ABO Case Report

Correction of Crowding and Protrusion Complicated by Impacted Molars Bilaterally

HISTORY AND ETIOLOGY

A 12 year 1 month old male presented for orthodontics consultation (*Figure 1*). His chief complaint was irregularity (*crowding*) of both upper and lower arches (*Figure 2 and 3*). There was no other contributing medical or dental history. The patient was treated to an excellent result as documented in Figures 4-10, as will be subsequently discussed

The panoramic radiograph (*Figure 9*) revealed bilateral impaction of the mandibular 2nd molars. The etiology of the malocclusion was deemed to be insufficient development of width in both arches.

Fig 1. Pretreatment facial photographs

Fig 2. Pretreatment intraoral photographs

Fig 3. Pretreatment study models

DIAGNOSIS

Skeletal:

- Skeletal Class I (*SNA 85°, SNB 80°, ANB 5°*)
- Mandibular plane angle (*SN-MP 33°, FMA 34°*)

Dental:

- Right Class I molar relationship, Class II canine
- Left end-on Class II molar relationship, Class I canine
- OJ 8.0 mm; OB 3.0 mm
- Lingual cross-bite maxillary left second premolar
- Mesially inclined and partially impacted mandibular

second molar

- Horizontal impaction mandibular second molar
- ABO Discrepancy Index 21, fitting the major malocclusion category (*DI>20*)

Dr. Eugene W. Roberts, Consultant, News and Trends in Orthodontics (left)
Dr. Chris HN Chang, Director, Beethoven Orthodontic Center (middle)
Dr. Yu Lin Hsu, Lecturer, Beethoven Orthodontic Course (right)

Facial:

Convex profile

Competent, severely protrusive lips

Asymmetric auditory canals (*S-Na and Frankfurt Horizontal planes almost equal*)

Fig 4. Posttreatment facial photographs

SPECIFIC OBJECTIVES OF TREATMENT

Skeletal:

Skeletal Class I (*SNA 85°, SNB 80°, ANB 5°*)

Mandibular plane angle (*SN-MP 33°, FMA 34°*)

Dental:

Right Class I molar relationship, Class II canine

Left end-on Class II molar relationship, Class I canine

OJ 8.0 mm; OB 3.0 mm

Lingual cross-bite maxillary left second premolar

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ABO Discrepancy Index 21, fitting the major malocclusion category (*DI>20*)

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Asymmetric auditory canals (*S-Na and Frankfurt Horizontal planes almost equal*)

Fig 5. Posttreatment intraoral photographs

TREATMENT PLAN

The initial treatment plan was to use two miniscrews to retract the whole maxillary arch and extract both

Fig 6. Posttreatment study models

Fig. 7. Pretreatment pano and ceph radiographs

Fig. 8. Posttreatment pano and ceph radiographs

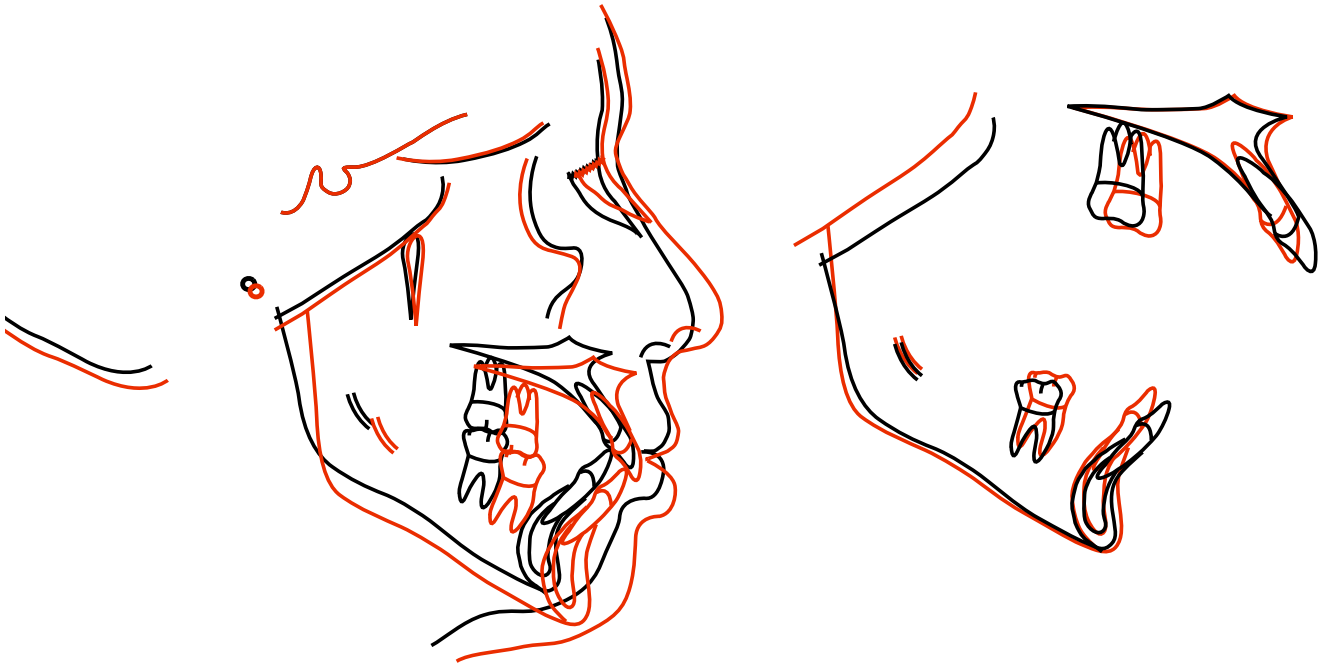

Fig 9. Superimposed tracings

mandibular second molars to relieve crowding and upright the mandibular 3rd molars. In the 20th month of progress, excessive protrusion of the maxillary dentition required extraction of maxillary second molars in order to retract the whole arch (*Figures 10*). In the 21st month, two OBS (*OrthoBoneScrew®*) were inserted in the bilateral infrazygomatic crest to serve as anchorage to retract the entire maxillary dentition.

After 8-month of maxillary retraction, the facial profile was excessively convex (*Figure 11*), and there was insufficient space for uprighting the mandibular 3rd molars (*Figure 12*). After consultation with the parents, both maxillary 1st premolars and mandibular 2nd premolars were extracted (*Figure 13*). In the 32nd month, the mandibular 3rd molars started to erupt into the oral cavity after the first molars moved mesially. Buccal molar tubes were bonded in the 35th month of treatment (*Figure 14*).

Class II elastics were used to resolve the residual sagittal discrepancy and detailing bends produced the final occlusion. Fixed appliances were removed and the corrected dentition was retained with anterior fixed retainers in both arches.

Fig. 10. Progress of the 18th month

Fig. 11. Lateral profile in the 29th

Fig. 12. The panograph in the 29th month showed no space for uprighting the 3rd molars.

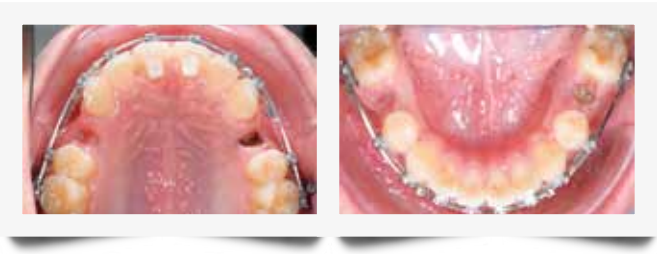

Fig. 13. Four premolars were extracted for protrusive lips and impacted 3rd molars in 30th month.

Fig. 14. Molar tubes were bonded on the 3rd molars in the 35th month.

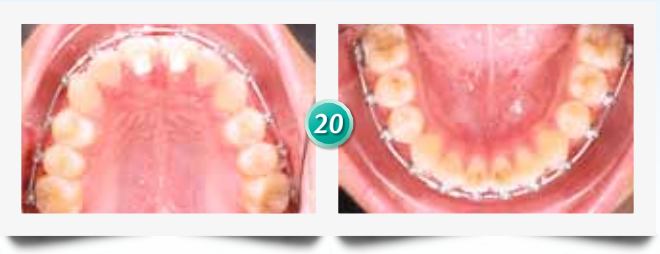

Fig. 15. Bite turbos were placed on the lingual surface of the central incisors to prevent bite from

APPLIANCES AND TREATMENT PROGRESS

The bracket system selected was 0.022" Damon D3MX (*Ormco*). Open coil springs were applied between the left maxillary 1st premolar and 1st molar to create space for alignment of the palatally displaced 2nd premolar. In the 2nd month, both mandibular second molars were extracted to relieve the crowding. Figure 15 at about 20 months of treatment shows the maxillary incisal bite turbos, and the archwire progress of the 014X.025 copper NiTi in both arches.

After 31-month of active treatment, the lower dentition was aligned and the 2nd molar extraction space was closed, but both mandibular 3rd molars were horizontally impacted and facial protrusion was excessive (*Figure 11*). Hence, extraction of upper 1st and lower 2nd premolars was necessary (*Figure 16*) for retraction of the anterior segments as well as for protraction of the mandibular 2nd molars. The mandibular 3rd molars erupted and 2nd molar tubes were bonded on the buccal (*Figure 14*). An uprighting force was created by inserting a section of open coil springs and bonding the tubes with a mesial-tilted angulation (*Figure 17*). It required 20 additional months of treatment to align the mandibular 3rd molars, and retract the maxillary

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA°	85°	88°	3°
SNB°	80°	83°	3°
ANB°	5°	5°	0°
SN-MP°	33°	35°	2°
FMA°	34°	35°	1°
DENTAL ANALYSIS			
U1-NA mm	10.0mm	4.2mm	-5.8mm
U1-SN°	116°	111°	-5°
L1-NB mm	10.2mm	8.0mm	-2.2mm
L1-MP°	104°	100°	-4°
FACIAL ANALYSIS			
E-LINE(*U*)	3.0mm	-1.0mm	-4mm
E-LINE(*L*)	7.0mm	1.0mm	-6mm

Table. Cephalometric summary

Fig. 16. Extraction of our premolars could facilitate anterior segment retraction and #36,46 protraction.

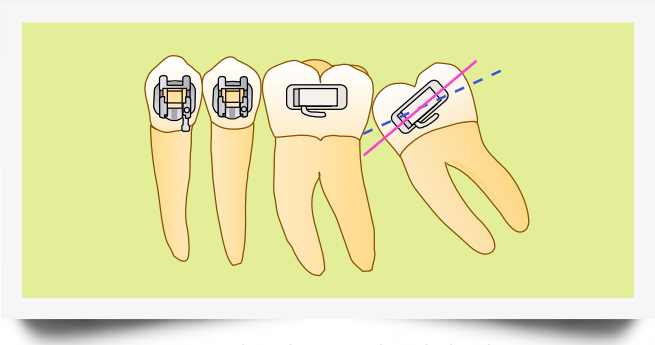

Fig. 17. Molar tubes were bonded with an angulation tilted more mesially.

arch (*Figure 18*). All appliances were removed after 52 month of active treatment. Figure 19 is the radiographic series documenting the alignment problems in the mandibular molar area.

RESULTS ACHIEVED

Maxilla (*all three planes*) :

- A - P : Optimal growth expression
- Vertical : Optimal growth expression
- Transverse : Maintained

Mandible (*all three planes*) :

- A - P : Optimal growth expression
- Vertical : Optimal growth expression
- Transverse : Maintained

Fig. 18. Space closed and alignment of both arches were done.

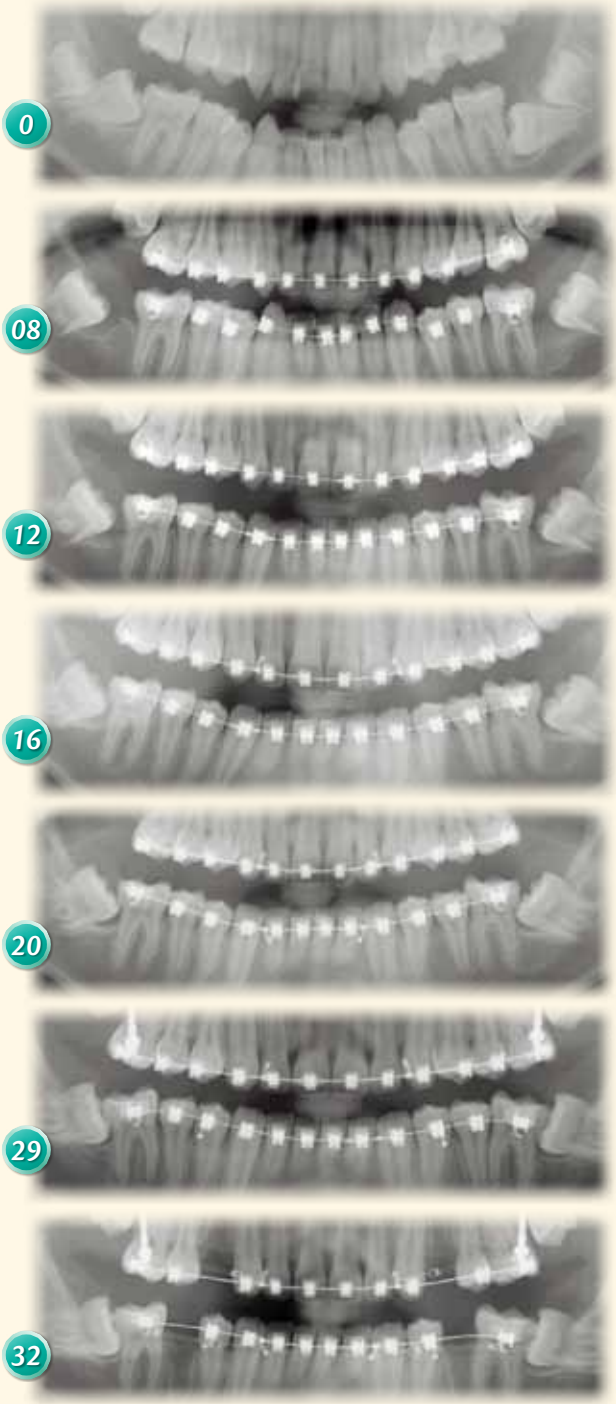

Fig. 19. X-ray films showed the space changing in the lower arch.

Maxillary Dentition

- A - P : Decreased axial inclination of the incisors
- Vertical: Intrusion of the incisors
- Inter-molar / Inter-canine Width: Maintained

Mandibular Dentition

- A - P: Incisors retracted
- Vertical: Extruded molars and incisors in response to growth
- Inter-molar/Inter-canine Width: Maintained

Facial Esthetics: A pleasing profile with competent lips was achieved.

RETENTION

The upper fixed retainer (2-2) and the lower fixed retainer (3-3) were bonded on every tooth. An upper clear overlay retainer was delivered. The patient was instructed to wear it full time for the first 6 months and nights only thereafter. The patient was instructed relative to proper home hygiene and maintenance of the retainers.

FINAL EVALUATION OF TREATMENT

The ABO Cast-Radiograph Evaluation was scored at 22 points. The major discrepancies were mal-alignment (*7 points*), uneven marginal ridges (*7 points*) and loss of contact over mandibular molars (*Figures 20, 21*).

The retraction of the anterior dentoalveolar process resulted in the E-line decreasing from -1/3mm to 1/7mm. As noted in Figures 4, 9 and 11, facial esthetics improved as the lips were retracted and the nasolabial angle was increased. Overall, the treatment results for this challenging case were pleasing to the patient and the clinician.

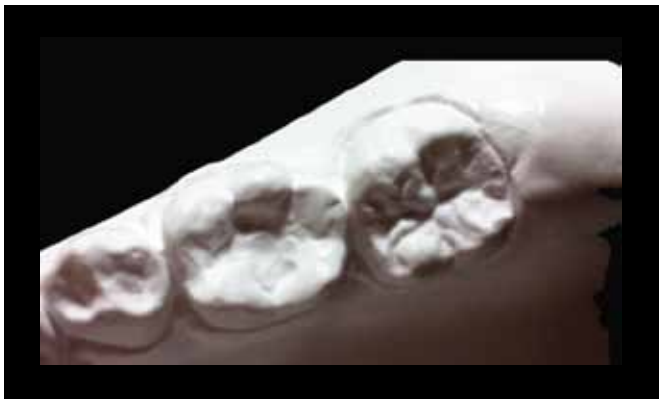

Fig 20. Buccal view of left posterior

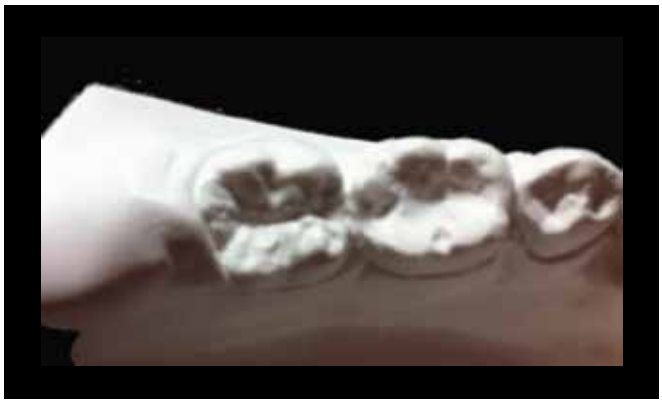

Fig 21. Palatal view of UL area.

DISCUSSION

The key The key issue for this case was determining how much extraction space was required for uprighting the impacted teeth, as well as for aligning and retracting both dentitions.[1-3] Initially the extraction of both mandibular second molars provided 12mm of space bilaterally in the posterior mandible. The space was adequate to relieve 10 mm of mandibular arch crowding, but it was insufficient for retracting the protrusive lips. The 3rd molars continued to tip mesially into the 2nd molar space until they were horizontally impacted. Figure 22 documents the angulation change of the 3rd molars. As the lower dentition was aligned, the 1st molars were retracted into the extraction site. Underestimating the space required and the importance of the position of the space resulted in a significantly prolonged treatment time. Recommendations for treating complex impaction and crowding cases include: 1. accurate estimation of extraction space needed, 2. securing space in an optimal location, 3. proper torque selection for brackets, 4. a simple design of uprighting force applied to mesially tipped molars.

For the present case, the lower arch presented a more complex situation. The extraction space requirement involves two considerations. One is to extract two premolars to relieve dental crowding, retract the incisors and correct the protrusive lips. The other is to extract the impacted 2nd molars and upright the 3rd molars. Another option was to extract the 3rd molars and upright the 2nd molars, but each approach has its pros and cons.[1-3] In retrospect, treatment time may have been less if the 3rd molars and 2nd premolars had been extracted early in treatment.

Treatment for the upper arch was straightforward: bilateral extraction of the 1st premolars to relieve crowding and improve lip protrusion. In retrospective, the extraction of the maxillary 2nd molars was unnecessary because it did not interfere with retraction of the whole arch. Even if the retraction caused 3rd molar impaction, they could be extracted after treatment.

In addition to planning extraction space, the clinician should pay particular attention to proper torque selection of brackets due to incisor flaring.[4-6] High torque brackets were selected for the upper incisors because of the class II malocclusion and necessity for anterior retraction. Low torque brackets were placed on the mandibular anterior segment to prevent inclination of incisors from increasing.[7]

The most critical element of uprighting impacted molars is to create sufficient space.[1-3] Once erupted, one can design an upright force by bonding tubes slightly tilted more mesially and inserting a section of open coil springs. Surgical uprighting is painful and usually is unnecessary.

The ABO Cast-Radiograph score was 22 points, which is within the acceptable range for a board case. The major alignment discrepancies were uneven marginal ridges (*7 points*) and failure to achieve intermaxillary occlusal contacts in the molar area (*7 points*) (*Figures 20, 21*). These problems could be prevented by collecting and scoring casts obtained about 6 months before the projected debond date.[8]

Regarding retention, no fixed retention was placed between the lower 1st and 3rd molar because further settling is expected.

CONCLUSION

This case report demonstrates that even a complex impaction and crowding case with protrusion can be treated effectively without surgical uprighting. The critical considerations include, 1. accurate estimation of extraction space needed, 2. proper bracket torque selection, 3. a simple force design for uprighting the mandibular 3rd molars. Failure to create sufficient space early in treatment significantly delayed the treatment progress and affected the final detailing.

ACKNOWLEDGMENT

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References

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3. Alessandri BG. et al. Manafement of Bilaterally impacted mandibular second and third molars. J Am Dent Assoc. 1999 Aug;130(8):1190-4

4. Hsu YL. Secrets of Torque Selection. NTO 2006 Sep;7:11

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DISCREPANCY INDEX WORKSHEET

CASE # _____ **PATIENT** G.Y. D

TOTAL D.I. SCORE 21

EXAM YEAR	2011
ID#	96113

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 = 0

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 = 7

OCCLUSION

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

Total = 2

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 1

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° 5 x 1 pt. = 5

Total = 5

OTHER (See Instructions)

Supernumerary teeth	_____ x 1 pt. =	_____
Ankylosis of perm. teeth	_____ x 2 pts. =	_____
Anomalous morphology	_____ x 2 pts. =	_____
Impaction (except 3rd molars)	2 x 2 pts. =	4
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 = 4

Exam Year	2011
ABO ID#	96112

Examiners will verify measurements in each parameter.

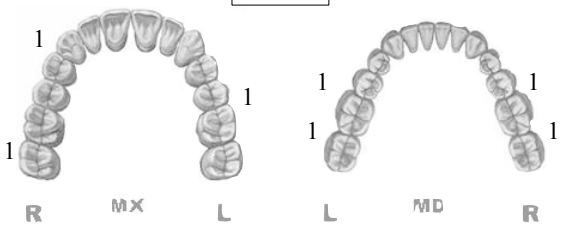
ABO Cast-Radiograph Evaluation (Rev.6-1-08)

Case # | **Patient** G.Y. D

Total Score: 22

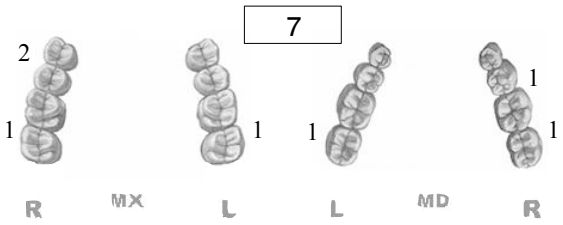
Alignment/Rotations

7



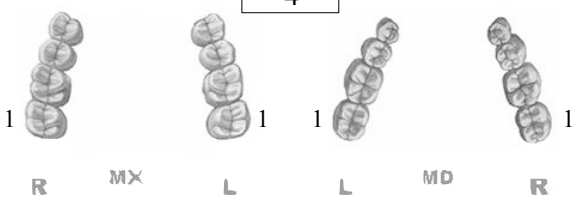
Marginal Ridges

7



Buccolingual Inclination

4



Overjet

2

Occlusal Contacts

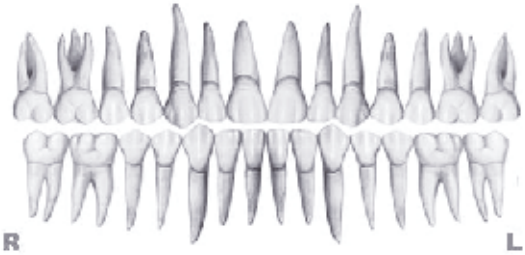
0

Occlusal Relationships

0

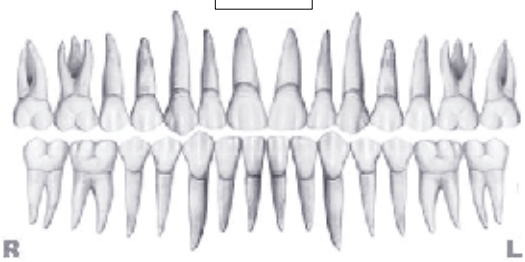
Interproximal Contacts

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.