Correction of a Full Cusp Class II Malocclusion and Palatal Impingement with Intermaxillary Elastics

Abstract

A 13yr 5mo old female presented with a bilateral full cusp, Class II malocclusion, large overjet, deep curve of Spee and palatal impingement. A passive self-ligating appliance, with maxillary anterior bite turbos, was used as a platform for the application of an array of intermaxillary elastics. The severe Class II malocclusion, Discrepancy Index (DI) of 25, was conservatively corrected in 18 months to an excellent result, as documented with a Cast Radiograph Evaluation (CRE) of 21 and a Pink & White (P&W) dental esthetics score of 3. (Int J Othod Implantol 2015;38:54-72)

Key words:

large overjet, palatal impingement, bite turbos, early light short elastics, Class II orthodontic mechanics, finishing elastics, residual Class II relationship

History and Etiology

A 13-year-5-month-old female was referred by her dentist for orthodontic consultation (*Fig. 1*) because of difficulty incising food. There was no contributory medical or dental history. A clinical examination revealed protrusive lips, large overjet, deep lower curve of Spee, and palatal impingement (*Figs. 2 and 3*). Intraoral photographs and study casts confirmed a bilateral, full-cusp Class II molar relationship. Careful evaluation of the patient's age, facial profile, and occlusal problems suggested the etiology of the malocclusion was due to a lip trap (*lower incisors posture between the incisors*) and forward (*counterclockwise*) rotation of the mandibular arch.

The patient was treated to a pleasing result as shown in Figs. 4-9. Pre-treatment (*Fig. 7*) and post-treatment (*Fig. 8*) cephalometric and panoramic radiographs document the dental and skeletal relationships. Superimposed cephalometric tracings reveal the treatment achieved (*Fig. 9*). The details for diagnosis and treatment are discussed below.

Diagnosis

Skeletal:

- Skeletal Class II (*SNA 81°, SNB 78°, ANB 3°*)
- Mandibular plane angle (*SN-MP 26°, FMA 21°*)

Dental:

- Bilateral full cusp Class II molar relationship
- Overjet was 7mm (*Fig. 10*)
- Overbite 3.5 mm and the with palatal impingement.
- Curve of Spee was ~5mm.

Facial:

- Moderate convex profile with protrusive lips

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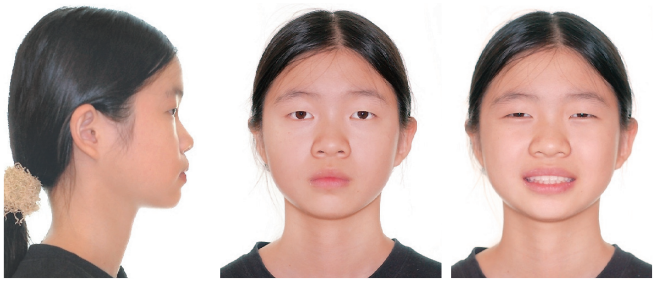


Fig. 1: Pre-treatment facial photographs

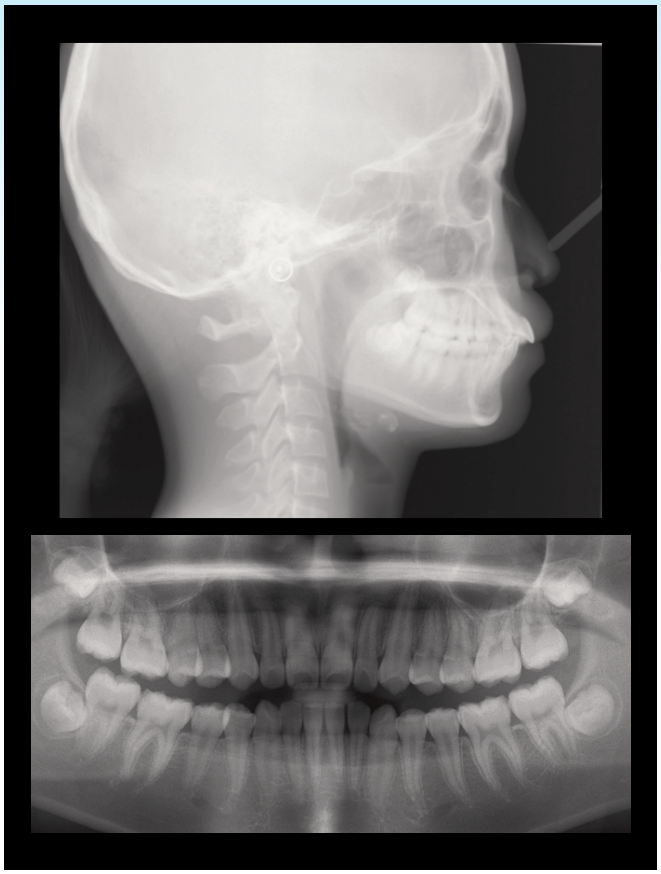
Fig. 4: Post-treatment facial photographs

Fig. 2: Pre-treatment intraoral photographs

Fig. 5: Post-treatment intraoral photographs

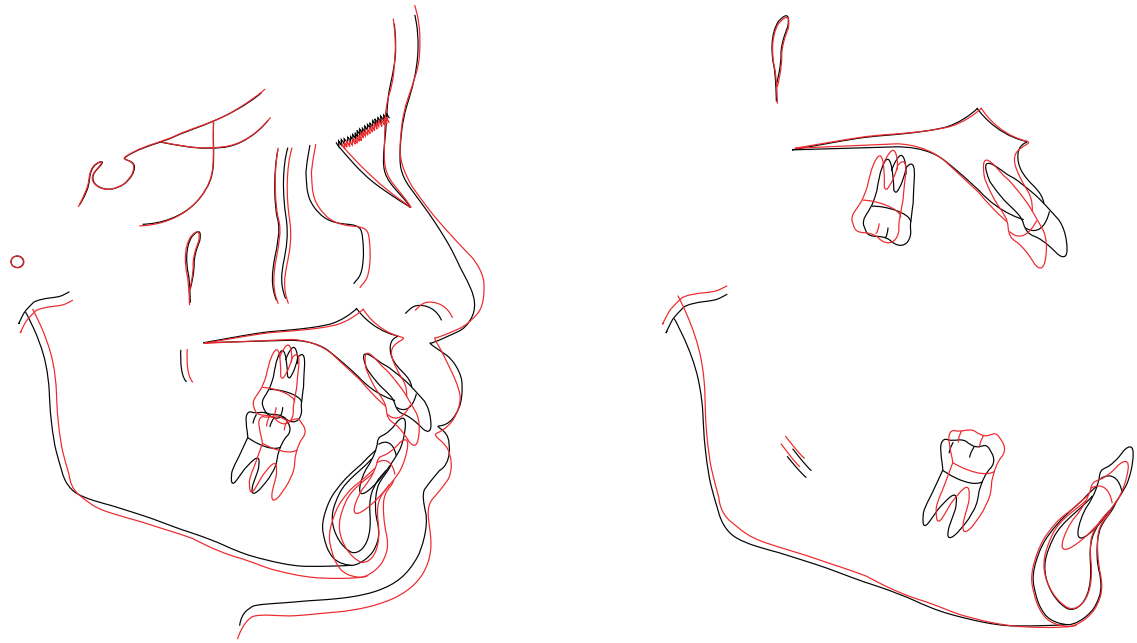
Fig. 3: Pre-treatment study models (casts)

Fig. 6: Post-treatment study models (casts)



■ *Fig. 7:*
Pre-treatment cephalometric and panoramic radiographs

■ *Fig. 8:*
Post-treatment cephalometric and panoramic radiographs



■ *Fig. 9:*
Pre-treatment (black) and post-treatment (red) cephalometric tracings superimposed on the anterior cranial base (left) show normal growth, clockwise rotation of the mandible, and an improved facial profile. Maxillary superimposition (upper right) documents the retraction of the entire upper dentition. Mandibular superimposition (lower right) reveals that the flattening of the curve of Spee was accomplished by extruding the molars and intruding the incisors.

Fig. 10:
Pre-treatment there was palatal impingement with 7mm overjet.

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

Specific Objectives of Treatment

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

- A - P: *Protract*
- Vertical: *Allow for normal expression of growth*
- Transverse: *Maintain*

Maxillary Dentition

- A - P: *Retract*
- Vertical: *Maintain*
- Inter-molar Width: *Maintain*

Mandibular Dentition

- A - P: *Maintain*
- Vertical: *Extrude molars, intrude incisors*
- Inter-molar / Inter-canine Width: *Maintain*

Facial Esthetics: *Retract the upper lip*

Treatment Plan

Place a full fixed orthodontic appliance to align and level the dentition with a non-extraction approach. Expedite leveling of the curve of Spee with a series of bite turbos (*BTs*), placed first on the lower molars and next on the upper incisors, along with light short Class II elastics. Subsequently, use conventional Class II elastics to protract the mandible and rotate the occlusal plane, clockwise to correct the sagittal discrepancy. Intermaxillary elastics and detailing bends are planned to produce the final occlusion. After debonding, place upper and lower fixed anterior retainers, and fabricate clear overlay retainers for both arches.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	81°	82°	1°
SNB°	78°	80°	2°
ANB°	3°	2°	1°
SN-MP°	26°	26°	0°
FMA°	21°	21°	0°
DENTAL ANALYSIS			
U1 TO NA mm	9 mm	5 mm	4 mm
U1 TO SN°	120°	107°	13°
L1 TO NB mm	7 mm	6 mm	1 mm
L1 TO MP°	106°	110°	4°
FACIAL ANALYSIS			
E-LINE UL	2.5 mm	-0.5 mm	3 mm
E-LINE LL	2mm	1 mm	1 mm

Table 1: Cephalometric summary

Appliances and Treatment Progress

A .022" slot standard torque Damon D3MX® bracket system (*Ormco, Glendora, CA*) was used. All elastics and archwires used were supplied by the same manufacturer. The maxillary arch was bonded for initial alignment to facilitate the bonding of the mandibular arch the next month. When the lower arch was bonded, bracket interference required installation of two bite turbos (*BTs*), constructed with FUJI II glass ionomer cement (*GIC*) on the lower first molars (*#19 and 30*) (*Figs. 11, 12*). In the 2nd month, the upper arch wire was changed to .014x.025" CuNiTi. In the 4th month, two metal bite turbos were bonded on the palatal surface of the maxillary central incisors (*#8 and 9*). Early light short class II elastics (*Quail 3/16" 2oz*) were applied from lower first molars to upper first premolars to protract the mandible and extrude the lower molars (*Figs. 13, 14*). Once the buccal

Fig. 11:
Bite-turbos made of type II glass ionomer cement were attached to the occlusal surfaces of the lower first molars to prevent bracket interference during the initial alignment phase.

Fig. 12:
The bite was opened slightly with the BTs, just enough to control bracket interference.

Fig. 13:
Anterior BTs provided an incisal stop that allowed the posterior segments to extrude and level to correct the lower curve of Spee. In addition, the mandible was free to move anteriorly for a more comfortable occlusion with the maxilla.

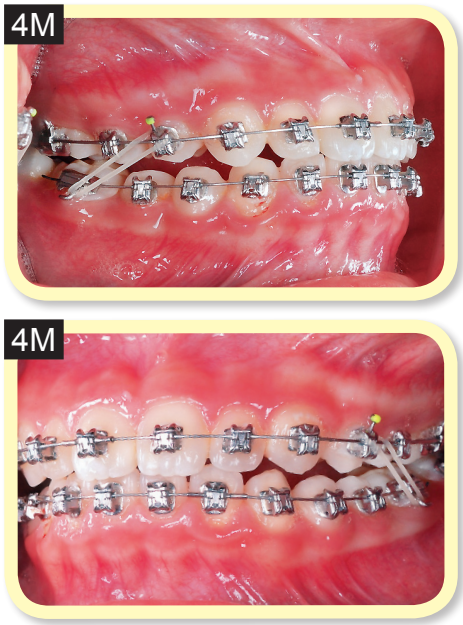


Fig. 14:
Early light short class II elastics were applied from lower first molars to upper first premolars to move the mandible forward and extrude the lower molars.

segments reached the occlusal plane, the posterior BTs were removed (*Fig. 15*). In the 6th month, the upper arch wire was changed to .017x.025" TMA. The anteriors were consolidated with a figure-8 steel ligature tie. The lower arch wire was changed to .014x.025" CuNiTi. In the 8th month, the bracket on tooth #29 was repositioned mesially (*Fig. 16*). The light short elastics were replaced with conventional Class II elastics (*Fox 1/4" 3.5oz*), stretched from the lower first molars to the upper canines. In the 10th month, a panoramic radiograph was exposed to evaluate bracket positions relative to the axial inclinations of all teeth (*Fig. 17*). The lower arch wire was changed to .017x.025" TMA. At 11 months, some occlusal irregularities were noted (*Fig. 18*) and records collection was scheduled for two months later. In the 13th month of active treatment, progress records were collected. The dental casts were assessed using the Cast Radiograph Evaluation (*CRE*) method established by the American Board of Orthodontics (*ABO*), and an open bite in the cuspid area was noticed. To help seat the canines, Monkey® (*3/8" 3.5oz*) elastics were applied in an L-configuration: from the lower first molar, over the upper canine bracket, and

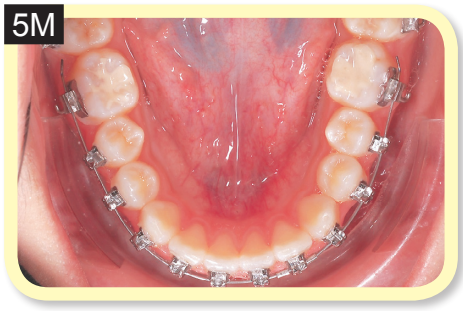


Fig. 15:
BTs were removed as soon as the lower arch was aligned.

Fig. 16: Bracket on #29 was repositioned mesially.

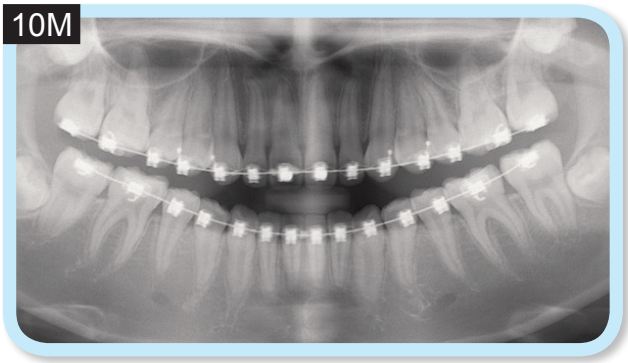


Fig. 17:
A panoramic radiograph was exposed to evaluate bracket positions relative to the axial inclinations of the teeth.

Fig. 18:
Open occlusal contacts (embrasures) were noted in the cuspid regions.

then attached to the lower canine, bilaterally (*Fig. 19*). In the 14th month, alignment finishing was achieved with first order bends on teeth #5, 6, and 13. Elastic configurations were changed to seat the buccal occlusion (*Fig. 20*). For the intermaxillary finishing stage, the appointments were scheduled every other week. Detailing bends and setting elastics produced the desired alignment (*Figs. 20-23*). Six weeks prior to the completion of active treatment, the upper arch wire was sectioned distal to the cuspids. Closing elastics (*Bear® 1/4" 4.5 oz*) were used to improve occlusal contacts (*Fig. 23*). Following 18 months of active treatment, all appliances were removed and retainers were delivered: fixed anterior retainers and clear overlays were for both arches (*Fig. 24*).

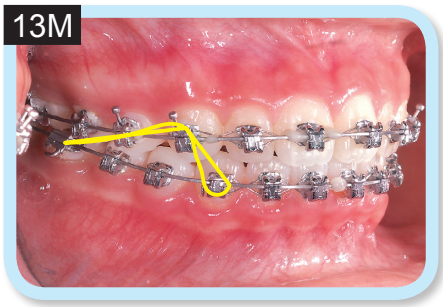


Fig. 19:
Use reverse L-shape elastics (yellow) help improve occlusal contact and embrasure relationships.

Fig. 20:
M-shape configuration of larger diameter elastics (Moose 5/16" 6oz) help seat the occlusion

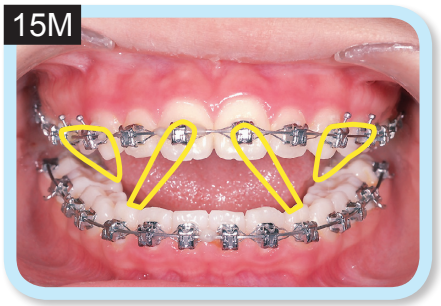


Fig. 21:
Criss-Cross elastics from buccal side of upper teeth to lingual side of lower teeth were used to rectify the buccal overjet. (Monkey 3/8" 3.5oz)

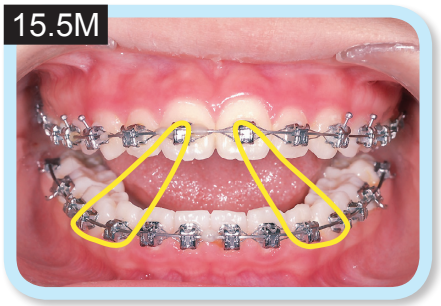


Fig. 22: Triangular elastics with class II pull (Bear 1/4" 4.5oz)

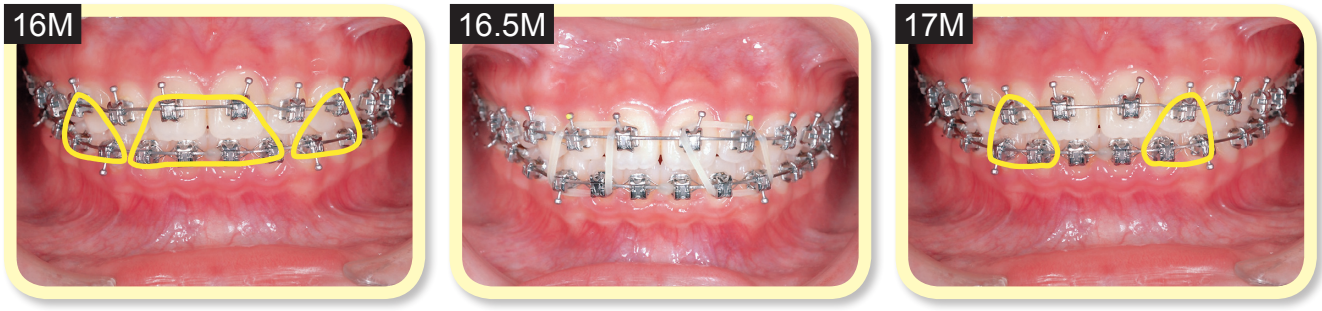


Fig. 23:
Multiple box and triangular configurations (Bear ¼" 4.5oz) were used from 16-18 months to refine intercuspation. The upper arch wire was sectioned distally to the cuspids, and closing elastics were used to improve occlusal contacts.

Fig. 24:
Fixed retainers were bonded from canine to canine for both arches.

Results Achieved

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

- A - P: *Favorable growth expressed*
- Vertical: *Favorable growth expressed*
- Transverse: *Maintained*

Maxillary Dentition

- A - P: *Retracted*
- Vertical: *Maintained for the molars and extruded in the incisal region*
- Inter-molar / Inter-canine Width: *Maintained*

Mandibular Dentition

- A - P: *Maintained*
- Vertical: *Molars extruded, incisors intruded*
- Inter-molar / Inter-canine Width: *Maintained*

Facial Esthetics: Straight profile

Retention

Fixed retainers were bonded on the lingual surface, from canine to canine, in both arches. Full time wear was prescribed for the clear overlay retainers for the first 6 months and then nights only. The patient was instructed in home hygiene, and for the proper maintenance of the retainers.

Final Evaluation of Treatment

The ABO CRE score was 21 points, which is an excellent clinical result for this difficult malocclusion (*DI 25*).[1] The large overjet and deep, impinging overbite were treated to an ideal outcome. Post treatment photographs (*Fig. 5*) and study casts (*Fig. 6*) reveal a class I molar relationship but some class II tendency in the buccal segments. The patient's facial appearance was very good. Superimposed cephalometric tracings documented the clockwise rotation of the mandible due to normal growth, as well as extrusion of the lower molars and intrusion of the lower incisors. The entire maxillary arch was retracted. The major CRE discrepancy was in the occlusal relationship (*8 points*) for the residual Class II tendency of the buccal segments. In retrospect, these problems could have been corrected by stripping the interproximal enamel of the lower incisors, retracting them to produce overjet, and then using Class II elastics to complete the correction. OrthoBoneScrews (*OBS*) at the infrazygomatic crest area would have been effective for retracting the entire maxilla, without tipping the

plane of occlusion, but a transient increase in overjet was still necessary to allow correction of the Class II tendency in the buccal segments.

Discussion

Class II Orthodontic Mechanics[1]

Assessment of orthodontic mechanics explains how applied loads move teeth and change the relationships of the jaws (*Fig. 25*). Class II elastics have predicable effects on the maxillary teeth: 1. retract the entire arch, 2. extrude the upper anterior segment, and 3. rotate the plane of occlusion clockwise because the line of force is occlusal to the center of resistance of the maxilla. The reciprocal elastic force has the opposite effect on the mandibular arch: 1. protracts buccal segments, 2. extrudes lower molars, and 3. intrudes lower incisors, to correct the curve of Spee and conform to the clockwise rotation of the occlusal plane. For Class II malocclusions, it is usually preferable to use high torque brackets on upper anteriors and low torque brackets on lower anteriors to resist the effects of intermaxillary elastics. However, for the present patient standard torque brackets were used on both arches because all incisors were labially inclined. This approach worked well for the upper arch: U1 to SN° improved from 120 to 107°, but the lower incisors flared excessively (*L1 to MP° from 106 to 110°*). This problem with the lower incisors was preventable with low torque brackets and/or the use of labial root torque in the archwire.

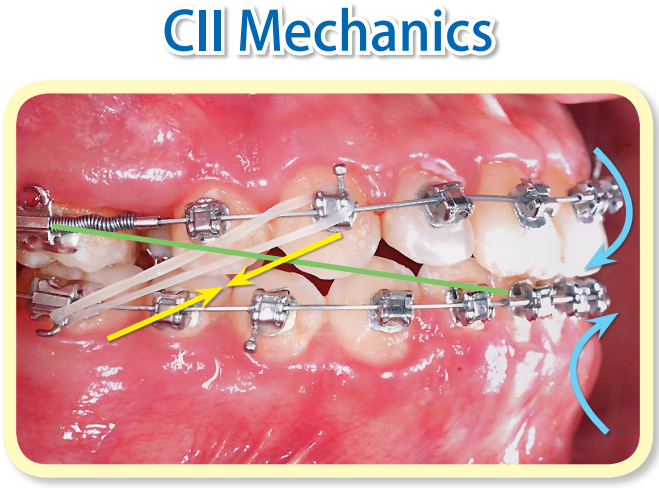


Fig. 25:
The class II elastic delivers reciprocal force (yellow arrows), which results in reciprocal moments in each arch (orange arrows), and steepening of the plane of occlusion (green arrow). Consistent with the rotation of the occlusal plane, the elastics generate components that extrude the upper anteriors and lower molars. The extrusion of the lower molars, and the intrusion of the lower incisors due to the BTs, levels the curve of Spee. The anterior component of elastics force protracts the mandibular dentition resulting in flaring of the lower incisors.

Petrovic et al.[2] revealed that Class II elastics not only move teeth, but are capable of enhancing the amount, and rate of condylar cartilage proliferation. Morphologically, this effect is manifest as lengthening and posterior rotation of the mandible in a growing patient (*Fig. 9*).

	Anterior BT	Posterior BT
Location	Anterior teeth	Molars
Material	Resin or metal	GIC or resin
Application	Low angle or deep bite cases	High angle or cross bite cases
Special Consideration	Proper inclination	Combine with squeeze exercise

Bite Turbos

Bite turbos (*BTs*) have come to mean any occlusal stops on teeth that unlock the malocclusion for greater freedom of tooth movement[3] (*Figs. 11, 13, 26*). According to where they are positioned, BTs are classified as anterior and/or posterior. Anterior BTs for deep bite cases are bonded more gingivally for big overjet cases. Weak teeth, such as endodontically treated maxillary incisors, are a contraindication for BTs because they are prone to fracture. The axial inclination of the maxillary incisors must be considered. If they are upright or retroclined, it may be necessary to correct the inclination prior to installing BTs[4,5,6] (*Fig. 27*). Anterior bite turbos on maxillary incisors tend to intrude lower incisors, and furthermore serve as effective vertical stops for the overbite.[3,7] For open bites, posterior BTs can be combined with squeeze exercises to intrude molars [8,9] (*Fig. 28*). For cross bites, unlocking the inter-digitation with contralateral BTs is effective for facilitating transalveolar correction.

	Latex Natural Rubber	Synthetic Rubber
Origin	Juice of a tree	Developed from petrochemicals
Main ingredient	Pure rubber and water	Polyurethane
Function	Intermaxillary traction	Elastic ligatures; move the tooth along the arch wire
Renew	Changed by the patient every day	Replaced by the orthodontist at the next visit of the patient
Form	Ring	Chain

Fig. 26:
Anterior BTs can be quite versatile. In addition to the present application on the lingual surfaces of maxillary incisors (Fig. 13), they can be bonded on the lingual surface of lower incisors to assist in anterior cross bite correction.

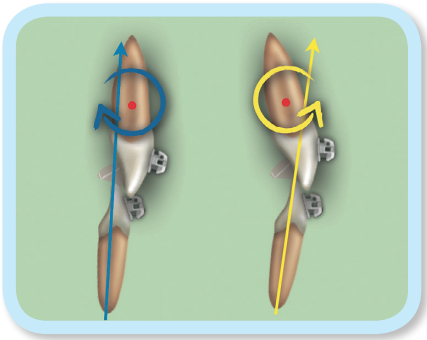
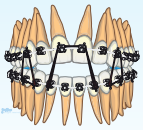


Fig. 27:
It is important to check the axial inclination of the maxillary incisors before bonding BTs. Occlusal force from lower incisors can produce an undesirable moment, so partial correction of maxillary incisor inclination is necessary before bonding lingual BTs on maxillary incisors.

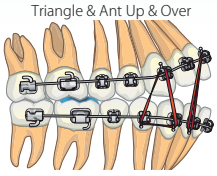
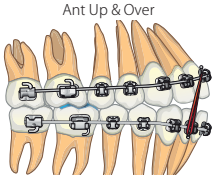
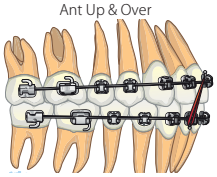
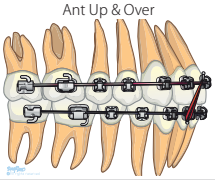
Elastics Within and Between Arches

Baker (*1846*) as well as both Case and Angle (*1902*) were early advocates for natural latex elastics in orthodontic treatment.[10] Elastomeric (*synthetic rubber*) chains were introduced to dental profession in 1960s and have largely replaced latex for intra-arch tooth movement (*Fig. 29*). Elastics have been handy orthodontics mechanics for many years, they are a routine measure throughout the whole treatment process. These materials fit two

Dr. Tom Pitts' Protocol of Elastics and Bite Turbos



Class I Open Bite Non-extraction

Class I Open Bite, Non-Extraction				
Wire	**Elastics**	**Direction**	**Duration**	**Bite Turbo**
.014 NiTi * (*.013 PRN*)	Quail 3/16, 2 oz. or Parrot 5/16, 2.5 oz.	Triangle & Ant Up & Over 	Full Time	L Molar
.018 NiTi	Parrot 5/16, 2.5 oz.	Ant Up & Over 	Full Time	L Molar
.014 x .025 NiTi or .018 x .025 NiTi	Parrot 5/16, 2.5 oz. or Dolphin 5/16, 3 oz.	Ant Up & Over 	Full Time	--
U : .019 x .025 SS / TMA L : .016 x .025 SS	Dolphin 5/16, 3 oz. or Zebra 5/16, 4.5 oz.	Ant Up & Over 	Full Time	--

* *Begin squeeze exercise at the first day. Put fingers on post. fiber of temporalis muscle area to feel the muscle contraction whenever bites on. 50 times as a cycle, do 6 cycles a day to accelerate molar intrusion.*

Fig. 28: Dr. Tom Pitts protocol for elastics and bite turbos.

Fig. 29:
There are two fundamental types of elastics: latex for inter-arch, and synthetic rubber (elastomers) for intra-arch applications.

fundamental categories: latex and synthetic rubber (*elastomer*). According to their location and mode of action, elastics are classified as follows:

1. **Class I Elastics** (*horizontal, intra-maxillary, or intra-arch elastics*) (*Fig. 30*)

Fig. 30:
Synthetic rubber (elastomers) move the teeth along an arch wire to close the space.

Example: A unilateral latex or elastomer elastic, extended from the molar tube to the a hook on the canine in the same arch

Application: These are typical mechanics for intra-arch space closure. When closing large spaces, efficiency can be increased by using lingual elastics to control the axial rotation moments, and placing gable bends in the archwire to prevent the tipping of teeth into the space.

Side effects: Mesial-in axial rotation and arch expansion are common problems for the terminal teeth in the arch. Using lingual elastics, or stopping the labial elastic one tooth anterior of the terminal tooth, can help avoid this undesirable side effect.

2. **Class II Elastics** (*inter-maxillary or inter-arch elastics*) (*Fig. 31*)

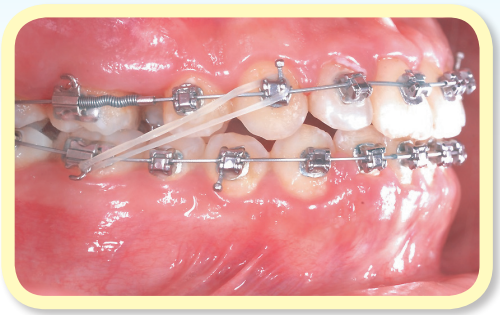


Fig. 31:
Latex, class II elastics are for intermaxillary correction.

Example: A typical configuration is a latex elastic extended from a lower molar to a hook on, or mesial to, the upper canine on the same side.

Application: Corrects a Class II buccal relationship and steepens the occlusal plane by two reciprocal actions: 1. maxillary retraction and clockwise rotation of the upper arch, and 2. mandibular arch protraction and clockwise rotation of the lower arch. This combination of A-P and vertical effects corrects Class II buccal segments to Class I.

Side effects: Extrusion of lower molars produces posterior rotation of the mandibular plane and an increase in the vertical dimension of occlusion (*VDO*). Retraction and distal tipping of maxillary incisors, in conjunction with the increase in VDO, may produce unesthetic maxillary anterior gingival exposure (*"gummy smile"*). The lingual tipping of the maxillary incisors and labial tipping of the lower incisors can be controlled with archwire torque and/or bracket selection: high torque for upper incisors and low torque for the lower incisors.

3. **Class III Elastics** (*Fig. 32*)

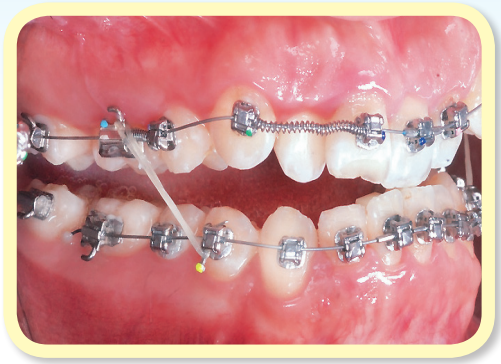


Fig. 32:
Latex, class III elastics are effective for anterior cross-bite correction when combined with lower incisor BTs (Fig. 26).

Example: A typical configuration is a latex elastic extended from an upper molar to a hook on, or mesial to, the lower canine on the same side.

Application: Corrects a Class III buccal relationship and flattens the occlusal plane by two reciprocal actions: 1. maxillary protraction and counterclockwise rotation of the upper arch, and 2. mandibular arch retraction and counterclockwise rotation of the lower arch. This combination of A-P and vertical effects corrects Class III buccal segments to Class I.

Side effects: Common problems are extrusion of the upper molars, flaring of the maxillary incisors and lingual tipping of the lower incisors. The incisal axial inclination problems can be controlled with high torque brackets on lower incisors and low torque brackets in the upper anterior segment.

4. **Anterior Vertical Elastics** (*Fig. 28*)

Example: Intermaxillary elastics can be applied in a vertical, box or triangle configuration, depending on the desired components of force.

Application: They are used to close open bites and/or improve occlusal contacts.

Side effects: They may produce a gummy smile and are often associated with root resorption. When using vertical elastics, it is important to diagnose and treat the etiology of the openbite, which is usually due to abnormal soft tissue posture of the lips and/or tongue.[11]

5. **Finishing Elastics** (*up and down, and continuous intermaxillary elastics*) (*Fig. 33*)

Fig. 33: Finishing elastics improve occlusal contacts.

Example: Single or continuous intermaxillary elastics applied to achieve maximum intercuspation.

Application: This approach is used to seat or settle the occlusion in the final stage of fixed appliance therapy. They are most effective when one or both opposing archwires are removed. A typical approach is to cut the archwires distal to the cuspids before using finishing elastics.

Side effects: They may create marginal ridge discrepancies and occlusal prematurities, so it is best to limit their use to no more than three weeks.

6. **Cross bite elastics** (*Fig. 34*)

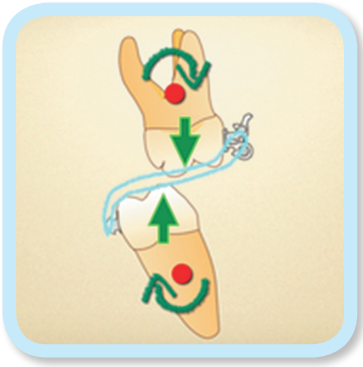


Fig. 34:
Cross bite (transalveolar) elastics from buccal or lingual surfaces of affected teeth are most effective if the malocclusion is discluded with a contralateral BT.

Example: These transalveolar elastics are effective for correcting all maxillary teeth to occlude in a buccal relationship to the mandibular teeth. For posterior teeth mandibular buccal cusps should occlude in the respective fossa of their maxillary antagonist(*s*).

Application: They are used to correct lingual or buccal cross bites. Constructing BTs on the contralateral side of the arch is often essential for disarticulating the malocclusion and allowing the malposed teeth to move to the correct relationship with minimum trauma.

Side effects: produce a cant in the occlusal plane

Fig. 35:
Diagonal elastics were used to a correct midline deviations, but with longterm use can cant the occlusal plane, and alter the axial inclinations of the incisors.

7. **Diagonal elastics** (*midline and/or asymmetric elastics*) (*Fig. 35*)

Example: A typical configuration for midline correction is to extend a latex elastic from a lower canine to the upper canine of the other side.

Application: They are used to correct dental midline deviations and improve intercuspation.

Side effects: Extensive use of midline elastics can produce a cant in the occlusal plane and abnormal axial inclinations of the incisors.

Clinical Tips

The force extension value of latex elastics should be provided by the manufacturers for different sizes. The standard force index is to stretch the elastic to 3 times the original internal diameter to achieve the force stated on the package.[11]

To achieve a more consistent force, routine pre-stretching of elastic chains is recommended.[12]

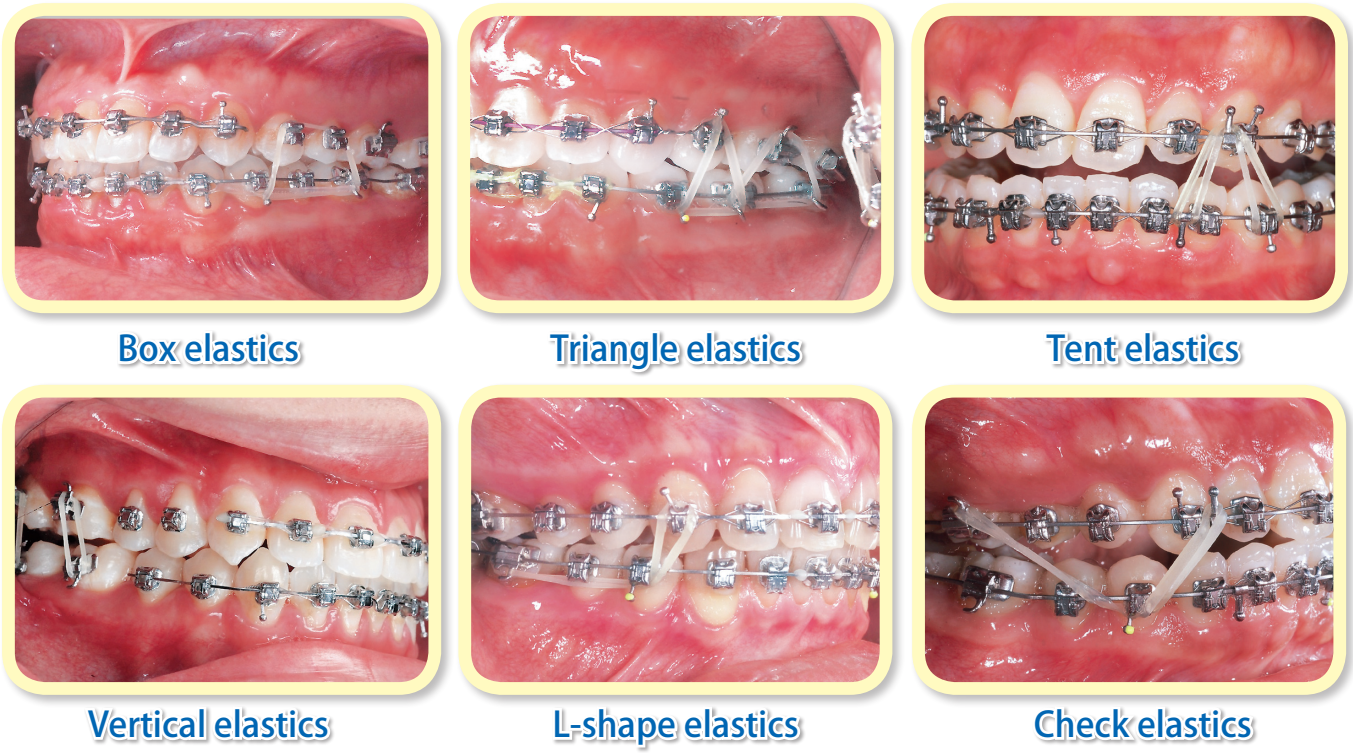


Fig. 36:
Elastics to correct open bites can have many configurations as shown. However, it is also important to correct the etiology of the open bite which is usually soft tissue or digit posture between the teeth. Applying vertical elastics on the lingual surfaces may be more effective for tongue posture problems.

Wong[13] suggests pre-stretching 1/3rd the length of the elastomeric chain to achieve a more uniform strain in the material. Young and Sandrik[14] demonstrated that pre-stretching elastomeric chains decreases the loss of force after they are applied. The latter is an important problem with elastomeric chains because the force can decrease ~30% after two hours in the oral cavity.[15] Most of the elastomeric chains on the market lose 50~70% of their initial force during the first day of application.[16,17] Pre-stretching does not prevent the loss of force but it does decrease it.[12-14]

Instruct the patient to change latex elastics at least once per day. In Beethoven Orthodontic Center, patients are asked to replace elastics four times a day. It is essential for the patient to demonstrate their ability to properly change elastics before leaving the clinic.

The ABO CRE score of 21 documents an excellent final alignment of the dentition. As mentioned previously, the major residual problem was occlusal relationships (*8 points*) due to the Class II tendency in buccal relationships, bilaterally (*Fig. 37*). In retrospect, extra-alveolar miniscrew anchorage[18,19] would facilitate a more complete correction of the Class II relationship without excessive tipping the occlusal plane.

Conclusion

A severe full cusp Class II malocclusion with a large overjet and palatal impingment was effectively treated with passive self-ligating brackets, bite turbos and class II elastics. Elastics are among the most versatile and widely applied materials in orthodontics. It is important to change elastics regularly because their force level decreases rapidly.

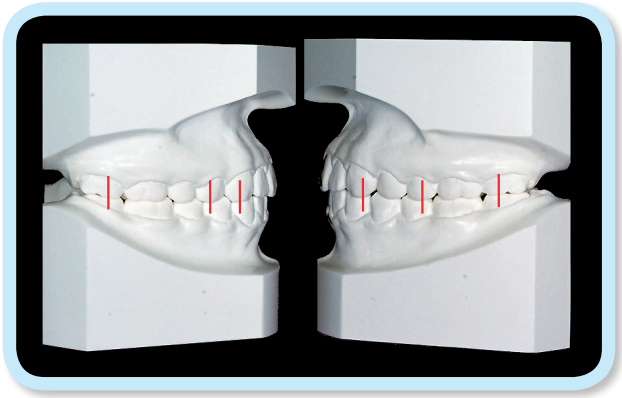


Fig. 37:
The occlusal relationship were under-corrected resulting in a residual Class II tendency. Since there is no overjet (Fig. 38), correction of the Class II buccal segments before debonding would have required stripping of interproximal enamel and retracting the lower incisors to create overjet. Then Class II could then completed with Class II elastics.

Fig. 38:
Four and a half years after treatment, the overjet remains closed and the prospective doctor's smile is very attractive!

Effective use of elastics to resolve challenging malocclusions requires excellent patient cooperation. After four and a half years of follow up for the present patient, the occlusion remained stable, and the patient was well satisfied with the result.

Acknowledgment

Thanks to Mr. Hughes for proofreading this article.

References

1. Chang CH, Roberts WE. Objective assessment of orthodontics clinical outcomes. Chapters 1-3, 3D i-Ortho encyclopedia. Orthodontics Vol I [E-reader version]. Hsinchu: Newton's A Ltd; 2012. Available from: https://itunes.apple.com/book/orthodontics-vol.-i/id520098562?mt=11.
2. Petrovic AG, Stutzmann JJ, Oudet CL. Control processes in the post-natal growth of the condylar cartilage of the mandible. In: Craniofacial Growth and Development. 2nd ed. McNamara JA (Ed.) Monograph No. 4. Ann Arbor: The University of Michigan Press, 1975, pp 101–153.
3. Kozlowski J. Honing Damon system mechanics for the ultimate in efficiency and excellence. Clin Impressions 2008;16:23-28.
4. Thavarungkul R. Correcting deep-bite with fixed bite ramps. News & Trends in Orthodontics 2009;16:68-71.
5. Lin SL, Chang CH, Roberts WE. Mutilated class II division 2 malocclusion: implant-orthodontic treatment utilizing flapless implant surgery and platelet-rich fibrin. Int J Orthod Implantol 2014;33:22-45.
6. Liu CW, Chang CH, Roberts WE. Class II deep bite malocclusion with posteriorly-inclined incisors. Int J Orthod Implantol 2012;25:32-42.
7. Pitts T. Begin with the end in mind: bracket placement and early elastics protocols for smile arc protection. Clin Impressions 2009;17:4-13.
8. Huang S. Dr. Tom Pitts's secrets of excellent finishing (I) News & Trends in Orthodontics 2009;13:14-22.
9. Huang S. Dr. Tom Pitts's secrets of excellent finishing (II) News & Trends in Orthodontics 2009;14:6-23.
10. Bales TR, Chaconas SJ. Force extension characteristics of orthodontic elastics. Am J Orthod 1977 Sept;72(3):296-302.
11. Proffit WR, Fields Jr HW, Sarver DM. Contemporary orthodontics, 4th ed. St. Louis: Mosby Elsevier; 2007.
12. Brantley WA. Effects of pre-stretching on force degradation characteristics of plastic modules. Angle Orthod 1979;49:37-43.
13. Wong AK. Orthodontic elastic materials. Angle Orthod 1976;46(2):196-205.
14. Young J, Sandrik JL. The influence of preloading on stress relaxation of orthodontic elastic polymers. Angle Orthod 1979;49(2):104-9.
15. Langlade M. Optimization of orthodontic elastics. New York: GAC International; 2000.
16. Kanchana P, Godfrey K. Calibration of force extension and force degradation characteristics of orthodontic latex elastics. Am J Orthod 2000 Oct;118(3):280-7.
17. Wang T, Zhou G, Tan X, Dong Y. Evaluation of force Degradation characteristics of orthodontic latex elastics in vitro and in vivo. Angle Orthod 2007;77(4):688-93.
18. Chang CH, Roberts WE. Stability of mini-screws on buccal shelves: a retrospective study of 1680 Mini-screw insertions by the same orthodontist. Int J Orthod Implantol 2013;30:76-78.
19. Chang CH, Roberts WE. A retrospective study of the extra-alveolar screw placement on buccal shelves. Int J Orthod Implantol 2013;32:80-89.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 25

OVERJET

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

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

Total = 3

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 = 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 = 0

OCCLUSION

Class I to end on	=	0 pts.	
End on Class II or III	=	2 pts. per side	pts.
Full Class II or III	=	4 pts. per side	8 pts.
Beyond Class II or III	=	1 pt. per mm. additional	pts.

Total = 8

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° 7 x 1 pt. = 7

Total = 9

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

IMPLANT SITE

Lip line : Low (0 pt), Medium (1 pt), High (2 pts) =_____

Gingival biotype : Low-scalloped, thick (0 pt), Medium-scalloped, medium-thick (1 pt), High-scalloped, thin (2 pts) =_____

Shape of tooth crowns : Rectangular (0 pt), Triangular (2 pts) =_____

Bone level at adjacent teeth : ≤ 5 mm to contact point (0 pt), 5.5 to 6.5 mm to contact point (1 pt), ≥ 7mm to contact point (2 pts) =_____

Bone anatomy of alveolar crest : H&V sufficient (0 pt), Deficient H, allow simultaneous augment (1 pt), Deficient H, require prior grafting (2 pts), Deficient V or Both H&V (3 pts) =_____

Soft tissue anatomy : Intact (0 pt), Defective (2 pts) =_____

Infection at implant site : None (0 pt), Chronic (1 pt), Acute(2 pts) =_____

Total = 0

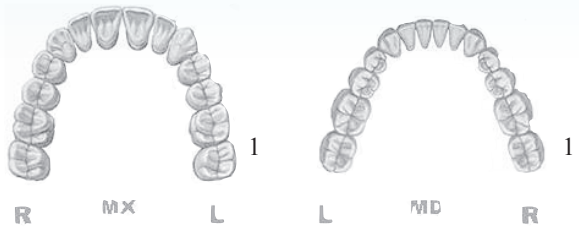
Cast-Radiograph Evaluation

Case # 1 **Patient**

Total Score: 21

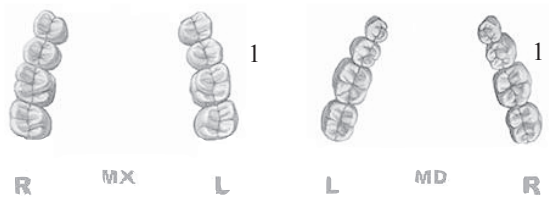
Alignment/Rotations

2



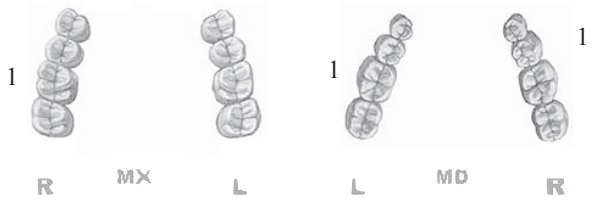
Marginal Ridges

2



Buccolingual Inclination

3

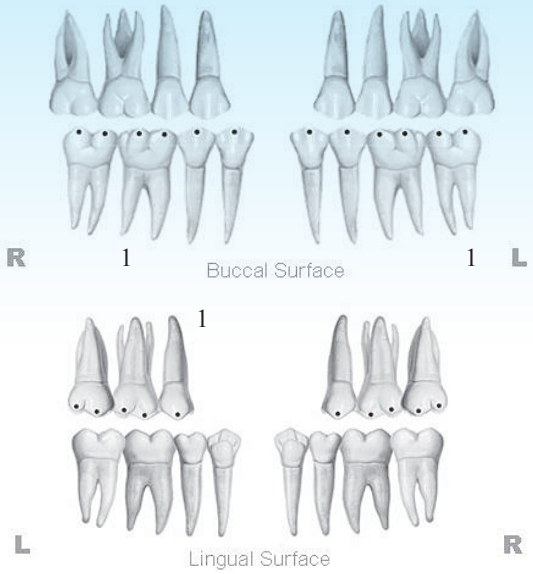


Overjet

1

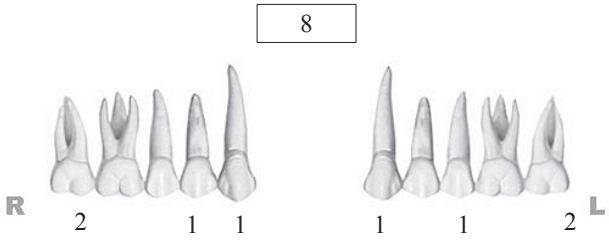
Occlusal Contacts

3



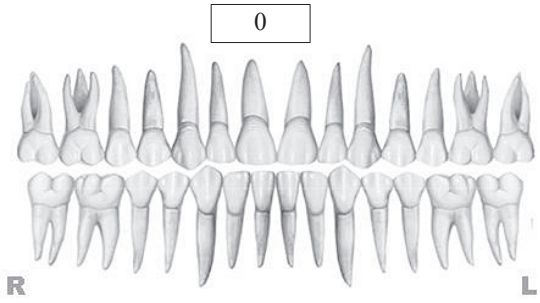
Occlusal Relationships

8



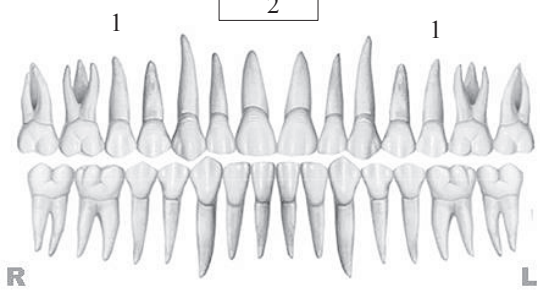
Interproximal Contacts

0



Root Angulation

2



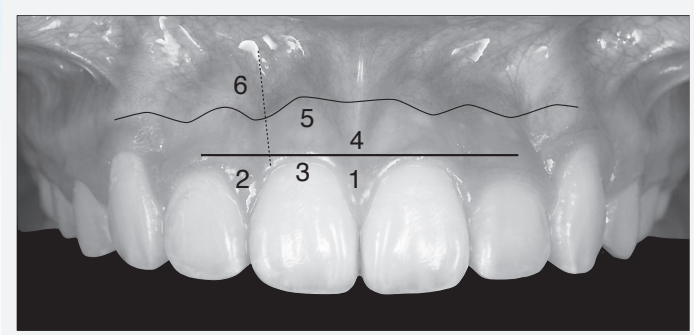
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

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

Total Score: = 3

1. Pink Esthetic Score

Total = 2

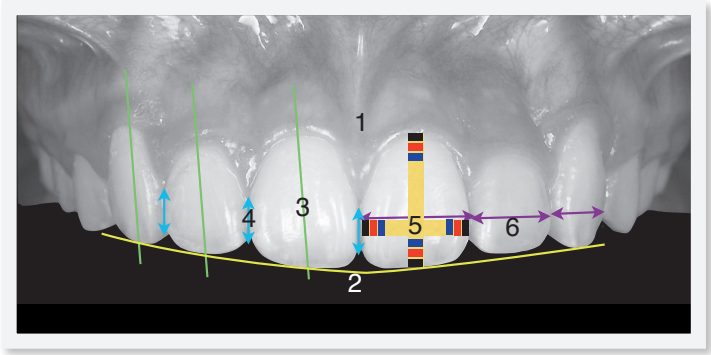


1. M-D Papilla	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

1. M & D 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-esthetics)

Total = 1



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