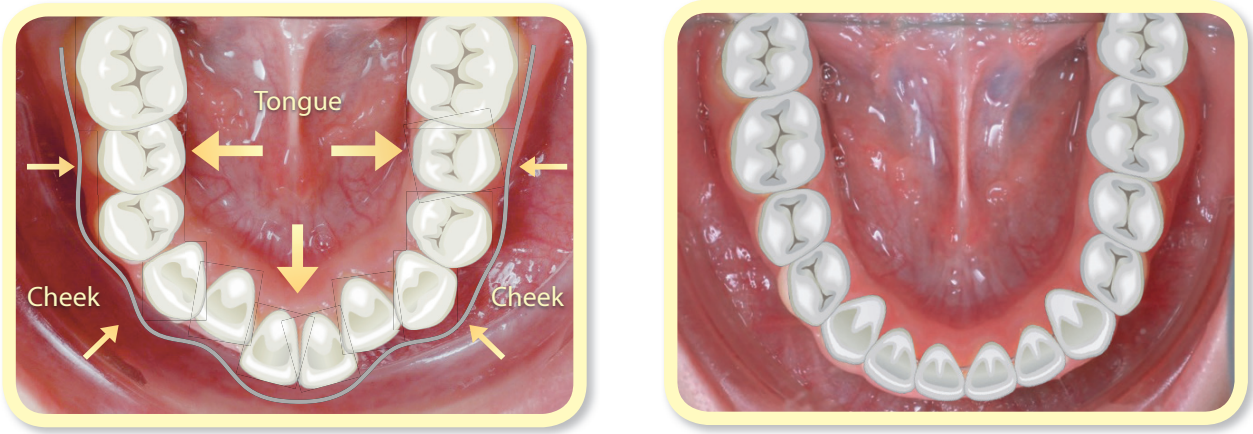


Fig. 20:
Damon[15,16] philosophy is summarized for arch expansion to correct crowding. Superelastic CuNiTi archwires in passive self-ligating brackets move teeth to the "position of least resistance." The arch expansion is viewed as "posterior transverse functional adaptation."

So from the initial consultation, it is very important that the patient and her parents understand that reality of their choice. It is possible over time that the facial musculoskeletal system (*tongue, lips and cheeks*) will adapt to the expanded arch form (*Fig. 20*), but that mechanism has not been established with randomized clinical trails.

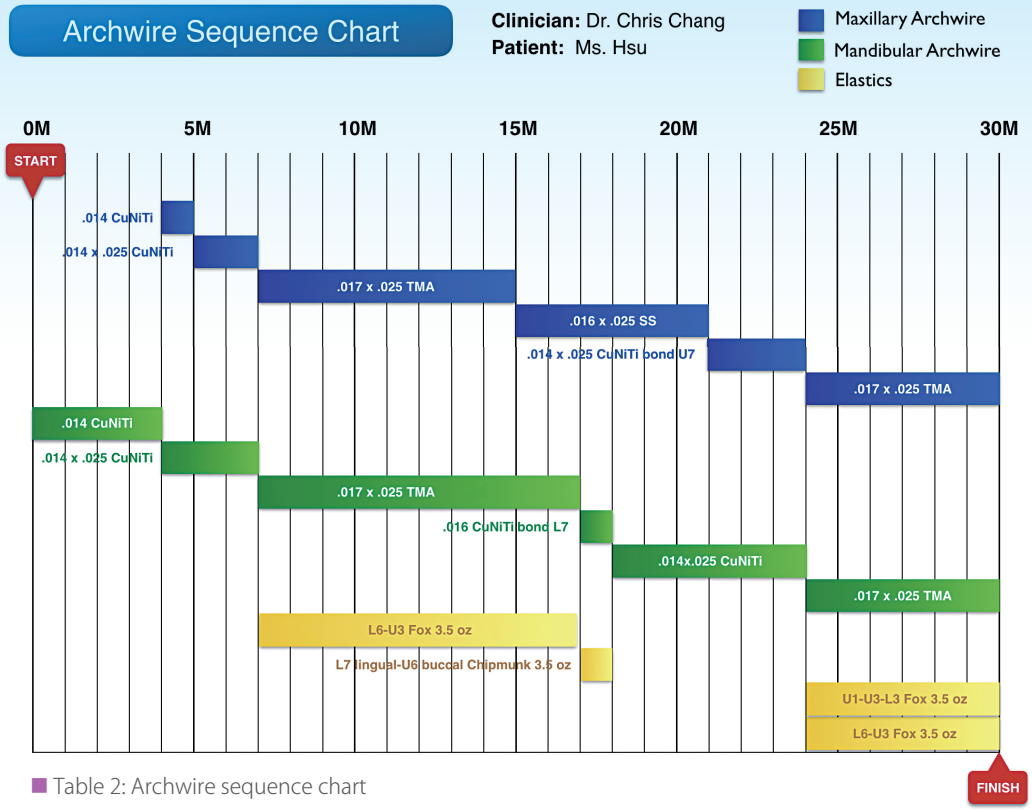
Arch expansion is only one of the nonextraction possibilities for delivering a pleasing smile. There are conservative treatment alternatives for correcting the malocclusion with little or no arch expansion. First, interproximal enamel reduction (*IPR*) is an excellent option because 0.25mm reduction of each approximating surface could have produced over 7mm of arch length in both arches. This is more than enough to allow ideal alignment with light wires in a PSL appliance, without producing any arch expansion. Even in the absence of arch expansion, a 3-3 fixed retainer bonded to all of the lower teeth is still indicated to prevent incisor crowding and arch collapse. However, a removable retainer such as a Hawley at night is all that would be needed to retain the upper arch. Avoiding fixed retention in the maxillary anterior region is advantageous because retainer debonding is common on the palatal surfaces of maxillary incisors. Second, retraction of the upper and/or lower molars to create arch length is readily accomplished with extra-alveolar (*E-A*) OrthoBoneScrews® (*OBS*) (*Newton's A Ltd., Hsinchu, Taiwan*). Seven millimeters of arch length can be easily achieved with OBS anchorage, particularly if there is IPR simultaneously. For the present patient, some expansion was indicated, but it was not necessary to expand to the degree shown in Fig. 18 to correct the crowding. Although IPR was an attractive alternative for treating the present patient, it is an invasive procedure which was undesirable to the patient and her parents. When marked arch expansion is the outcome, whether it was planned to or not, some degree of permanent retention is indicated.

Conventional Expansion Appliances

For the present patient, PSL brackets with light wires was an effective and relatively comfortable arch expansion appliance (*Figs. 16-19*). There are many different types of expansion appliances: Hyrax, Haas, bonded rapid palatal expander, Schwarz appliance, lingual arches, quadhelix, W arch, pendex (*pendulum*) appliance, lip bumper, and conventional fixed appliances with arch wires.[4] The rapid palatal or maxillary expanders (*RPE or RME*) have long been among the most popular expansion appliances. Table 3 compares some of the most popular expansion appliances.

Rapid Maxillary Expansion Appliances Compared to Light Wires with PSL Brackets

The most common undesirable effects of rapid expansion are pain and discomfort, from the time of activation up to several days later. The size of the appliance is uncomfortable and soft tissue impingement may result in irritation and/or ulceration. The most significant longterm complication is compromised periodontal health and gingival recession.[5,6] If rapid expansion is performed after the mid-palatal suture begins to fuse (*~14-16 years of age*), there may be a delayed risk of recession of the buccal gingival tissue in the maxillary buccal segments.[5] Garib[6] reported that RME exerts a high level of force (*up to 20-40 lb.*), reducing the buccal bone plate thickness from 0.6 to 0.9mm, and it may even result in dehiscence.



■ Table 2: Archwire sequence chart

	Upper/ Lower	Fixed/ Removable	Working method
Hyrax expander	Upper	Fixed	Activate the expansion screw (*One turn ~ 0.25mm/day*)
Haas expander	Upper	Fixed	Activate the expansion screw (*One turn ~ 0.7mm/day*)
Bonded rapid palatal expander	Upper	Fixed	Activate the expansion screw per day
Lower Schwarz appliance	Lower	Removable	Activate the expansion screw per week
Fixed mandibular expander	Lower	Fixed	Activate the expansion screw per week
Quadhelix	Upper	Fixed	Activate the helical loops by compressing it
W arch	Upper	Fixed	Activate by compressing it
Pendex	Upper	Fixed	Activate the helical loops of the appliance by compressing it
Lip bumper	Either	Fixed	By removing the buccal pressure

■ Table 3: The comparison of different arch expansion appliances.

	Light Force, Archwire Expansion	Rapid Maxillary Expansion
Appliances	Simple	Complicated
Force	Light continue	Heavy short (*20-40 lb*)
Compliance	No	Yes
Create diastema	No	Yes
Age limit	No	Yes, unpredictable suture splitting
Moving teeth with bone	Yes	No
Moving teeth though bone	No	Yes
Side effects	No	Thinning of buccal plate

■ Table 4: Light force, archwire vs. rapid maxillary expansion (Revision of Dr. John Lin's table).[8]

Expansion complications are rare when the arches are expanded with light wires in PSL brackets associated with minimal friction and binding (*Damon philosophy*).[7] Light lateral loads achieve substantial arch expansion without pain, discomfort and periodontal problems.[7,8] Lin[8] compared expansion philosophies and organized them into a table which has been modified for the current report (*Table 4*).

Arch Circumference Relative to Expansion

Many studies report a relationship between arch width increase and the creation of space to resolve crowding.[9-11] Intermolar expansion of 1mm creates ~0.6mm arch length space because the molars tend to drift mesially as the arches expand (*Fig. 9*), due to the pull of the supracrestal fibers. For the present patient, 11-12mm of expansion was necessary to create the necessary arch length to resolve ~7mm of crowding. However, infrazygomatic crest (*IZC*) bone screws were a viable option for preventing the mesial molar drift, that is a natural consequence of arch expansion (*Fig. 9*). Bone screws would help correct the crowding with less expansion, and reduce the overjet without as much tipping of the maxillary incisors. This option was not available for the present patient because her parents had rejected the use of miniscrews.

Longterm Stability of Arch Expansion

In 1969, Riedel[2] reviewed stability studies of arch form without retention, concluding that changes in inter-canine and inter-molar width during orthodontic treatment tend to return to their pre-treatment position. In 1988, Sandstrom et al.[12] observed that the average amount of increased lower inter-canine width was about 1.1mm and the inter-molar width was 2.9mm; these small changes result in a negligible increase in arch

length to correct crowding. Haas[13] studied the long-term outcomes of RME and reported a few cases with an increase in inter-canine width of 3-4mm. The predictability of the latter result is unclear, particularly for archwire expansion.

In contrast to expansion of the mid palatal suture (*RPE or RME*), numerous authors[7,8,15,16] have proposed that expansion with very light wires in PSL brackets results in a more physiologically determined tooth positions (*Fig. 20*). The present case study confirms that a major malocclusion (*DI=21*) can be treated to a very good functional (*CRE 20*) and esthetic (*P&W Esthetic Score 4*) result, that is stable for at least three years, with permanent retention: fixed 3-3 in both arches and clear overlay retainers at night. However, there are no longterm studies indicating that large increases in dental arch width, achieved with light wires and PSL brackets, are stable without retention.

Conclusion

A challenging malocclusion (*DI 21*), was treated non-invasively to an excellent alignment (*CRE 20*) with simple mechanics. Unfortunately there was an unfavorable (*vertical*) growth response and the mandible rotated posteriorly. Because of failure to grow anteriorly and develop arch length with natural expansion, it was necessary to over-expand the arches to conservatively correct the crowding. Patients may choose "*simple treatment*" options that produce good functional and esthetic results, but they should be informed of the potential for adverse outcomes, particularly with respect to unpredictable growth patterns and stability. Accepting the limitations for a desired course of treatment is an essential aspect of informed consent. The present patient and her parents were well pleased with both the treatment and the outcome.

Acknowledgement

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 21

OVERJET

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

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

Total = 4

OVERBITE

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

Total = 3

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 4

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° 2 x 2 pts. = 4

≤ 26° = 1 pt.

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

1 to MP ≥ 99° = (1 pt.)

Each degree > 99° 3 x 1 pt. = 3

Total = 10

OTHER (See Instructions)

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

Identify:

Total = 0

Cast-Radiograph Evaluation

Case # **Patient**

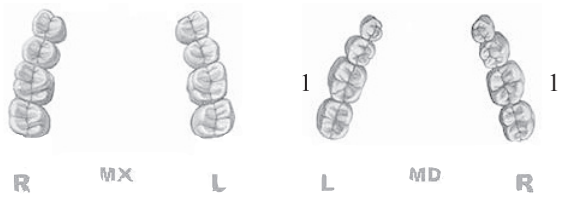
Total Score: 20

Alignment/Rotations

2

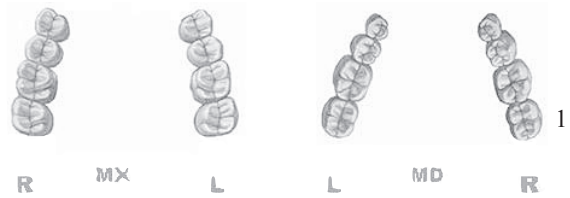
Marginal Ridges

2



Buccolingual Inclination

1

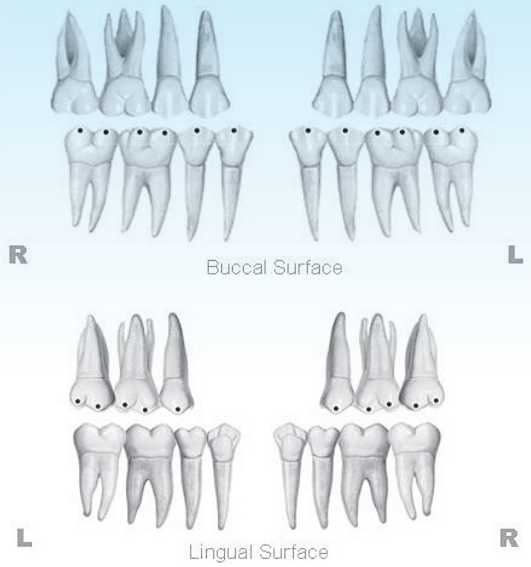


Overjet

6

Occlusal Contacts

0

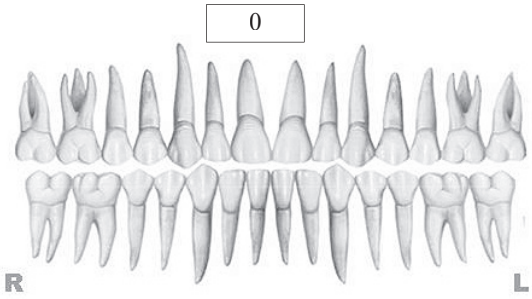


Occlusal Relationships

4

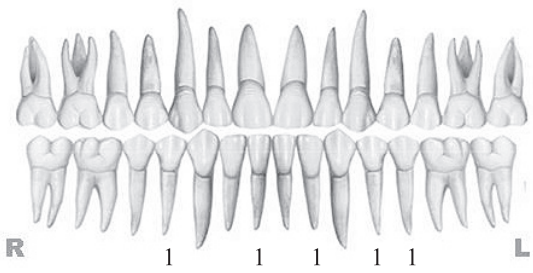
Interproximal Contacts

0



Root Angulation

5



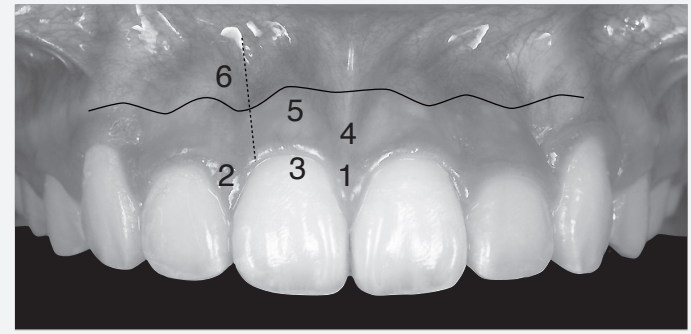
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score (Before Surgical Crown Lengthening)

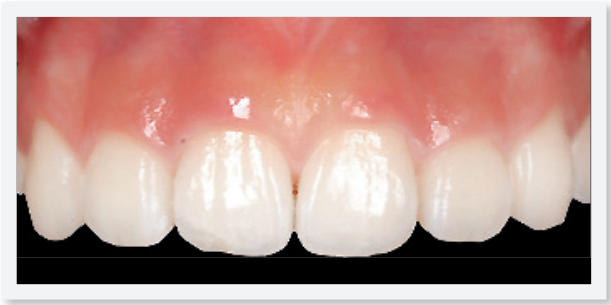
Total Score: = 4

1. Pink Esthetic Score

Total = 2



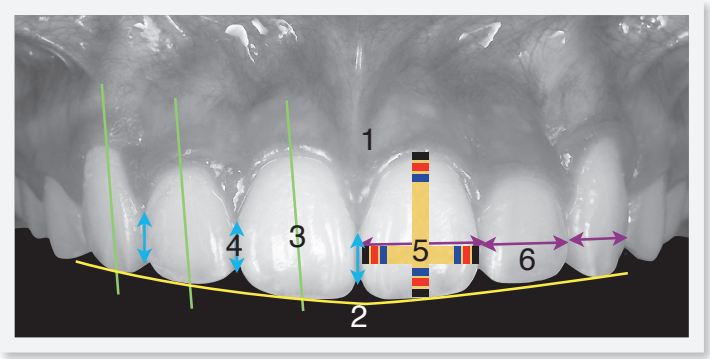
1. M & D Papilla	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2



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

2. White Esthetic Score (for Micro-esthetics)

Total = 2



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

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