MIXED DENTITION ANALYSIS

Department of Pediatric and Preventive Dentistry
SRM Dental College, Ramapuram
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Introduction

Factors to be evaluated for space maintainence

Space analysis

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Conclusion
INTRODUCTION

Development of well-aligned dental arches – dependent upon a favorable relationship between permanent tooth size and available arch space.

Crowding of teeth – may adversely affect periodontal health, caries resistance, occlusal function & esthetics.

INTRODUCTION

Early recognition & accurate assessment – wider choice of management methods than if the situation was ignored until matured into an established adult malocclusion.

FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

<table>
<thead>
<tr>
<th>Incidence of space loss</th>
<th>Early primary molar loss – decrease in arch length – mesial movement of permanent molars / distal movement of anterior teeth</th>
</tr>
</thead>
</table>

Amount of closure is affected by numerous variables – tooth involved, time of loss

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights : Mosby; 2012.
FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

<table>
<thead>
<tr>
<th>Time elapsed since loss</th>
<th>Space loss – occurs during first 6 months after extraction of primary teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best time to insert the appliance – soon after extraction</td>
</tr>
<tr>
<td></td>
<td>If space closure already occurred – space regainers to be considered</td>
</tr>
</tbody>
</table>

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights : Mosby; 2012.
# FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

<table>
<thead>
<tr>
<th>Stage of development / dental age</th>
<th>Chronological age is not important for planning space maintainence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing permanent tooth starts its eruptive movement after $\frac{3}{4}$th of root development</td>
<td></td>
</tr>
<tr>
<td>Hence, dental age has to be considered rather than chronological age</td>
<td></td>
</tr>
</tbody>
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**FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE**

<table>
<thead>
<tr>
<th>Amount of space closure</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary primary 2\textsuperscript{nd} molar loss – greatest space loss (upto 8mm / quadrant)</td>
<td></td>
</tr>
<tr>
<td>Mandibular primary 2\textsuperscript{nd} molar loss – next greatest space loss (upto 4mm / quadrant)</td>
<td></td>
</tr>
<tr>
<td>Loss of primary 1\textsuperscript{st} molar – shows equal amounts of space closure</td>
<td></td>
</tr>
<tr>
<td>Space loss potential – high – if primary molar loss occurs in approximation to permanent 1\textsuperscript{st} molar eruption</td>
<td></td>
</tr>
<tr>
<td>Loss of primary 2\textsuperscript{nd} molar – after eruption of permanent molar – still result in significant space closure</td>
<td></td>
</tr>
</tbody>
</table>

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9\textsuperscript{th} edition. Maryland Heights : Mosby; 2012.

FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

<table>
<thead>
<tr>
<th>Direction of closure</th>
<th>Maxillary posterior space closes – mesial bodily movement &amp; mesio-lingual rotation around the palatal root of 1st permanent molar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mandibular space closes – mesial tipping of 1st permanent molar along with distal movement &amp; retroclination of teeth anterior to the space</td>
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</tbody>
</table>

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights : Mosby; 2012.
FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

Eruption of neighboring teeth

Active eruption of 1\textsuperscript{st} permanent molar – causes severe space loss (if the primary 2\textsuperscript{nd} molar is extracted during the eruption of permanent 1\textsuperscript{st} molar)

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9\textsuperscript{th} edition. Maryland Heights : Mosby; 2012.
FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

<table>
<thead>
<tr>
<th>Amount of bone covering the unerupted tooth</th>
<th>If the bone covering the unerupted premolar is destroyed – predictions based on root development are not accurate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>An erupting premolar takes 4-5 months to travel 1mm of bone</td>
</tr>
</tbody>
</table>

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights : Mosby; 2012.
## FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

<table>
<thead>
<tr>
<th>Abnormal oral musculature</th>
<th>Strong mentalis muscle patterns – may have pronounced negative effect – after loss of primary mandibular molars / canines with collapse of arch &amp; distal drifting of the anterior segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thumb / finger habits</td>
<td>Thumb / finger habits – produce abnormal forces – initiates collapse of dental arches after untimely loss of primary teeth</td>
</tr>
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</table>

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights : Mosby; 2012.
FACTORS TO BE EVALUATED FOR SPACE MAINTAINENCE

| Congenital absence of permanent teeth | Congenital absence of teeth – may alter the eruption path of other teeth |

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights : Mosby; 2012.
SPACE ANALYSIS

Usually completed in the mixed dentition – crucial in determining whether or no space will be available for unerupted permanent teeth.

Predicted - using the dimensions of tooth present in the mouth.

Hence, an assessment about the space needed or deficiency in the arch can be calculated.

DEVELOPMENT OF MIXED DENTITION

Baume’s classification, 1950’s

- Future permanent molar relationship – based on primary molar relationship

DEVELOPMENT OF MIXED DENTITION

- Moorees & Reed – arch length decreases 2-3mm - 10-14 years of age – when the primary molars are replaced by permanent premolars

- They also demonstrated a reduction in arch circumference of approximately
  - 3.5mm in boys
  - 4.5mm in girls


DEVELOPMENT OF MIXED DENTITION

3 stages of development

- Early transitional stage
- Inter-transitional stage
- Late transitional stage

Early & Late Mesial Shift:

Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights : Mosby; 2012.
FACTORS THAT PREVENTS NORMAL POSTERIOR OCCLUSION

Extensive inter-proximal caries / premature extraction of primary teeth – reduction of arch length – causes crowding

Ectopic eruption of permanent maxillary 1st molars – premature exfoliation of primary 2nd molars & loss of arch length – crowding & class 2 molar relationship

FACTORS THAT PREVENTS NORMAL POSTERIOR OCCLUSION

In mandibular arch – premature loss of primary 1st molar during active eruption of permanent 1st molar – mesial drifting of primary 2nd molar & permanent 1st molar

Reduced arch length – normal leeway space will be exceeded & crowding will occur

INDICATIONS

Nanda, 1993

- Mixed dentition period – 6-12 years
- Premature loss of primary canines
- Rotation or blocking of lateral incisor, because of lack of space
- Ectopic eruption of permanent first molars
- Distal terminal plane relationships

First permanent molar and permanent incisors are erupted
- The succedaneous permanent teeth are forming
- Size relationship between unerupted permanent teeth & primary teeth
- There is size difference in primary canines, molars and the succedaneous teeth
- Mesio-distal width of primary canines & molars is greater than permanent successors
CLASSIFICATION

3 approaches - to estimate the mesio-distal crown width of unerupted canines & premolars

• Use of measurements from erupted teeth

• Use of measurements from radiographs

• Use of a combination (most accurate – lowest standard error of estimate)

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## CLASSIFICATION

### Profitt & Ackermann:

<table>
<thead>
<tr>
<th>Measurement on radiograph</th>
<th>Radiographic analysis</th>
<th>Combination of radiographs &amp; prediction charts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Moyer’s analysis</td>
<td>• Nance’s analysis</td>
<td>• Hixon &amp; old father</td>
</tr>
<tr>
<td>• Tanaka Johnston</td>
<td>• Huckaba analysis</td>
<td>• Staley Kerber</td>
</tr>
<tr>
<td>• Ballard &amp; Wylie</td>
<td></td>
<td></td>
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CLASSIFICATION

Irwin, Herold, Richardson, 1995 – reviewed various methods

- Hixon and Old-father method – more accurate, but its disadvantage – more cumbersome
- Moyers – measure of mandibular incisors alone – 95% of dentition with a combined width of canine & premolar – within 1mm of predicted value – clinically acceptable
- Tanaka-Johnston analysis – significant clinical acceptability – minimal amount of time & effort
FUNDAMENTALS OF ANALYSIS

Space Available

Space Required

COMPARE

Space Excess

OK

Space Deficiency

Space available is calculated by 2 ways

Divide the dental arch into segments

Contour a piece of brass wire to the line of occlusion & straighten it for measurement

Space required is calculated by dimensions of mandibular permanent central & lateral incisors.

Mandibular incisors – used as standards.

They erupt earlier than maxillary incisors & offer the earliest opportunity of measurement.

They are least susceptible for morphologic variations.

Measure arch length segments from the buccal & labial sides of the arch at the contact points between the teeth.

If spacing between central incisors – disto-gingival surfaces of lateral incisors to a midline point on the alveolar crest between the teeth is measured.

METHODS FOR MIXED DENTITION ANALYSIS
This analysis is similar to arch perimeter analysis of permanent dentition

<table>
<thead>
<tr>
<th>ARMAMENTARIUM</th>
<th>Dental casts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boley gauge, millimeter ruler</td>
</tr>
<tr>
<td></td>
<td>Peri-apical radiographs</td>
</tr>
</tbody>
</table>

Oldfather, R. H.: Estimation of the combined widths of certain mandibular teeth, M.S. thesis, Department of Orthodontics, University of Iowa, 1957.
HAYS NANCE ANALYSIS

**PROCEDURE**
(Nanda, 1993)

- **Space required** – measure the width of each unerupted tooth (cuspsids & bicuspids) from the IOPA
- **Total M-D width of all the teeth in each quadrant** – indicate space required to accommodate permanent teeth
- **Space available** – measure arch perimeter from mesial of permanent 1st molar to the other side
- **Compare the space required & available** – arch length discrepancy

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HAYS NANCE ANALYSIS

ADVANTAGES

• Minimal error
• It can be performed with reliability
• Allows analysis of both arches

LIMITATIONS

• Requires cephalometric radiograph, knowledge of tweed analysis & an accurate tracing
• Time consuming
• Complete mouth radiographs are needed

Oldfather, R. H.: Estimation of the combined widths of certain mandibular teeth, M.S. thesis, Department of Orthodontics, University of Iowa, 1957.
MOYER’S ANALYSIS

Introduced by Moyer, in 1967

Moyer’s probability tables – formulated at the University of Michigan

Arch perimeter analysis

Most commonly used mixed dentition analysis

MOYER’S ANALYSIS

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<td></td>
<td>Probability chart</td>
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</table>

**MOYER’S ANALYSIS**

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>Measure the width of mandibular central &amp; lateral incisors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This value is used in the probability chart (75% of the value)</td>
</tr>
<tr>
<td><strong>SPACE NEEDED</strong></td>
<td>predicted value gives the predicted width of unerupted canine &amp; premolar</td>
</tr>
<tr>
<td><strong>SPACE AVAILABLE</strong></td>
<td>measured with a brass wire extending from the mesial side of 1st permanent molar from one side to other (after incisal alignment)</td>
</tr>
<tr>
<td></td>
<td>Brass wire is straightened &amp; measured with Boley’s gauge</td>
</tr>
<tr>
<td></td>
<td>Difference between space available &amp; space needed gives the <strong>DISCREPANCY</strong></td>
</tr>
</tbody>
</table>

### MOYER’S ANALYSIS

<table>
<thead>
<tr>
<th>Σ lower incisors</th>
<th>19.5</th>
<th>20.0</th>
<th>20.5</th>
<th>21.0</th>
<th>21.5</th>
<th>22.0</th>
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<tbody>
<tr>
<td>95%</td>
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<td>22.7</td>
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Probability chart for predicting the sum of the widths of lower 3,4, & 5 on one side.

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MOYER’S ANALYSIS

ADVANTAGES

• Minimal systematic error
• Even beginners can carry out this analysis with equal reliability
• Less time consuming
• No special equipment / radiographs are required
• Can be carried out for both arches

LIMITATIONS

• It’s a probability analysis
• It does not account for tipping of mandibular incisors
• Maxillary teeth size is predicted by mandibular teeth
• It may have population variations, thus it cannot universally be applied

TANAKA-JOHNSTON ANALYSIS

- A variation of moyer’s analysis except that a prediction table is not needed
- Very useful – requires no additional radiographs or tables to predict tooth size
- It can be applied to both the arches, has reasonable accuracy

## TANAKA-JOHNSTON ANALYSIS

### ARMAMENTARIUM
- Study casts, boley’s gauge

### TECHNIQUE

(Tanaka & Johnston, 1974)
- Determine the available arch length = distance from mesial of first permanent molar to the contralateral tooth
- Width of four mandibular incisors to be calculated
- Half the mesio-distal width of 4 lower incisors + 10.5 = Mandibular canines & premolars in one quadrant
- Half the mesio-distal width of 4 lower incisors + 11 = Maxillary canines & premolars in one quadrant
- Subtract this dimension from remaining space available – to give a positive / negative for total arch space

---

If the patient is not of the Northwestern European descent, Tanaka Johnston space analysis will either over-predict or under-predict the size of the unerupted teeth – this could cause serious treatment planning problems.

HUCKABA ANALYSIS

Introduced by Huckaba, in 1964.

It makes use of radiograph & study casts – to determine the width of unerupted teeth

HUCKABA ANALYSIS

PRINCIPLE

- With any type of radiograph, it is necessary to compensate for enlargement of radiographic image

- Enlargement ratio for each unerupted permanent tooth is computed by measuring the nearest erupted tooth first in the mouth & then in the radiograph

HUCKABA ANALYSIS

ARMAMENTARIUM

- Dental casts
- Boley gauge, millimeter ruler
- Peri-apical radiograph

PROCEDURE

- Width of primary tooth on IOPA \( Y' \)
- Width of its underlying successor on IOPA \( X' \)
- Width of primary tooth on the cast \( Y \)
- Width of unerupted permanent tooth \( X \)

\[
X = \frac{X'Y}{Y'}
\]

HUCKABA ANALYSIS

ADVANTAGES
• Very easy, practical & relatively accurate method
• Does not require any prediction table
• Can be used in maxillary & mandibular arches

DISADVANTAGES
• Inherent distortion of radiographic image causes error

HIXON-OLD FATHER ANALYSIS

Developed by Iowa Facial Growth Study, in 1956

Developed to avoid the difficulty involved in obtaining an accurate radiographic measurement of mandibular cuspid & reduce error found in other statistical & radiographic methods

HIXON-OLD FATHER ANALYSIS

- Original equation – primarily obtained from the measurements of the teeth on left side of the arch of each subject (Hixon & Oldfather, 1956)

- Revised equation – derived from the mean of measurements taken from both right & left side in each subject (Staley & Kerber, 1980)

- It is stated that it to be the most accurate

# HIXON-OLD FATHER ANALYSIS

**ARMAMENTARIUM**

<table>
<thead>
<tr>
<th>Boley’s gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study cast</td>
</tr>
<tr>
<td>Peri-apical radiograph</td>
</tr>
<tr>
<td>Hixon &amp; Oldfather prediction chart</td>
</tr>
</tbody>
</table>

HIXON-OLD FATHER ANALYSIS

**METHOD**

From model – on one side, measure mesio-distal width of permanent mandibular central & lateral incisors

From peri-apical radiograph – measure mesio-distal width of unerupted 1<sup>st</sup> & 2<sup>nd</sup> premolars

Total the mesio-distal width of four teeth

Compare the measured value to estimated tooth size from the prediction chart

<table>
<thead>
<tr>
<th>MEASURED VALUE (mm)</th>
<th>ESTIMATED TOOTH SIZE (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>18.4</td>
</tr>
<tr>
<td>24</td>
<td>19.0</td>
</tr>
<tr>
<td>25</td>
<td>19.7</td>
</tr>
<tr>
<td>26</td>
<td>20.3</td>
</tr>
<tr>
<td>27</td>
<td>21.0</td>
</tr>
<tr>
<td>28</td>
<td>21.6</td>
</tr>
<tr>
<td>29</td>
<td>22.3</td>
</tr>
<tr>
<td>30</td>
<td>22.9</td>
</tr>
</tbody>
</table>

A revision of the Hixon and Oldfather mixed-dentition prediction method

Robert N. Staley, D.D.S., M.A., M.S.,* and
Paul E. Kerber, Ph.D.** Iowa City, Iowa

A revision of the Hixon and Oldfather prediction method was undertaken with measurements obtained from persons who participated in the Iowa Facial Growth Study, the same group of subjects used originally by Hixon and Oldfather to develop their prediction equation. A significantly improved prediction equation was developed. A graph was made for clinical use in the prediction of mandibular canine and premolar widths in mixed-dentition patients.

Key words: Prediction, lower, tooth, widths, revision

HIXON-OLD FATHER ANALYSIS

Staley & Kerber, 1980 – revised equation

- Significantly reduced standard error of estimate
- Co-efficient of correlation of revised equation
  - Significantly higher than that of original equation

HIXON-OLD FATHER ANALYSIS

A graph was made – for clinical use – in prediction of mandibular canine & premolar widths

It is accurate to the nearest

PROCEDURE

• Measure & add up widths of mandibular incisors on one side
• Measure widths of unerupted premolars from IOPA of same side
• Add 1 and 2
• Use the prediction graph to calculate width of unerupted canine & premolar

HIXON-OLD FATHER ANALYSIS

HIXON-OLD FATHER ANALYSIS

ADVANTAGES
• Only study casts & peri-apical radiographs are needed
• It has a co-efficient of correlation of 0.87 or 75% reliability
• Very accurate analysis

LIMITATIONS
• It can be used only for lower arch

## SIGNS OF DIFFERENT TYPES OF DENTITION

<table>
<thead>
<tr>
<th>TYPE OF DENTITION</th>
<th>SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not crowded (Excess space)</td>
<td>• Spacing between incisors</td>
</tr>
<tr>
<td></td>
<td>• <strong>Radiograph</strong> – long axes of maxillary molars vertical</td>
</tr>
<tr>
<td></td>
<td>• <strong>MDA</strong> – space available in arch exceeds that required for eruption of premolars &amp; canines</td>
</tr>
<tr>
<td>Not crowded (Just sufficient space)</td>
<td>• Normal contacts between incisors</td>
</tr>
<tr>
<td></td>
<td>• <strong>Radiograph</strong> – long axes of maxillary molars vertical or with slight distal inclination</td>
</tr>
<tr>
<td></td>
<td>• <strong>MDA</strong> – space available in arch equals space required</td>
</tr>
</tbody>
</table>


# SIGNS OF DIFFERENT TYPES OF DENTITION

<table>
<thead>
<tr>
<th>TYPE OF DENTITION</th>
<th>SIGNS</th>
</tr>
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<tbody>
<tr>
<td>Mild crowding</td>
<td>• Slight overlapping of incisors</td>
</tr>
<tr>
<td></td>
<td>• <strong>Radiograph</strong> – distal inclination of maxillary molars</td>
</tr>
<tr>
<td></td>
<td>• <strong>MDA</strong> – space available in arch upto 4mm less than</td>
</tr>
<tr>
<td></td>
<td>that required for eruption of canines &amp; premolars</td>
</tr>
<tr>
<td>Severe crowding</td>
<td>• Overlapping, rotation or displacement of incisors</td>
</tr>
<tr>
<td></td>
<td>• <strong>Radiograph</strong> – marked distal inclination of maxillary molars</td>
</tr>
<tr>
<td></td>
<td>with “Stacking”; distal inclination of mandibular molars</td>
</tr>
<tr>
<td></td>
<td>• <strong>MDA</strong> – space available in arch over 4mm less than</td>
</tr>
<tr>
<td></td>
<td>that of space required</td>
</tr>
</tbody>
</table>

Moyer’s analysis must be carefully used, since the probability of 75% was not as accurate as expected, leading to the need of adapting the probability leads depending on the study population.
<table>
<thead>
<tr>
<th>S.N</th>
<th>Title of the article</th>
<th>Background / Aim</th>
<th>Conclusion / Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Suruchi Juneja, et al. Comparative Evaluation of Three Mixed Dentition Analyses and Formulation of Regression Equations for North Indian Population: A Cross-sectional Study. Biomed J.2015: Vol 38(5). 450-55.</td>
<td>To evaluate the accuracy of • Tanaka-Johnston • Moyers • Bernabe &amp; Flores-Mir In forecast M-D dimensions of permanent canine &amp; premolars</td>
<td>• Found to be inaccurate and they overestimate the mesio-distal widths • Revised linear regression equations were derived using the data obtained from this population</td>
</tr>
</tbody>
</table>

Males
Maxilla: \( Y = 9.783 + 0.511 \times (X) \)
Mandible: \( Y = 8.415 + 0.546 \times (X) \)

Females
Maxilla: \( Y = 10.029 + 0.467 \times (X) \)
Mandible: \( Y = 8.796 + 0.496 \times (X) \)
<table>
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</thead>
</table>
• Age group – 13-16 years | • Moyers- not accurate to this sample  
• Differences are the result of racial and ethnic diversity  
• Tooth dimension shows sexual dimorphism.  
• Mesio-distal dimension in buccal segment of mandibular arch is larger in males than in females. |

**Male:**
- Maxilla - $Y = 10.52 + 0.48x$
- Mandible - $Y = 9.46 + 0.50x$

**Female:**
- Maxilla - $Y = 11.73 + 0.41x$
- Mandible - $Y = 11.67 + 0.39x$
# Review of literature

<table>
<thead>
<tr>
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<th>Background / Aim</th>
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• 200 adolescents                                                             | • Moyers prediction chart was not comparable with the study population group  
• There was statistically differences present                                      |

# Review of literature

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<tr>
<td>1.</td>
<td>Nishi Grover, et al.</td>
<td>To test the reliability of • Moyers • Tanaka- Johnston Among Lucknow population.</td>
<td>• Both methods are considering it to be inapplicable for the Lucknow population • Regression equations proposed – one of the most accurate method for Lucknow population</td>
</tr>
</tbody>
</table>

**Males:**
- Maxilla : \( y = 15.935 + 0.315 \times Mdl \)
- Mandible : \( y = 8.556 + 0.620 \times Mdl \)

**Females:**
- Maxilla : \( y = 15.133 + 0.269 \times Mdl \)
- Mandible : \( y = 11.350 + 0.403 \times Mdl \)
## Review of literature

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<tr>
<td>1.</td>
<td>Sonaware. S, Bettigiri A. Comparison of two non-radiographic techniques of mixed dentition analysis &amp; evaluation of their applicability for Marathi population. Scientific Journal, 2008: 2. 385-9.</td>
<td>To examine &amp; compare the accuracy of Moyers Tanaka-Johnston</td>
<td>Both methods have comparable standard errors of estimate Moyers chart at 50% confidence level gives more realistic estimate as compared to 75% confidence level for Marathi population</td>
</tr>
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\[
Y = a + b (x) \\
X = \text{independent variable (mandibular incisors)} \\
Y = \text{dependent variable (sum of canine & premolars)} \\
\text{Maxilla} : Y = 12.143+0.481 (x) \\
\text{Mandible:} Y = 10.830+0.563 (x)
\]
## Review of literature

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| 1.   | Priya S, Munshi AK. Formulation of a prediction chart for mixed dentition analysis. J Indian Soc Pedod Prev Dent. 1994;12:7-11. | To formulate a prediction chart from the combined width of mandibular incisors on Moyers pattern for a section of Indian population – different schools in Mangalore Aged 12-15 years of similar ethnic background | • Moyers method – developed for northern European ancestry – difficult to apply in other populations – variation in tooth size  
• Over-estimation / under-estimation – when applied to different populations – prompted to make new probability tables for different populations  
• Sexual dimorphisms – noted in tooth sizes |
# Review of literature

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<tr>
<td>1.</td>
<td>Umapathy Thimmegowda et al., Validity of Moyers Analysis and a New Regression Equation. J Clin Diag Res. Aug 2015: 9(8): 1-6.</td>
<td>• To test the reliability of Moyer’s method&lt;br&gt;• To produce new regression equation for Bangalore population – 400 subjects, aged – 13-16 years</td>
<td>• Found that 50% is more applicable to boys and 75% to girls&lt;br&gt;• Canine-premolar segment in both arches - statistically larger in men than in women</td>
</tr>
</tbody>
</table>

The equation is $Y = a + b \cdot (x)$

For LCPM width
1. $Y= 17.204 + 0.174 \cdot (x)$ — Males
2. $Y= 13.431 + 0.330 \cdot (x)$ — Females

For UCPM width
1. $Y=16.904 + 0.209 \cdot (x)$ — Males
2. $Y=15.627 + 0.263 \cdot (x)$ — Females
STUDY MODELS / STUDY CASTS

Prominent role in diagnosis & treatment planning

Widespread in use even before skull radiography became popular

Reproduce teeth & investing structures with a fair degree of accuracy

STUDY MODELS / STUDY CASTS

- Ratio between anatomic to artistic portion – 2:1
- Ratio between tooth portion, soft tissue portion & artistic portion – 1:1:1
- Completed model should be 13mm in height – anterior & posterior regions

STUDY MODELS / STUDY CASTS

Impression technique

• Pre-impression mouth wash – removes debris, reduces surface tension & bubble formation
• Alginate impression – ideally suited
• Greatest concentration of material – anterior region of tray

Pouring the impression

• Impression – rinsed & excess water removed – removes mucin & debris
• Good grade of white stone – poured as layers

## STUDY MODELS / STUDY CASTS

### Forming the base
- Base is poured with rubber base moulds
- Orientation of the model – anatomic portion is in center of rubber mould & occlusal plane parallel with the cast base of the base former

### Finishing of cast
- Bubbles at gingival margin – removed with small universal sealer
- Bubbles reproduced from impression in muco-buccal fold – removed with kingsley type sealer
- Final finishing – fine waterproof sand paper with Arkansas stone & water

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STUDY MODELS / STUDY CASTS

- Study cast – symmetrical after trimming
- Upper cast – 7 sides
- Lower cast – 6 sides

# Study Models / Study Casts

## Uses

- 3-Dimensional precise record
- Enables the study of malocclusion from all sides
- Essential diagnostic aid
- Valuable aids in patient education & communication
- Evaluation of inter-arch relationships in all 3 planes
- To assess & record the curves of occlusion
- Used in mixed dentition analysis along with charts & radiographs

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CONCLUSION

None of the mixed dentition analyses are as precise as one might like, and all must be used with judgement and knowledge of development.

Use of prediction chart personalized to the particular population is more accurate than the conventional prediction chart.
REFERENCES

- Dean JA, Avery DR, McDonald RE. McDonald and Avery’s Dentistry for the Child And Adolescent, 9th edition. Maryland Heights: Mosby; 2012.
REFERENCES

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THANK YOU!!