ANALYSIS OF THE DENTITION & OCCLUSION

By

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From

Riolo, M. and Avery, J. Eds., Essentials for Orthodontic Practice, EFOP Press of EFOP, LLC. Ann Arbor and Grand Haven, Michigan, U.S.A., 2003.

CHAPTER 13
Pages 315-370
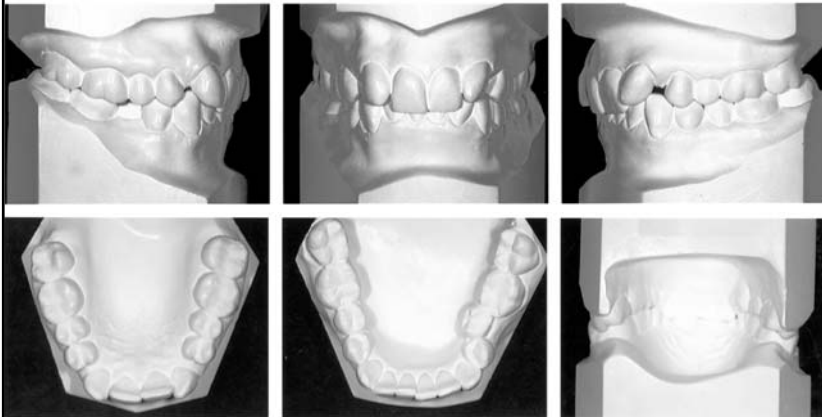

DIAGNOSIS & TREATMENT PLANNING

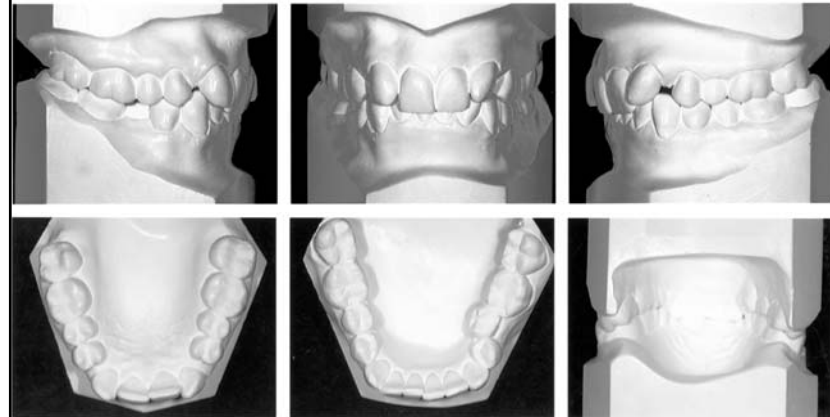ANALYSIS OF THE DENTITION & OCCLUSION

-BOLTON ANALYSIS

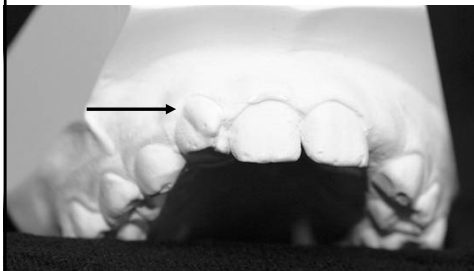-SPACE ANALYSIS

-MIXED DENTITION ANALYSIS

DENTAL CASTS

| TEETH | -number -size -morphology -position -inclination | DENTAL ARCH | -shape -symmetry -midlines | OCCLUSION | -sagittal -vertical -transverse |
| | | PALATAL VAULT | -depth -width | | |

DENTAL CASTS

TEETH -number -size -morphology

2

TEETH SHAPE / SIZE

PEG LIKE LATERAL INCISOR

CUSP OF CARABELLI

FACTORS AFFECTING OCCLUSION

fusion

peg lateral

taurodontia

4
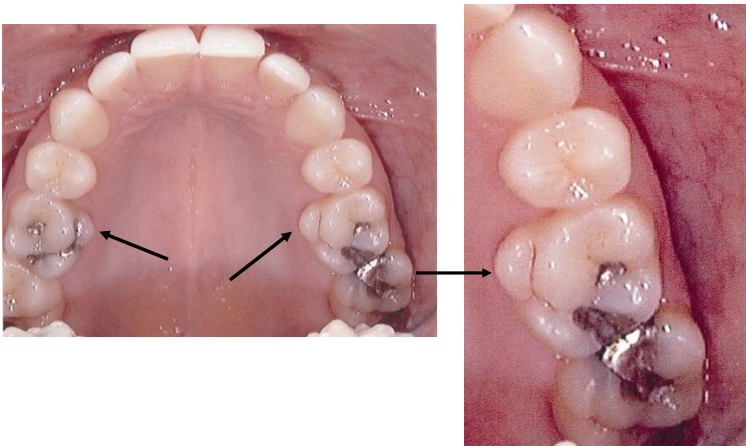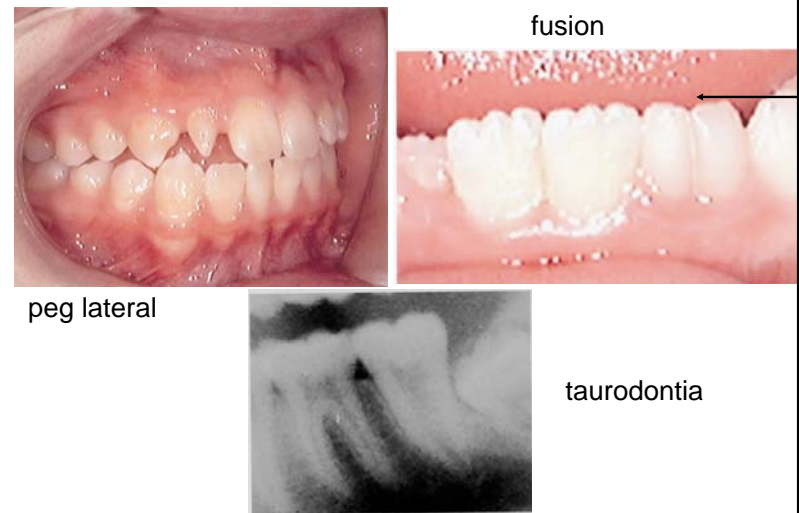
BALANCE

BETWEEN THE MESIODISTAL DIAMETER

(SIZE)

OF MAXILLARY & MANDIBULAR TEETH

BOLTON TOOTH RATIO ANALYSIS

Over-all Ratio

$$\frac{\text{Sum mandibular 12\_\_\_\_mm.}}{\text{Sum maxillary \quad 12\_\_\_\_mm.}} = \underline{\quad\quad} \times 100 = \underline{\quad\quad} \%$$

Over-all ratio

Mean 91.3 + 0.26
S. D. (σ) 1.91
Range 87.5 - 94.8

Maxillary 12	Mandibular 12	Maxillary 12	Mandibular 12	Maxillary 12	Mandibular 12
86	77.6	94	85.8	103	94.0
86	78.5	95	86.7	104	95.0
87	79.4	96	87.6	105	95.9
88	80.3	97	88.6	106	96.8
89	81.3	98	89.5	107	97.8
90	82.1	99	90.4	108	98.6
91	83.1	100	91.3	109	99.5
92	84.0	101	92.2	110	100.4
93	84.9	102	93.1		

Patient Analysis

If the over-all ratio exceeds 91.3 the discrepancy is in excessive mandibular arch length. In above chart locate the patient's maxillary 12 measurement and opposite it is the correct mandibular measurement. The difference between the actual and correct mandibular measurement is the amount of excessive mandibular arch length.

$$\overline{\text{Actual mandibular 12}} - \overline{\text{Correct mandibular 12}} = \overline{\text{Excess mandibular 12}}$$

If over-all ratio is less than 91.3:

$$\overline{\text{Actual maxillary 12}} - \overline{\text{Correct maxillary 12}} = \overline{\text{Excess maxillary 12}}$$

Anterior Ratio

$$\frac{\text{Sum mandibular 6\_\_\_\_mm.}}{\text{Sum maxillary \quad 6\_\_\_\_mm.}} = \underline{\quad\quad} \times 100 = \underline{\quad\quad} \%$$

Anterior ratio

Mean 77.2 + 0.22
S. D. (σ) 1.65
Range 74.5 - 80.4

Maxillary 6	Mandibular 6	Maxillary 6	Mandibular 6	Maxillary 6	Mandibular 6
40.0	30.9	45.5	35.1	50.5	39.0
40.5	31.3	46.0	35.5	51.0	39.4
41.0	31.7	46.5	35.9	51.5	39.8
41.5	32.0	47.0	36.3	52.0	40.1
42.0	32.4	47.5	36.7	52.5	40.5
42.5	32.8	48.0	37.1	53.0	40.9
43.0	33.2	48.5	37.4	53.5	41.3
43.5	33.6	49.0	37.8	54.0	41.7
44.0	34.0	49.5	38.2	54.5	42.1
44.5	34.4	50.0	38.6	55.0	42.5
45.0	34.7				

Patient Analysis

If anterior ratio exceeds 77.2:

$$\overline{\text{Actual mandibular 6}} - \overline{\text{Correct mandibular 6}} = \overline{\text{Excess mandibular 6}}$$

If anterior ratio is less than 77.2:

$$\overline{\text{Actual maxillary 6}} - \overline{\text{Correct maxillary 6}} = \overline{\text{Excess maxillary 6}}$$
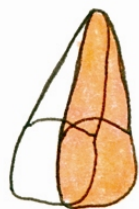
DENTAL CASTS
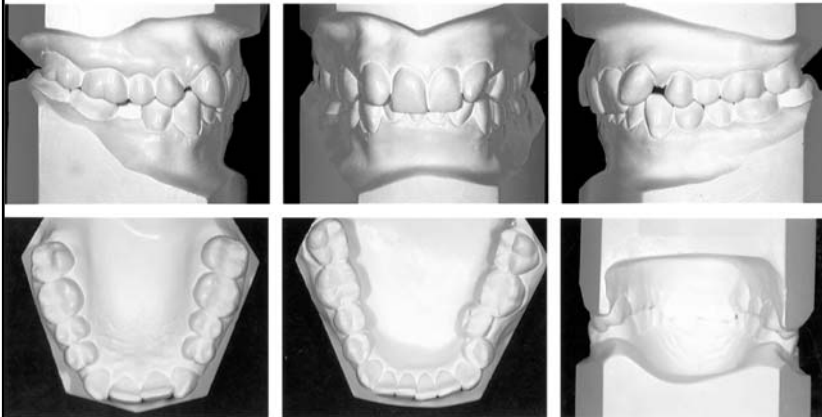
TEETH -position
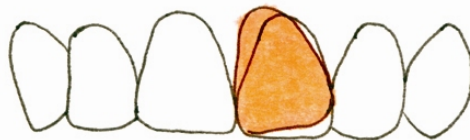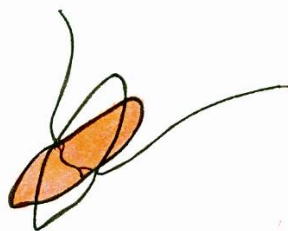-inclination

TOOTH POSITION
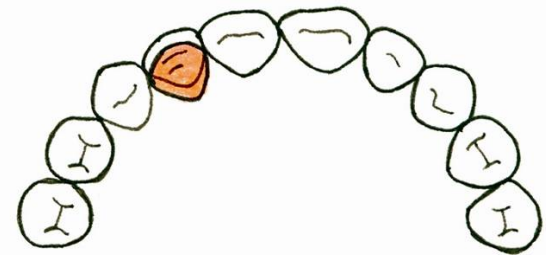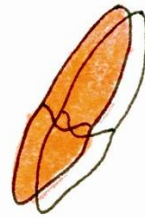
First order-labiolingual

TOOTH INCLINATION
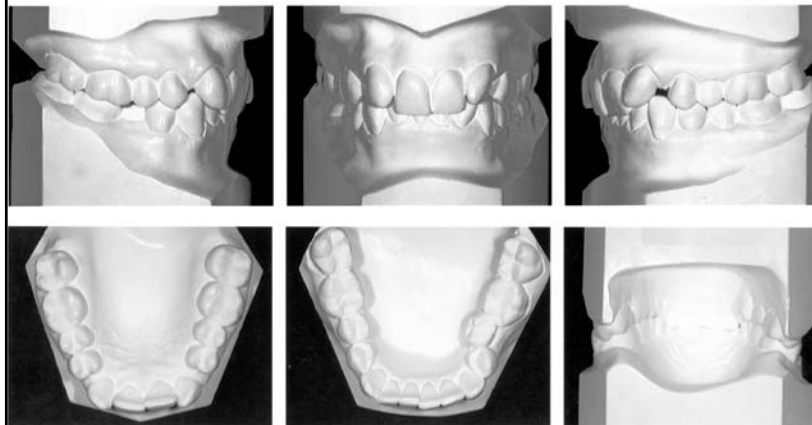
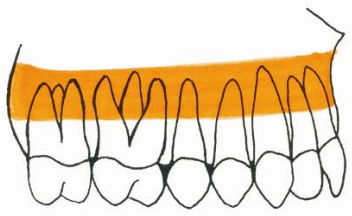Second order-mesiodistal

third order-labiolingual-torque
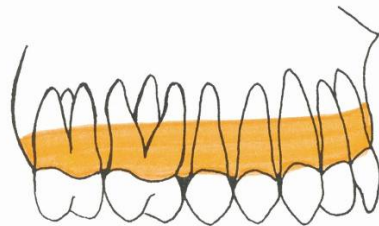
DENTO ALVEOLAR RELATIONSHIPS

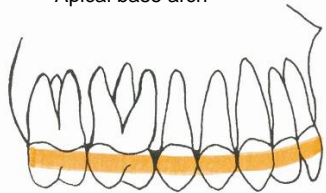DIFFERENCES BETWEEN **BASAL** ARCHES AND **DENTAL** ARCHES

DENTO-ALVEOLAR RELATIONSHIPS
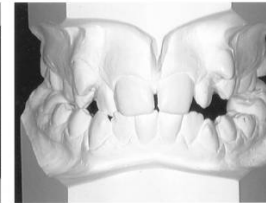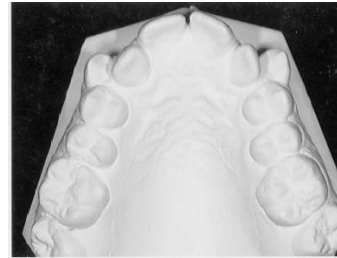
Apical base arch

Alveolar arch

Dental arch

APICAL BASE SIZES VERSUS DENTAL ARCH SIZES
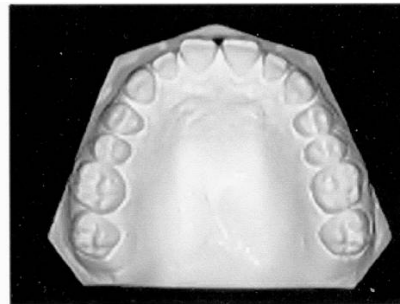
CROWDING CONSTRICTED MAXILLARY ARCH BROAD MANDIBULAR ARCH

CROWDING   SPACING

FORSYTH DENTAL CENTER - HARVARD SCHOOL OF DENTAL MEDICINE
Assessment of Available Space

Maxilla						Mandible					
MESIODISTAL CROWN DIAMETERS						**MESIODISTAL CROWN DIAMETERS**					
	Observed Value	Mean*	Difference	S. D.	Standard Score		Observed Value	Mean*	Difference	S. D.	Standard Score
DECIDUOUS dc		6.7		0.4		DECIDUOUS dc		5.7		0.4	
dm$_1$		7.0		0.4		dm$_1$		7.7		0.4	
dm$_2$		8.8		0.6		dm$_2$		9.6		0.5	
SUM:						SUM:					
PERMANENT I$_1$		8.4		0.5		PERMANENT I$_1$		5.3		0.4	
I$_2$		6.5		0.6		I$_2$		5.8		0.4	
SUM:						SUM:					
C		7.5		0.4		C		6.5		0.3	
Pm$_1$		6.9		0.4		Pm$_1$		6.9		0.4	
Pm$_2$		6.6		0.4		Pm$_2$		7.0		0.4	
SUM:						SUM:					
TOTAL:						TOTAL:					

ARCH CIRCUMFERENCE

CORRECTED ARCH CIRCUMFERENCE

LACK/EXCESS OF AVAILABLE SPACE

* Moorrees, et al., J. Dent. Research, 36: 39-47, 1957.

FORSYTH DENTAL CENTER - HARVARD SCHOOL OF DENTAL MEDICINE
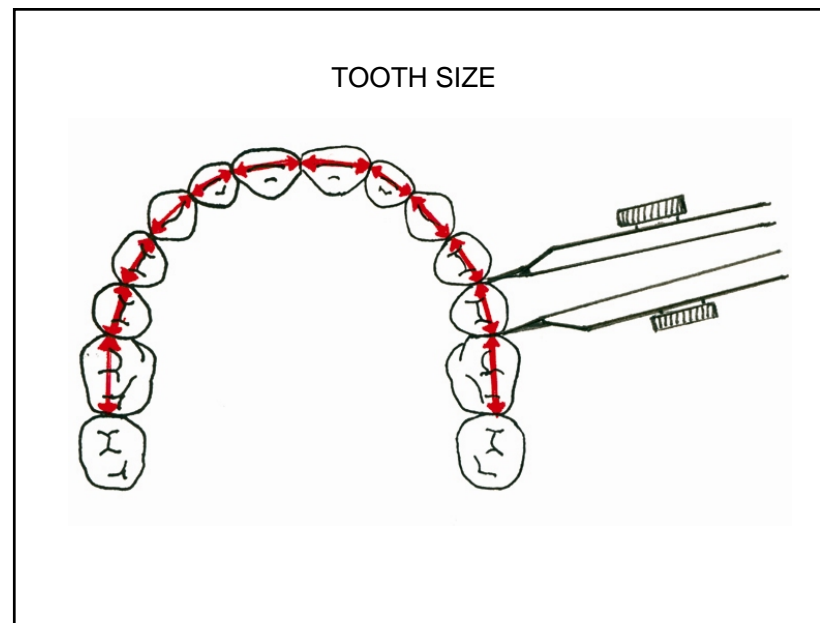
Assessment of Available Space

Maxilla

MESIODISTAL CROWN DIAMETERS

		Observed Value	Mean *	Difference	S. D.	Standard Score
DECIDUOUS	dc		6.9		0.4	
	dm$_1$		7.1		0.4	
	dm$_2$		9.1		0.5	
SUM:						
PERMANENT	I$_1$		8.8		0.5	
	I$_2$		6.6		0.6	
SUM:						
	C		8.0		0.4	
	Pm$_1$		7.0		0.4	
	Pm$_2$		6.8		0.4	
SUM:						
TOTAL:						

ARCH CIRCUMFERENCE

CORRECTED ARCH CIRCUMFERENCE

LACK/EXCESS OF AVAILABLE SPACE

Mandible

MESIODISTAL CROWN DIAMETERS

		Observed Value	Mean *	Difference	S. D.	Standard Score
DECIDUOUS	dc		5.9		0.3	
	dm$_1$		7.8		0.4	
	dm$_2$		9.8		0.5	
SUM:						
PERMANENT	I$_1$		5.4		0.3	
	I$_2$		6.0		0.4	
SUM:						
	C		7.0		0.4	
	Pm$_1$		7.1		0.4	
	Pm$_2$		7.3		0.5	
SUM:						
TOTAL:						

ARCH CIRCUMFERENCE

CORRECTED ARCH CIRCUMFERENCE

LACK/EXCESS OF AVAILABLE SPACE

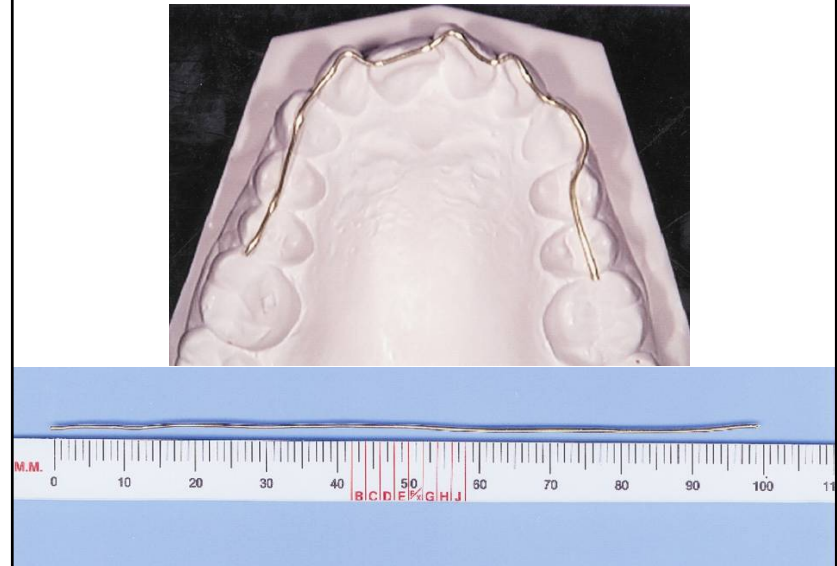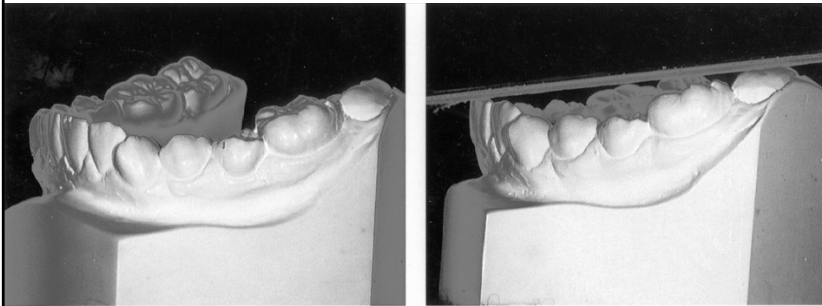Moorrees, et al., J. Dent. Research, 36: 39-47, 1957.

TOOTH SIZE

ARCH PERIMETER

ARCH CIRCUFERENCE
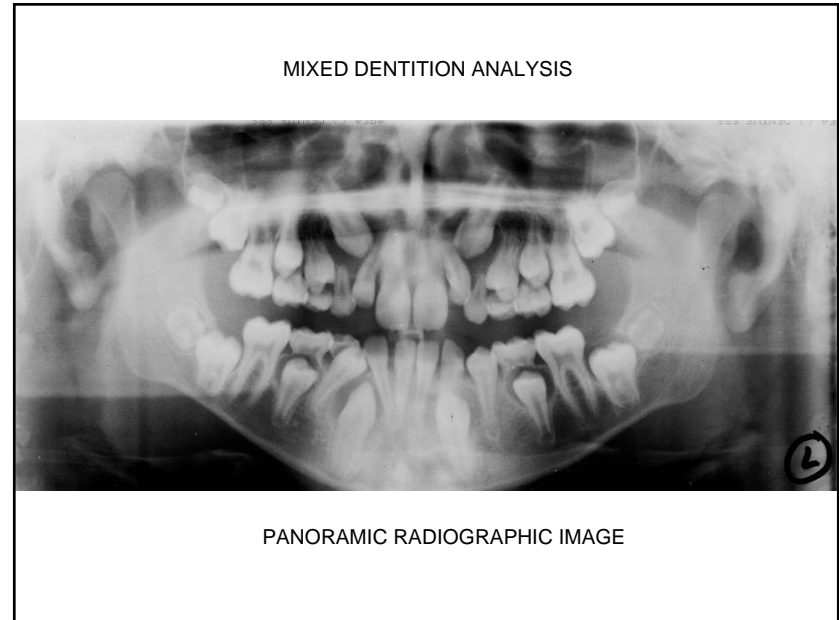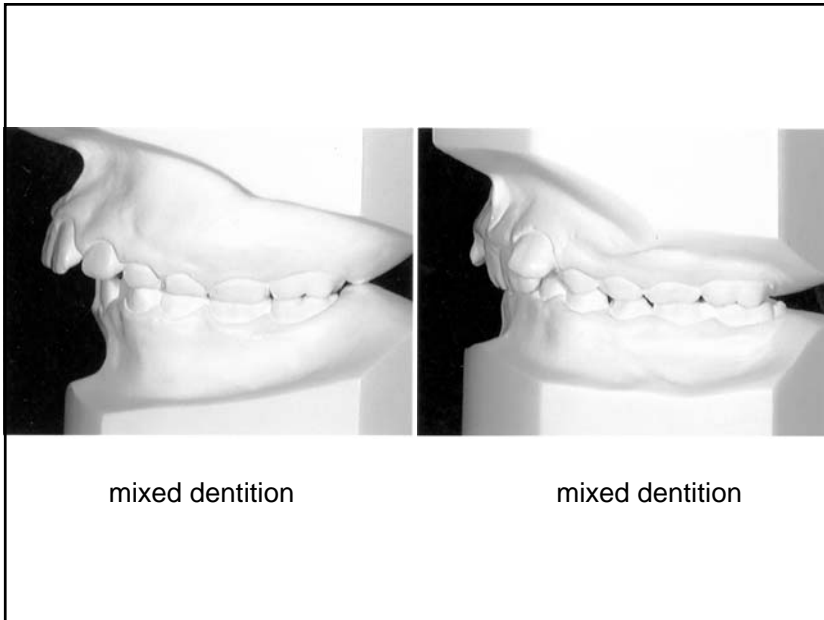
CURVE OF SPEE

MIXED DENTITION ANALYSIS

-Estimate of the size of permanent canines and premolars
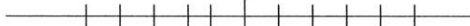-Estimate of the available space in permanent dentition

mixed dentition

mixed dentition

MIXED DENTITION ANALYSIS

PANORAMIC RADIOGRAPHIC IMAGE

MIXED DENTITION ANALYSIS

Patient_____ Age_____ years_____ months Sex_____

Date_____ Address_____ Parent_____

Tooth Size

Upper

	Right	Left
Space left for Alignment of 2 and 1		
Predicted size of 3 + 4 + 5		
Space left for molar adjustment		

Lower

	Right	Left
Space left after Alignment of 2 and 1		
Predicted size of 3 + 4+ + 5		
Space left for molar adjustment		

Remarks: Overjet = _____   Overbite = _____
Molar Relationship = _____

Remarks = _____

CURVE OF SPEE

14
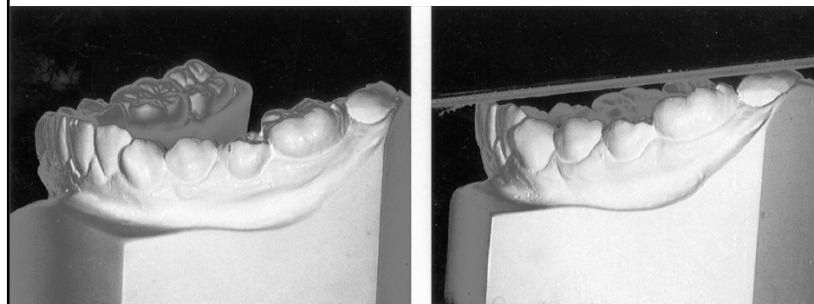
MOYERS MIXED DENTITION ANALYSIS

**PROBABILITY CHART FOR PREDICTING THE SUM OF THE WIDTHS OF 345 FROM 21|12**

21|12 =	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0
95%	21.6	21.8	22.1	22.4	22.7	22.9	23.2	23.5	23.8	24.0	24.3	24.6
85%	21.0	21.3	21.5	21.8	22.1	22.4	22.6	22.9	23.2	23.5	23.7	24.0
75%	20.6	20.9	21.2	21.5	21.8	22.0	22.3	22.6	22.9	23.1	23.4	23.7
65%	20.4	20.6	20.9	21.2	21.5	21.8	22.0	22.3	22.6	22.8	23.1	23.4
50%	20.0	20.3	20.6	20.8	21.1	21.4	21.7	21.9	22.2	22.5	22.8	23.0
35%	19.6	19.9	20.2	20.5	20.8	21.0	21.3	21.6	21.9	22.1	22.4	22.7
25%	19.4	19.7	19.9	20.2	20.5	20.8	21.0	21.3	21.6	21.9	22.1	22.4
15%	19.0	19.3	19.6	19.9	20.2	20.4	20.7	21.0	21.3	21.5	21.8	22.1
5%	18.5	18.8	19.0	19.3	19.6	19.9	20.1	20.4	20.7	21.0	21.2	21.5

PROBABILITY CHART FOR PREDICTING THE SUM OF THE WIDTHS OF 345 FROM 21|12

21|12 =	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0
95 %	21.1	21.4	21.7	22.0	22.3	22.6	22.9	23.2	23.5	23.8	24.1	24.4
85%	20.5	20.8	21.1	21.4	21.7	22.0	22.3	22.6	22.9	23.2	23.5	23.8
75%	20.1	20.4	20.7	21.0	21.3	21.6	21.9	22.2	22.5	22.8	23.1	23.4
65%	19.8	20.1	20.4	20.7	21.0	21.3	21.6	21.9	22.2	22.5	22.8	23.1
50%	19.4	19.7	20.0	20.3	20.6	20.9	21.2	21.5	21.8	22.1	22.4	22.7
35%	19.0	19.3	19.6	19.9	20.2	20.5	20.8	21.1	21.4	21.7	22.0	22.3
25%	18.7	19.0	19.3	19.6	19.9	20.2	20.5	20.8	21.1	21.4	21.7	22.0
15%	18.4	18.7	19.0	19.3	19.6	19.8	20.1	20.4	20.7	21.0	21.3	21.6
5%	17.7	18.0	18.3	18.6	18.9	19.2	19.5	19.8	20.1	20.4	20.7	21.0

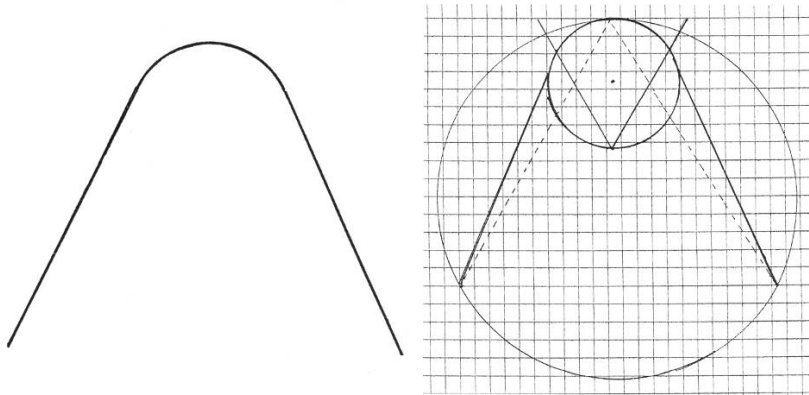## DENTAL CASTS
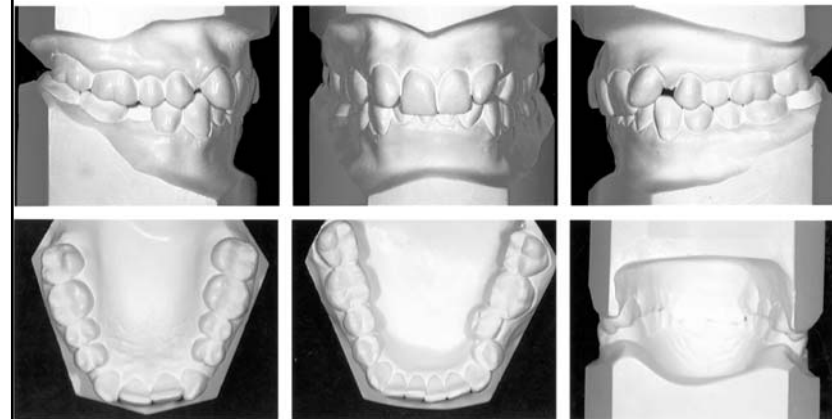
DENTAL ARCH
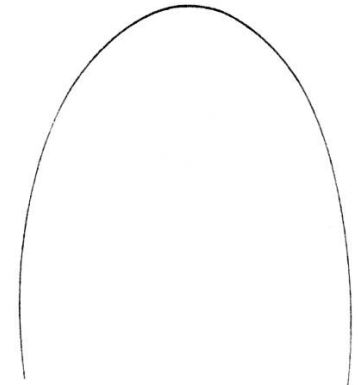-shape
-symmetry
-midlines

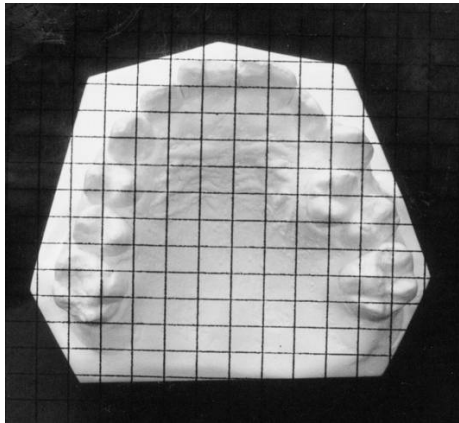Bonwill-Hawley Arch Form

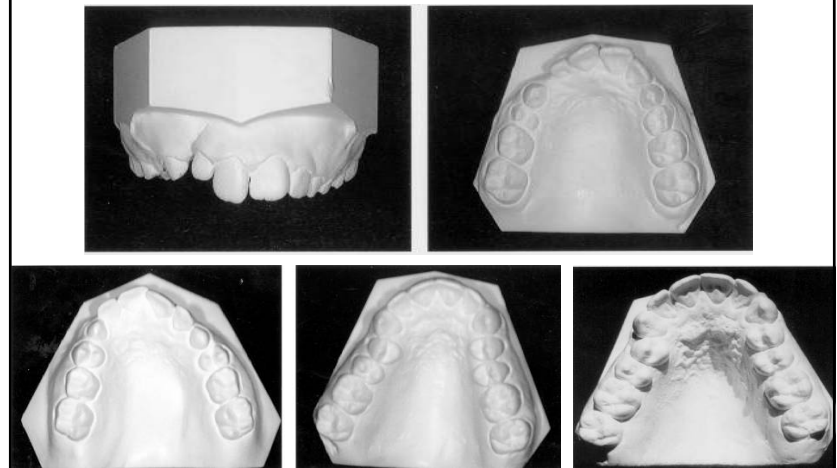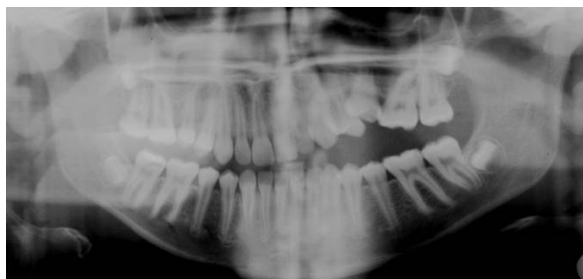Catenary Curve   Brader Arch Form
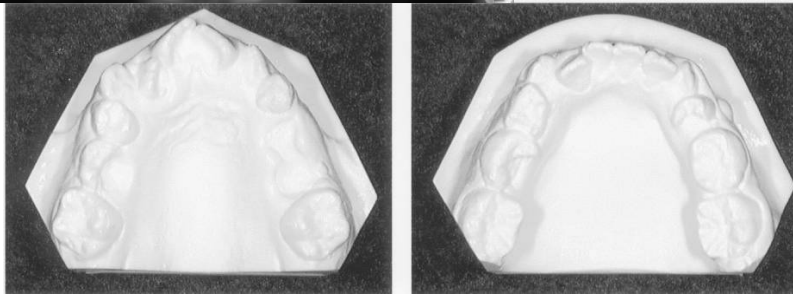
SYMMETOGRAPH

ASYMMETRY

Asymmetry (ankylosis)

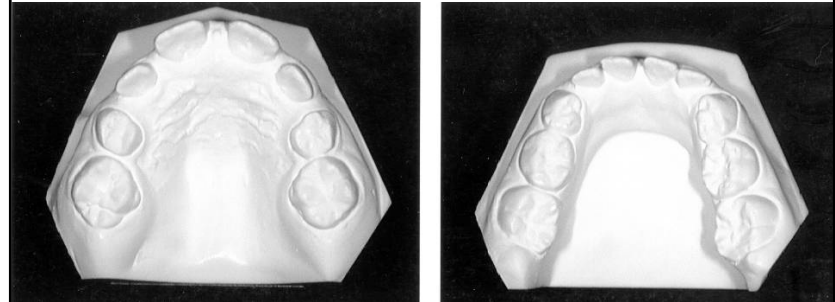
Asymmetry (ectopic eruption)

ASYMMETRY (SPACE LOSS)

Interproximal caries

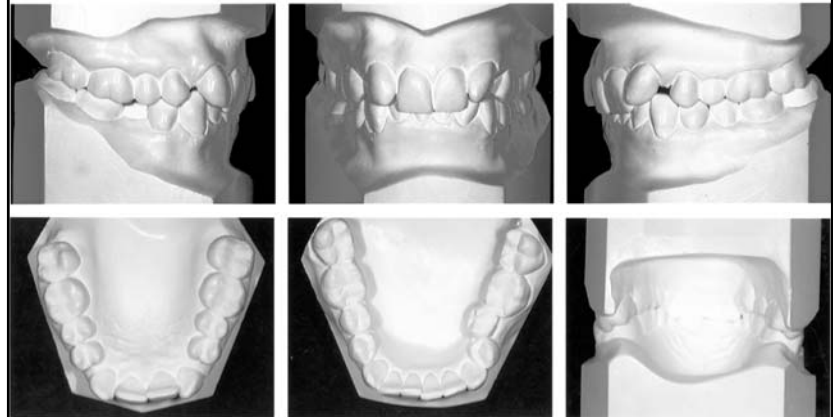ASYMMETRY

(SPACE LOSS)

Early extraction of deciduous teeth

ASYMMETRY

Midline discrepancy

congenittally missing teeth

DENTAL CASTS

OCCLUSION
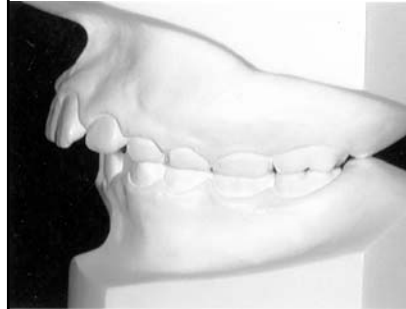-sagittal
-vertical
-transverse

CLASS I (Angle)
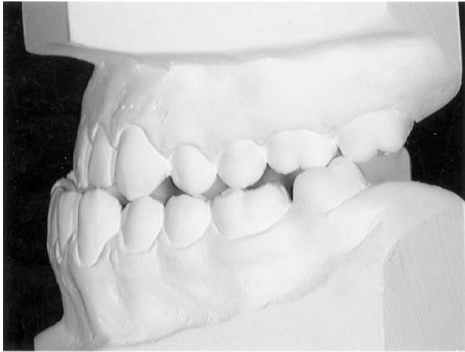
sagittal plane

Class II division 1 (Angle)   Class II division 2 (Angle)

sagittal

mixed dentition   mixed dentition

Class III (Angle)

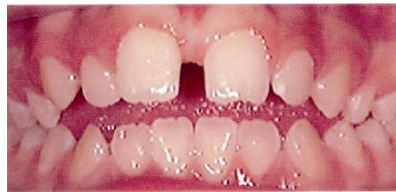
sagittal

permanent dentition

VERTICAL PLANE

DEEP OVERBITE

VERTICAL PLANE

ANTERIOR OPEN BITE

VERTICAL PLANE

open bite malocclusion

midline deviation
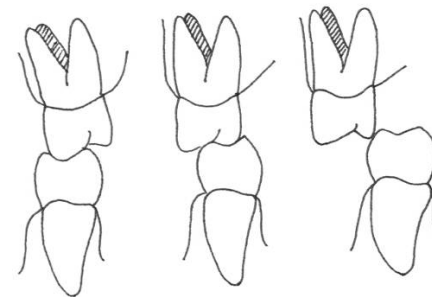
asymmetric open bite

habit ?

VERTICAL MALOCCLUSION

POSTERIOR OPEN BITE

TRANSVERSE RELATIONSHIP

cross bite

TRANSVERSE   RELATIONSHIP

posterior bilateral cross bite   anterior cross bite
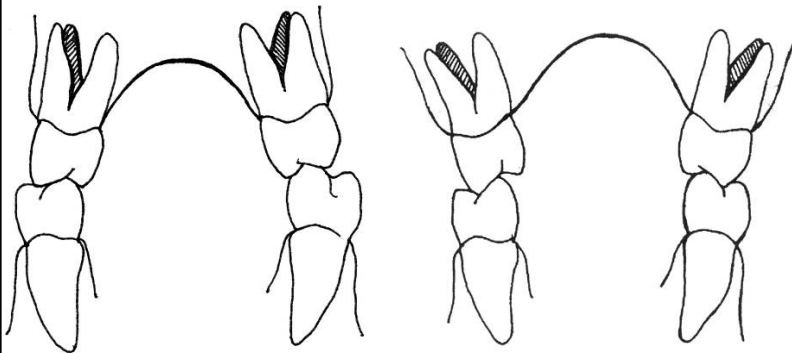

TRANSVERSE RELATIONSHIP

FUNCTIONAL SHIFT

TRANSVERSE RELATIONSHIP

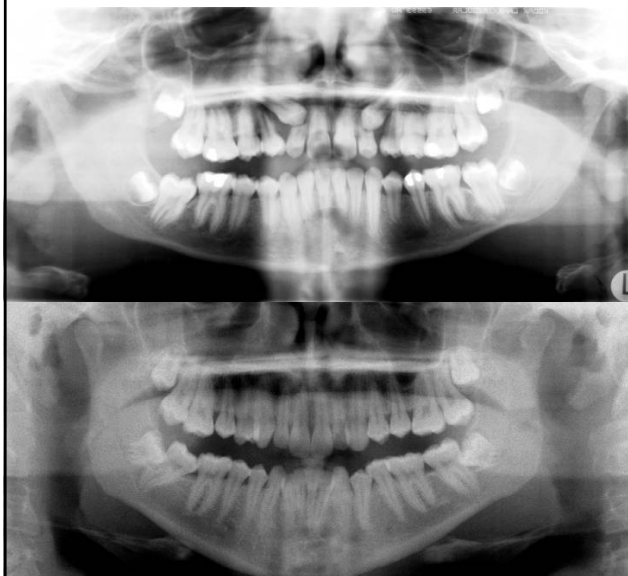large mandibular arch   narrow maxillary arch

CROSS BITE

MORE FACTORS AFFECTING OCCLUSION

TEETH POSITION & INCLINATION

impacted
maxillary canines

impacted
third molars

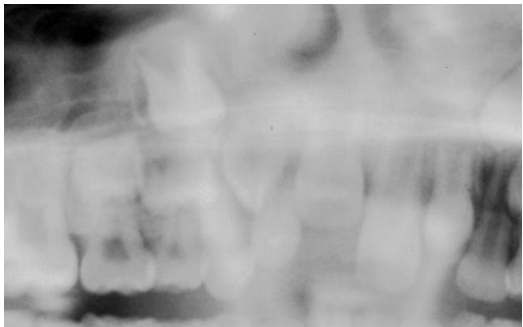TEETH SIZE / MORPHOLOGY

small teeth

FACTORS AFFECTING OCCLUSION
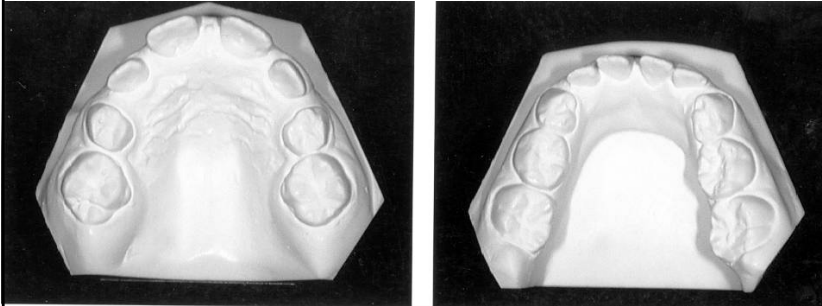

agenesis

FACTORS AFFECTING OCCLUSION

supernumerary teeth

crowding

MIXED DENTITION

CROWDING

Factors affecting occlusion

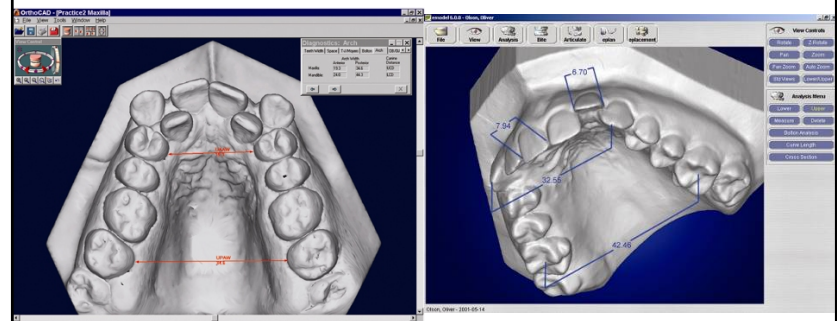Premature loss of deciduous teeth

ASYMMETRY
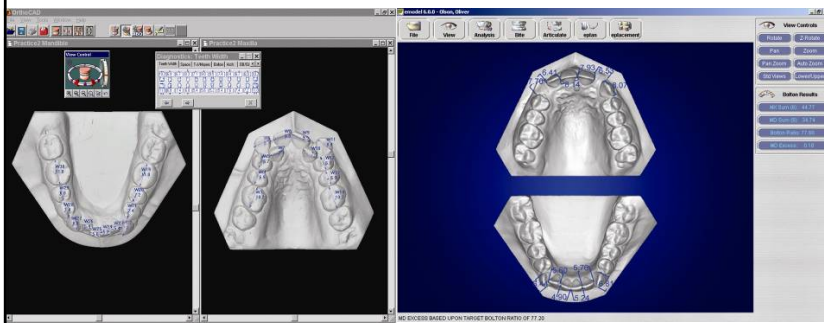

condyle morphology affecting one side

ASYMMETRY

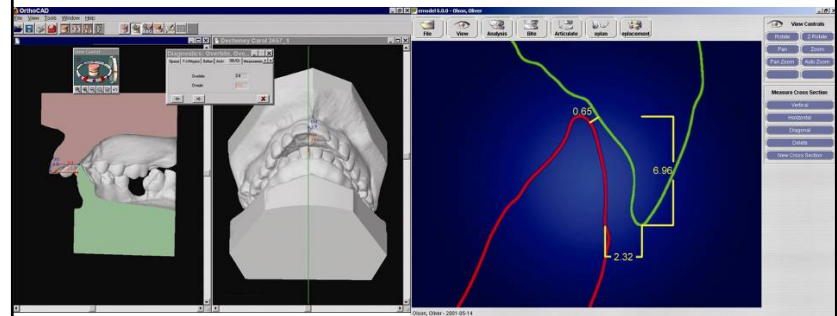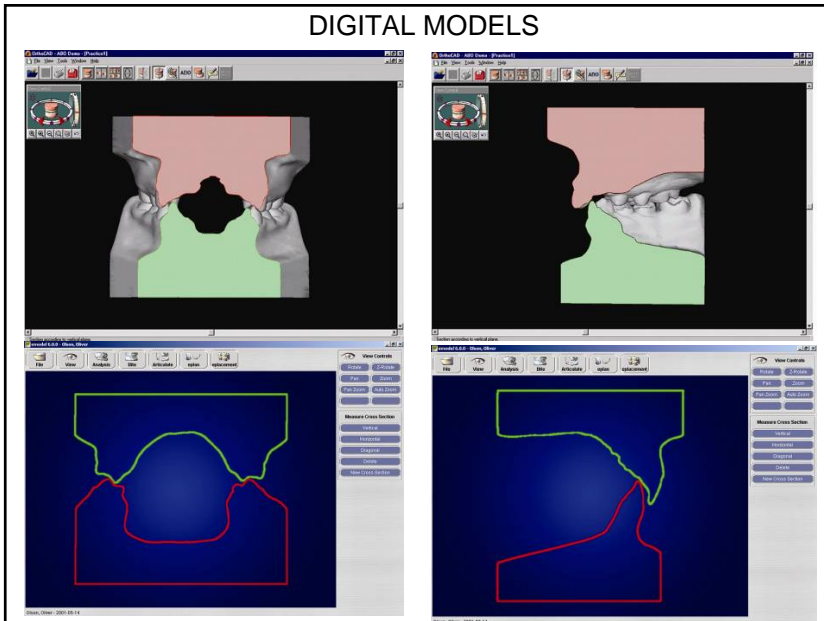
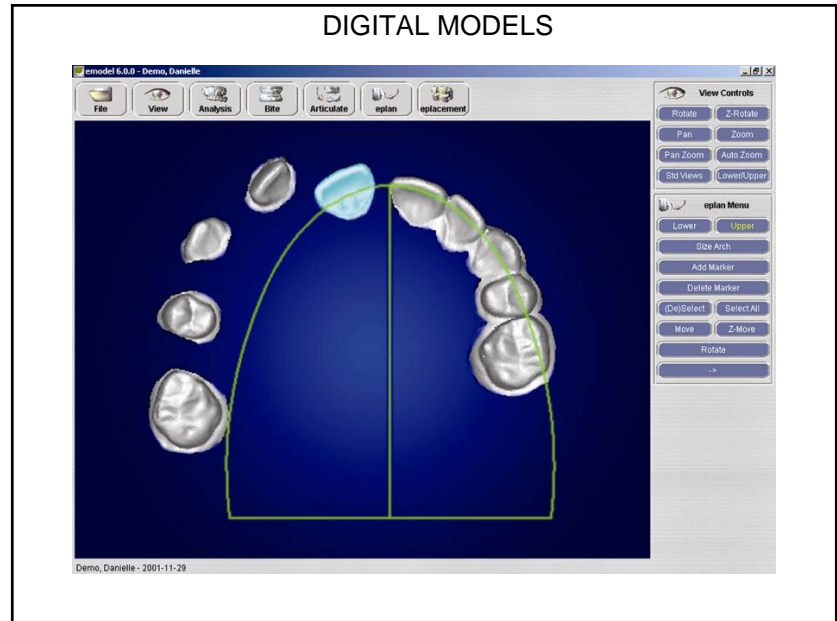hyperplasia of mandible affecting one side

DIGITAL MODELS
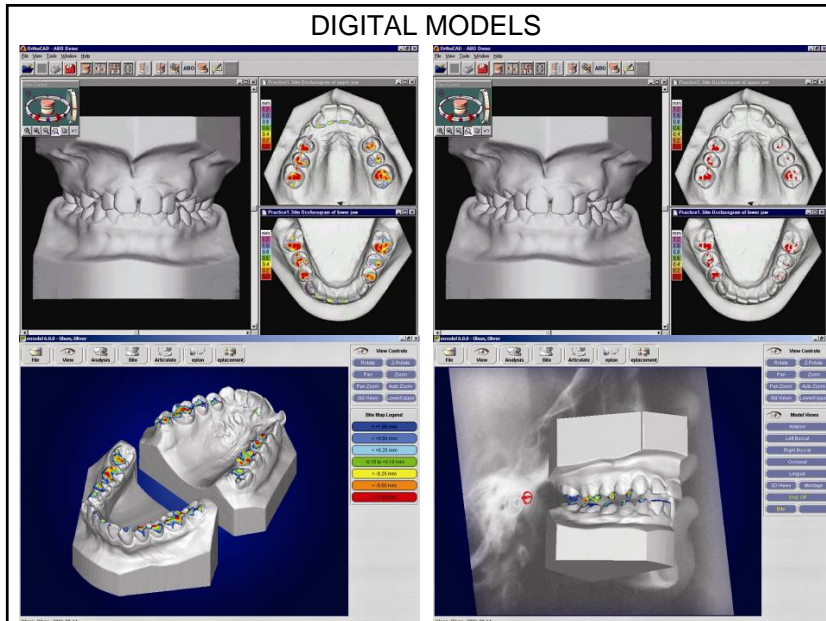
DIGITAL MODELS

DIGITAL MODELS

DIGITAL MODELS

DIGITAL MODELS

DIGITAL MODELS

BOLTON ANALYSIS OF TOOTH-SIZE DISCREPANCIES *

ANTERIOR RATIO

Sum mandibular 6 ____ mm.

Sum maxillary 6 ____ mm.

= _____ × 100 = _____ %

Anterior ratio

Mean: 77.2 ± 0.22
S.D.: 1.65
Range: 74.5 - 80.4

Maxillary 6	Mandibular 6	Maxillary 6	Mandibular 6	Maxillary 6	Mandibular 6
40.0	30.9	45.5	35.1	50.5	39.0
40.5	31.3	46.0	35.5	51.0	39.4
41.0	31.7	46.5	35.9	51.5	39.8
41.5	32.0	47.0	36.3	52.0	40.1
42.0	32.4	47.5	36.7	52.5	40.5
42.5	32.8	48.0	37.1	53.0	40.9
43.0	33.2	48.5	37.4	53.5	41.3
43.5	33.6	49.0	37.8	54.0	41.7
44.0	34.0	49.5	38.2	54.5	42.1
44.5	34.4	50.0	38.6	55.0	42.5
45.0	34.7				

PATIENT ANALYSIS

If anterior ratio exceeds 77.2:

_____ - _____ = _____
Actual   Correct   Excess
mandibular 6   mandibular 6   mandibular 6

If anterior ratio is less than 77.2:

_____ - _____ = _____
Actual   Correct   Excess
maxillary 6   maxillary 6   maxillary 6

*Am. J. Orthodontics, 48: 504-529, 1962.

DENTAL CASTS

TEETH
-number
-size
-morphology
-position
-inclination

DENTAL ARCH
-shape
-symmetry
-midlines
PALATAL VAULT

OCCLUSION
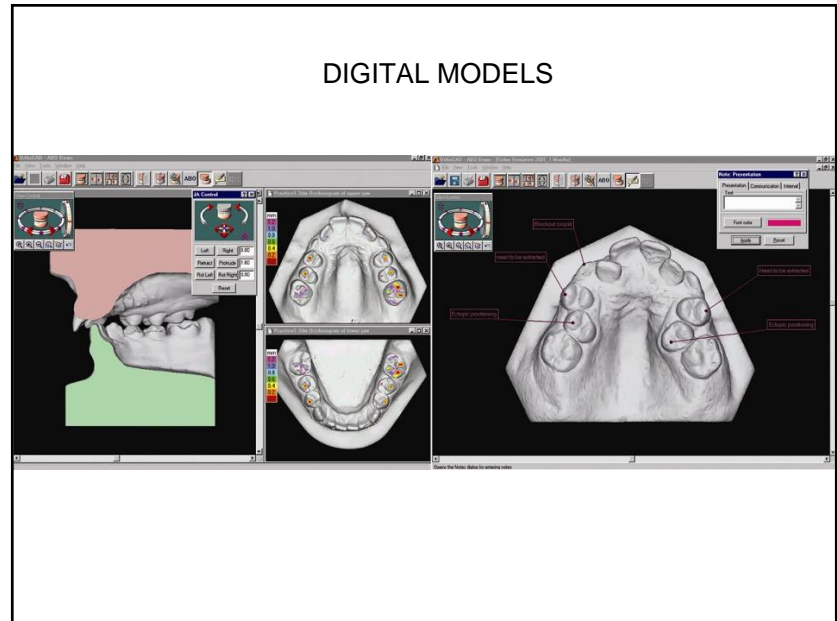-sagittal
-vertical
-tranverse

Figure 13-8

Figure 13-71   Figure 13-72

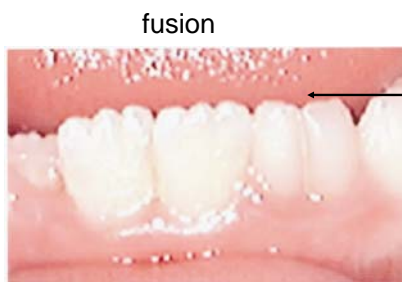Figure 13-7

Figure 13-10

Figure 13-11

FACTORS AFFECTING OCCLUSION

fusion

peg lateral

taurodontia

VERTICAL MAXILLARY EXCESS

"gummy smile"

short teeth ?

upper thin lip