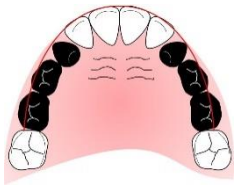
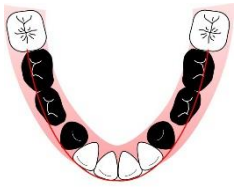
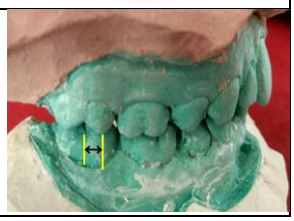
Patient name: Age/ sex: Date: Registration no.:

MIXED DENTITION ANALYSES

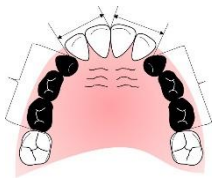
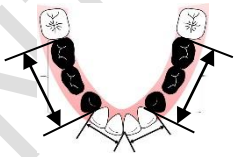
While it must not be supposed that variations from normal occlusion can be measured accurately and that orthodontic diagnosis can be based upon mathematical calculations, nevertheless, the ability to predetermine arch size, within limits is a useful diagnostic aid. *.....JOHN STIFTER; Angle Orthodontist,28(4):1958*

Instructions: -The format is prepared for the mobile app "Ortho Assistant"
-Fill in the values in millimeters only.
- Huckaba analysis needs apparent width of teeth from IOPA X rays.
- Cephalometric mixed dentition analyses and Bolton anterior ratio use width of the unerupted teeth according to Huckaba's method
- Vernier caliper is preferable for measurements on cast or radiographs.

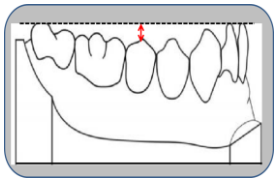
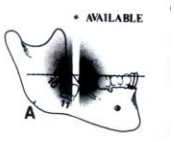
1. Cast measurements:

Tooth	***Maxillary***		***Mandibular***	
Permanent Central incisor	Left	Right	Left	Right
Permanent Lateral incisor	Left	Right	Left	Right
Permanent 1st molar	Left	Right	Left	Right
Primary canine	Left	Right	Left	Right
Primary 1st molar	Left	Right	Left	Right
Primary 2nd molar	Left	Right	Left	Right
Maxillary Space available From mesiobuccal line angle of the permanent 1st molar to the mesiobuccal line angle of the opposite permanent 1st molar along the buccal cusps of posterior teeth and incisal edges of anterior teeth on the basal bone (if incisors are proclined- from cingulum; retroclined- from labial surface)				
Mandibular Space available From mesiobuccal line angle of the permanent 1st molar to the mesiobuccal line angle of the opposite permanent 1st molar along the buccal cusps of posterior teeth and incisal edges of anterior teeth on the basal bone				
Distance between cusp tip of mesio-buccal cusp of maxillary permanent first molar to bucco- developemental groove of mandibular first permanent molar (in case of flush terminal plane only, for late mesial shift OR to move mandibular 1st permanent molar into class I relation)	Left	Right		

Patient name: Age/ sex: Date: Registration no.:

Available space Maxilla (SEGMENTAL) **Incisor space** Between midline to mesial point of primary canine/ distal point of permanent lateral incisor (including interdental spaces and primate spaces if any) **Available space Maxilla (SEGMENTAL)** **Buccal segment** Between the mesial point of primary canine/ distal point of permanent lateral incisor *(should be the same as chosen for incisor space available)* to mesial of the permanent first molar	Maxillary Left Right Total 
Available space Mandible (SEGMENTAL) **Incisor space** Between midline to mesial point of primary canine/ distal point of permanent lateral incisor (including interdental spaces if any) **Available space Mandible (SEGMENTAL)** **Buccal segment** Between the mesial point of primary canine/ distal point of permanent lateral incisor *(should be the same as chosen for incisor space available; including primate space if any)*	Mandibular Left Right Total  Left Right

2. Space available measurements on MANDIBULAR arch for Total Space Analysis:

Anterior segment		
Space available: Arch length from MB cusp of mandibular primary 1st molar to the MB cusp of opposite mandibular primary 1st molar		
Middle segment		
Space available: Arch length from MB cusp of the primary 1st molar to the DB cusp of permanent 1st molar	Right Left	
Curve of spee: Maximum perpendicular distance between the buccal cusp tips of the mandibular teeth and a measurement plane described by the central incisor and the distal cusp tip of the most posterior tooth in the mandibular arch	Right Left	
Posterior segment		
Presently available space: Distal surface of the permanent 1st molar to the anterior border of the ramus on occlusal plane on lat. Ceph **or** on the cast optionally)	Right Left	 

Patient name: Age/ sex: Date: Registration no.:

3. Radiographic (apparent) measurement for Huckaba's analysis:

Tooth	***Maxillary***		***Mandibular***	
Permanent Canine	Left	Right	Left	Right
1st Premolar	Left	Right	Left	Right
2nd Premolar	Left	Right	Left	Right
Primary 2nd molar	Left	Right	Left	Right
Permanent 1st molar	Left	Right	Left	Right
Permanent 2nd molar	Mandibular only		Left	Right
Permanent 3rd molar (Wheeler's value for if not visible in radiographs- 10mm)	Mandibular only		Left	Right

4. Transverse arch measurements:

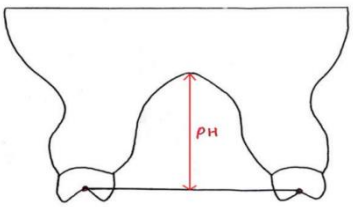
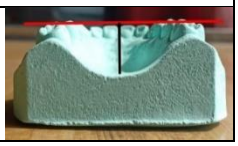
PONT'S ANALYSIS	
Measured premolar value (MPV)	
Width of the arch in the premolar region from the distal pit of the maxillary 1st premolar/ primary 1st molar to the distal pit of the opposite 1st premolar/ primary 1st molar	
Width of the arch in the premolar region between the distobuccal occlusal point angle of the right and left mandibular 1st premolars/ primary 1st molars	
Measured molar value (MMV)	
Width of the arch in the molar region between the mesial pit of the maxillary right and left permanent 1st molars	
Width of the arch in the molar region between the cusp tips of middle buccal cusp of right and left mandibular permanent 1st molars	

SCHWARZ ANALYSIS

Patient name: Age/ sex: Date: Registration no.:

Measured premolar value (MPV)	
Width of the arch in the premolar region between the distal pit of the left and right maxillary 1st premolars/ primary 1st molars	
Width of the arch in the premolar region from the interproximal contact between mandibular 1st & 2nd premolars/ primary 1st & 2nd molars on the left to the right side	
Measured molar value (MMV)	
Width of the arch in the molar region between the central fossa of maxillary right and left permanent 1st molars	
Width of the arch in the molar region between the Distal Buccal Cusp tip of right and left mandibular 1st molars	

5. Palatal Height/ Maxillary depth

Measured molar value (MMV) Width of the arch in the molar region between the mesial pit of the maxillary right and left permanent 1st molars	
Korkhaus Palatal height (1939)- Palatal height is measured as a vertical line perpendicular to the midpalatal raphe runs from the surface of the palate to the level of palatal plane, measured between the reference point of the Pont's index for posterior arch width. The vertical distance between depth of palate and occlusal surface at first molar region was measured using metallic scale and depth rod of digital Vernier caliper. The vertical distance between depth of first molar fissure and height of palatal cusp of first molar was subtracted from this distance to obtain the palatal height as described by Korkhaus. Adhikari D, Shrestha RM, Chand D, Acharya A. Comparison of Palatal Morphology in Angle's Class I and Class II Division 1 Malocclusions . J Nepal Dent Association 2020; Vol. 20 No. 1 (30): 28-31	
Maxillary depth Measured from a line which connects the occlusal plane up to the greatest palatal depth.	

RESULT PAGES

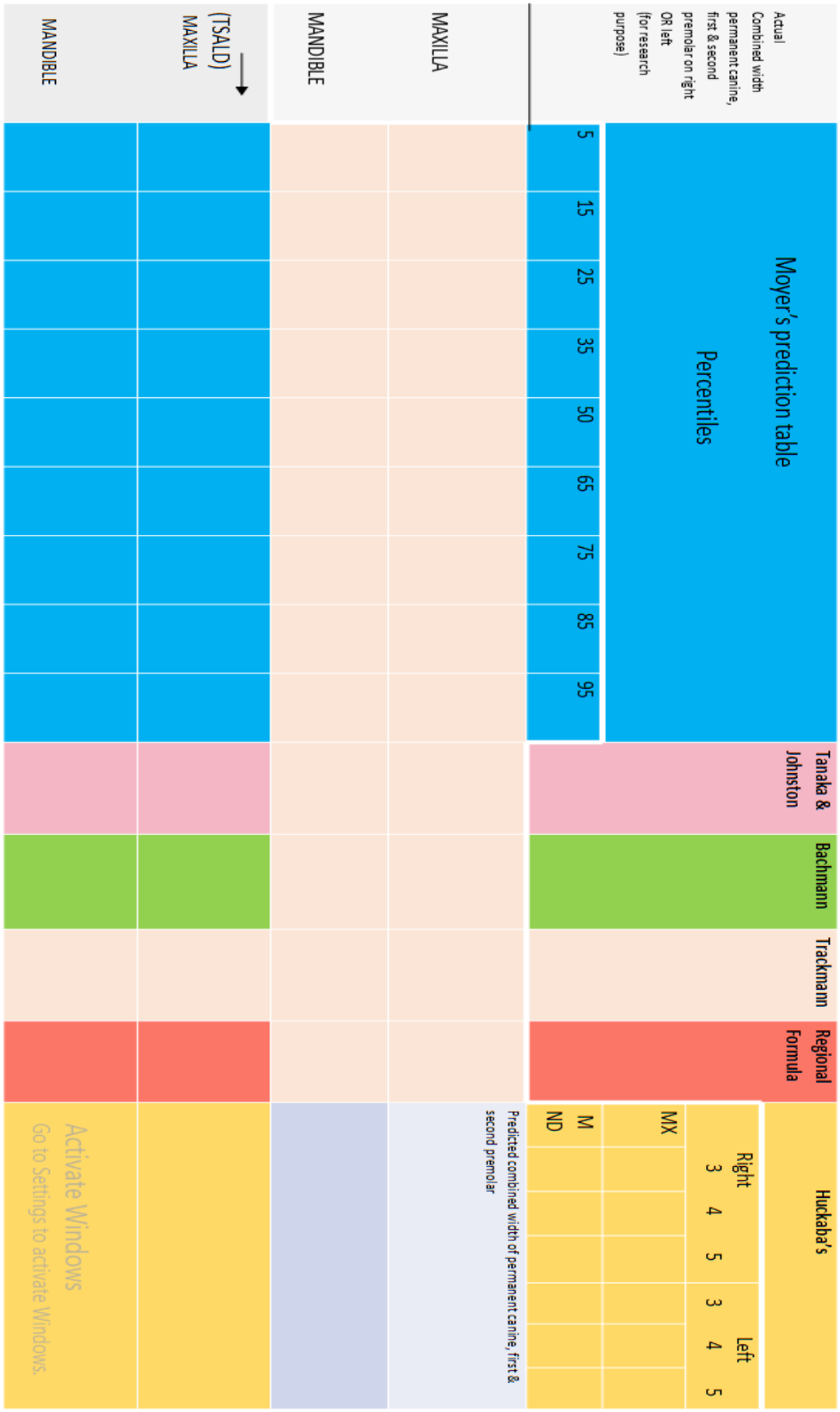
Descriptive Arch Analysis

- Always assess Maxillo-mandibular midline alignment and B/L symmetry of posterior occlusion. In case of midline not coinciding and B/L post. occlusion asymmetry, rule out functional mandibular shift first. If it is not, causes may be dental (tooth shift due to proximal caries) or skeletal (bone anomalies).

Patient name: Age/ sex: Date: Registration no.:

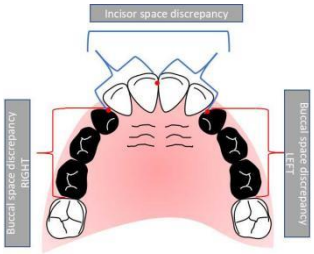
Patient name: Age/ sex: Date: Registration no.:

1. Comprehensive table for Mixed dentition analysis
Tooth size arch length discrepancy

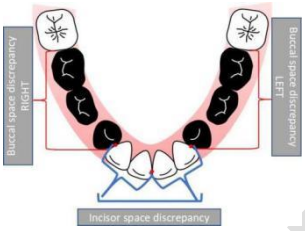


Patient name: Age/ sex: Date: Registration no.:

2. SEGMENTAL ARCH ANALYSIS



Predicted combined width of mandibular permanent cuspid and bicuspids (MAXILLA)			Buccal space discrepancy		Incisor space discrepancy	All total discrepancy
According to	right	left	right	left		
Moyer's (.....%)						
Tanaka & Johnston						
Huckaba's						
Fauda's						
Bachmann's						
Trankmann's						
Regional						



Predicted combined width of mandibular permanent cuspid and bicuspids (MANDIBLE)			Buccal space discrepancy		Incisor space discrepancy	All total discrepancy
According to	right	left	right	left		
Moyer's (.....%)						
Tanaka & Johnston						
Huckaba's						
Fauda's						
Bachmann's						
Trankmann's						
Regional						

Patient name: Age/ sex: Date: Registration no.:

3. Space available Vs Space need for erupting individual permanent in buccal segment

Maxillary right			Maxillary left		
E space	D space	C space	C space	D space	E space
2nd PM	1st PM	Perm Canine	Perm Canine	1st PM	2nd PM
Mandibular right			**Mandibular left**		
E space	D space	C space	C space	D space	E space
2nd PM	1st PM	Perm Canine	Perm Canine	1st PM	2nd PM

Patient name: Age/ sex: Date: Registration no.:

4. TRANSVERSE ARCH ANALYSIS

Pont's analysis			
	Maxilla	Mandible	Inference
Measured premolar value (MPV)			If the MPV/ MMV is less than CPV/ CMV, it indicates expansion is needed
Calculated premolar value (CPV)			
Discrepancy			
Measured molar value (MMV)			
Calculated molar value (CMV)			
Discrepancy			

Schwarz analysis			
	Maxilla	Mandible	Inference
Measured premolar value (MPV) (Actual)			***1. Discrepancy <4mm:*** *Straight wire may be adequate enough to develop the arches without the need for expansion appliances. If the* ***Discrepancy >4mm:*** *consider starting the case with expanders to quickly create Ideal Arch Forms and then finishing the case with Straight wire to simply align the teeth. When the* ***Discrepancy >10mm:*** *second expansion appliance per arch may be needed to gain all of the space required. These arches are severely constricted and treatment time is longer and more complex.* ***The discrepancy*** *can also help determine which arch needs expansion or if both arches need it. In many posterior crossbite cases the upper arch will be deficient and the lower arch will be close to ideal, so you may only need to expand the upper arch.* Schwarz Model analysis. Technical Bulletin. Ohlendorf appliance laboratory *2.* ***Discrepancy <4mm:*** *No extraction, space supervision, arch development* ***Discrepancy 5-9mm:*** *arch development, extraction of some teeth* ***Discrepancy >10mm:*** *almost always require extraction of premolars or 2nd molars* The Schwarz Model Analysis. The practice building bulletin. Vol IV, Issue XX.
Calculated premolar value (CPV) (Should be)			
Discrepancy			
Measured molar value (MMV) (Actual)			
Calculated molar value (CMV) (Should be)			
Discrepancy			

Patient name: Age/ sex: Date: Registration no.:

5. Palatal Height Index; Palatal/ Maxillary - Height/ Depth

Palatal height index

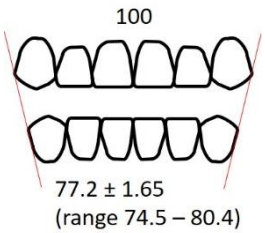
Patient's	Inference
	Korkhaus >42% = High Palate <42% = Shallow Palate Low palate: if the values were ≤27.9%. Medium palate: if the values ranged between 28.0 and 39.9%. High palate: if the values were greater than 40.0% (Maria, C.M.; Silva, A.M.; Busanello-Stella, A.R.; Bolzan, G.P.; Berwig, L.C. Avaliação da profundidad do palato duro: Correlação entre método quantitativo e qualitativo. *Rev. CEFAC* **2013**, *15*, 1292–1299. [Google Scholar] [CrossRef][Green Version) **Iran (5- 18 yrs)** korkhaus compass digital caliper Primary: 27.53 ± 3.0 38.9 ± 5.11 Mixed : 24.48 ± 3.79 33.38 ± 6.28 Perm. : 33.00 ± 5.51 41.50 ± 6.44

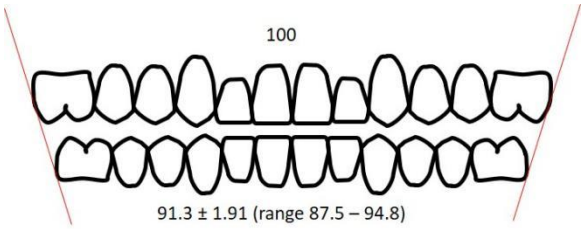
Palatal/ Maxillary - Height/ Depth

Patient's	Average values (mm) in class I subjects
	India (adults) Perm. : 20.75 13-16 yrs- Class I 15.0; Class II Div 1 13.90; Class II Div 2 13.30; Class III 12.6875 Bhalla A, Londhe SM, Kumar P, Datana S, Kadu A. Palatal dimension correlation in malocclusions for mixed Indian population. J Dent Res Rev 2014;1:137-42 ***Brazil (9-12yrs),*** from a line which connects the occlusal plane up to the greatest palatal depth.) male female 9 years - 11.0 9.40 10 years - 11.71 9.72 11 years - 11.00 10.84 12 years - 12.20 10.87 Louly F, Nouer PR, Janson G, Pinzan A. Dental arch dimensions in the mixed dentition: a study of Brazilian children from 9 to 12 years of age. J Appl Oral Sci. 2011 Apr;19(2):169-174. doi: 10.1590/s1678-77572011000200014. PMID: 21552719; PMCID: PMC4243756. ***Iran (5- 18 yrs)*** ***Palatal height at molar area***: **Primary dentition**: the perpendicular distance from a line drawn from the distal margin of second primary molars to the palatal vault in the midline **Mixed and permanent dentition**: the perpendicular distance from a line drawn from the distal margin of permanent first molars to the palatal vault in the midline male female Primary: 10.90 11.51 Mixed : 13.02 11.03 Perm. : 15.91 15.24 ***Iraq (16-24yrs)*** male female Perm. : 22.09 22.75 Abdulmawjood AA, Ahmad MK, Al-Saleem NR. Palatal depth & archperimeter in class I openbite & normal occlusion. Iraqi Orthod J 2005; 1(2): 26-31.

Patient name: Age/ sex: Date: Registration no.:

6. BOLTON'S OVERALL AND ANTERIOR RATIO

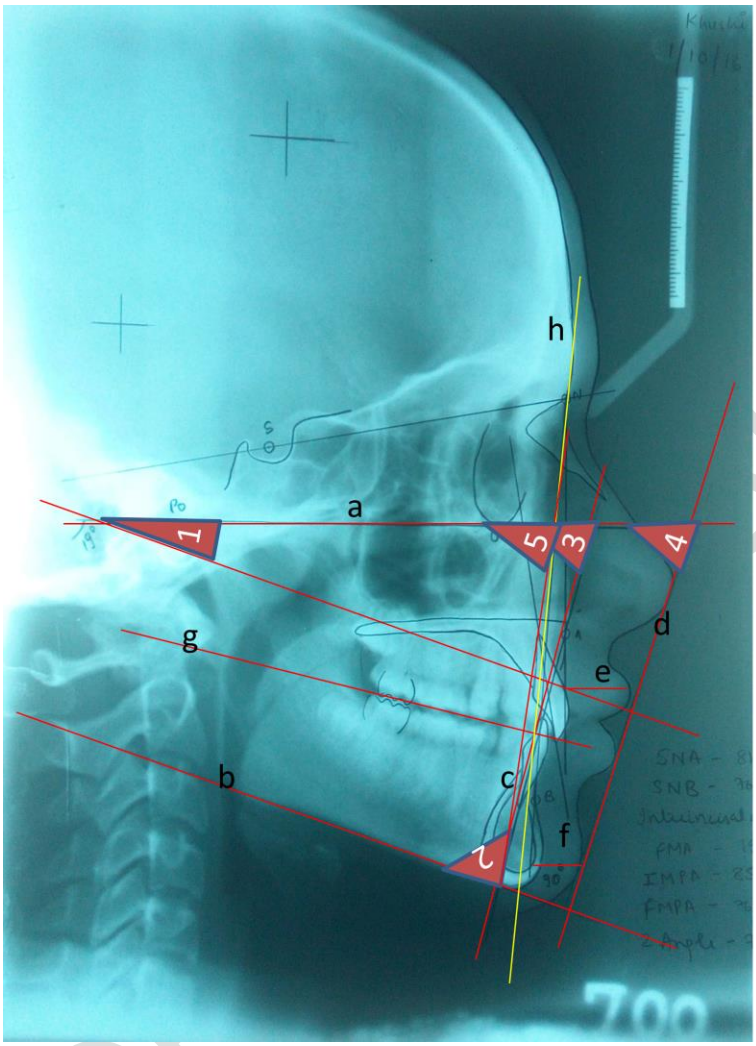




Bolton's anterior ratio *(Huckaba's analysis is needed in mixed dentition)*		>77.2 ± 1.65 - mandibular excess <77.2 ± 1.65 - maxillary excess	*Amount of mandibular/ maxillary excess*
Bolton's overall ratio		>91.3 ± 1.91- mandibular excess <91.3 ± 1.91- maxillary excess	*Amount of mandibular/ maxillary excess*

Patient name: Age/ sex: Date: Registration no.:

7. Cephalometric analyses



Guide to draw lines and angles for TWEED'S and TOTAL SPACE ANALYSES

Lines:

a. Frankfurt horizontal plane
b. Mandibular plane
c. Incisor mandibular plane
d. Merrifeild profile line
e. Lip thickness
f. Chin thickness
g. Occlusal plane
h. N-B line

Angles:

1. Frankfurt mandibular plane angle (FMA)
2. Incisor mandibular plane angle (IMPA)
3. Frankfurt mandibular incisor angle (FMIA)
4. 'Z' angle of Merrifeild
5. Objective FMIA

(can be drawn as new IMPA angle. 180 – objective FMIA + FMA)

Patient name: Age/ sex: Date: Registration no.:

Additional angles:

SNA: **SNB:** **ANB:**

Inter-incisal angle:

Z angle of Merrifield:

A. Tweed's analysis:

	Actual Value	**Objective value**
• Frankfort mandibular plane angle [FMA]:		
• Incisor mandibular plane angle [IMPA] :		
• Frankfort mandibular incisor angle [FMIA]:		

To draw objective FMIA on cephalogram, calculate objective IMPA= 180 – (FMA+ objective FMIA). Then draw corrected mandibular incisor position

- **Cephalometric correction (D):**
  Distance between actual and objective line on the occlusal plane:

Objective of FMIA after correction (Tweed foundation):

FMA	***FMIA***
21° - 29°	*68°*
30° - >30°	*65°*
20° - <20°	***IMPA** should not exceed 92°*

Patient name: Age/ sex: Date: Registration no.:

A. Total space analysis:

ANTERIOR

- Cephalometric correction (difference b/w actual and objective FMIA angle in degrees):
- Soft tissue modification:
  (z- angle Merrifield + Cephalometric correction in degrees):
- Upper lip (vermilion border to greatest curvature of central incisor):
  Chin thickness (soft tissue chin to the N-B line) [U – C]:

Soft tissue modification guideline:

If corrected Z angle of Merrifield is-

>80°: IMPA modified up to approximately 92°

<75°: additional upright positioning of mandibular incisors is needed

75°to 80°: no modification

- # If lip thickness > chin thickness:
  Lip thickness – chin thickness= value × 2, added to Space required (SR)
  If lip thickness is = or < chin thickness= no modification required

All total deficit: (Sum of anterior, middle & posterior)

Treatment plan

- **Extraction of 1st/ 2nd premolars :**
- **New Deficit:**
- **Extraction of 3rd molars:**

Final Discrepancy