



GENERAL PRINCIPLES OF SELECTION AND ARRANGEMENT OF TEETH : A LITERATURE REVIEW

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ABSTRACT Esthetics includes the appreciation and response to the beautiful in art and nature. The dentist must visualize esthetics in relation to the patient and then translate that visualization into an acceptable esthetic result. Dental esthetics and the beauty of the smile are of main importance in today's civilization. The edentulous patient is no exception, yet creating a natural-appearing smile for this patient is very hard to achieve. This article discuss about selection, arrangement and various types of posterior teeth and errors occur in teeth arrangement.

KEYWORDS : Anatomic Teeth , Non-anatomic Teeth, Overbite, Safety Zone.

INTRODUCTION

Denture esthetics is defined as the effect produced by a dental prosthesis that affects the beauty and attractiveness of the person. Teeth selection is not simple a mechanical procedure, but requires skill and understanding. Selection of teeth forms a main step before teeth arrangement¹. The selection of teeth for an edentulous patient is a most important and often difficult problem for the dentist. He should select teeth which not only embody the proper form and size but the most ideal shade as well². Artificial teeth must be placed in a position which will be esthetically acceptable to the patient and the clinician, functionally sound and in harmony with the other structures of the masticatory system³. The term "Teeth arrangement" would refer to a procedure of locating, tilting, rotating and spacing artificial tooth/teeth in relation to the plane of reference and to each other with the object of creating a natural appeal and based on biomechanical requirements of complete denture treatment. The dentist must visualize esthetics in relation to the patient and then translate that visualization into an acceptable esthetic result. The success of Dentist efforts depends upon his artistic ability, his powers of observation and his experience⁴.

Selection Of Anterior Teeth:

Seven anatomic entities are used as guides to select the size of the anterior teeth⁵.

1. Size of the face: The size of the upper central incisor tooth should be in harmony with the face size. Large faces require large teeth, and small faces small teeth for best esthetic values. The average width of the maxillary central incisor is estimated to be one sixteenth of the width of the face measured between the zygoma. The lateral incisors vary more in size, form, & position than any other maxillary anterior tooth. The combined width of the six maxillary anteriors is slightly less than one third of the bizygomatic width of the face⁵.

2. Size of the maxillary arch: Accurately contoured occlusion rims are required. The measurements are made from the midline on the maxillary occlusion rim to the distal of the cuspid eminence. Mold selector can be used to make measurement of maxillary cast.

3. Incisive papilla and canine eminence : If the eminences are discernible, a line can be placed on the cast at the distal termination of the eminence. If the eminences are not discernible, the attachments of the buccal frenum can be used. A line placed slightly anterior to the frenum attachment will be distal to the eminence.

4. Maxillomandibular relationship: Accurately articulated casts with the jaws in centric relation are necessary for the satisfactory determination of maxillomandibular relations, since patients can

shift the mandible and compensate for some of the malrelations⁶.

5. Contour of the residual ridge: The artificial teeth should be positioned to follow the contour of the residual ridges that existed when the natural teeth were present.

6. Vertical distance between the ridges: The length of the teeth is determined by the existing space between the ridges. When the space is available, it is more esthetically suitable to use a tooth long enough to remove the display of the denture base. Denture bases can be characterized, personalized, or natural appearing⁵

7. The lips: When the lips are relaxed and distant, the labial surfaces of the maxillary anterior teeth support the upper lip. In speech, the incisal edges of the maxillary anterior teeth contact the lower lip at the junction of the moist and dry surfaces of the vermilion border.

8. Nasal Width as a Guide: Boucher and Hoffman et al. referred to the nasal index as a guide to select the anterior teeth as it relates the inter alar width to the space available for setting the anterior teeth. Mavroskoufis and G.M. Ritchie gave a formula for the selection of the mesiodistal width of the anterior artificial teeth ($A = N + 7$ mm) where N is the nasal width⁷. Abdullah in 2002 has proposed a formula to calculate the width of the central incisor from the inner canthal distance⁸. The ICD was found to be greater than the combined width of maxillary central incisors. Thus the ICD was multiplied by 0.618. The resultant product was then divided by 2 to obtain the width of a single central incisor⁸. $FCIW = ICD / 2 \times 0.618$.

9. Facial profile: To determine the facial profile, observe the relative straightness or curvature. The facial profile is determined by three points: The forehead, base of the nose and prominent point of the chin.

Based on these three points the profile can be: Straight, Convex or Concave.

Selection Of Posterior Teeth:

Factors for selecting posterior teeth:

Size of The Teeth: Following factors for selecting the size of the teeth⁹

1. Buccolingual width of posterior teeth
2. Mesiodistal length of posterior teeth
3. Occlusogingival (vertical) height of the facial surfaces of posterior teeth

Form of Teeth : The occlusal form will be decided by the type of occlusion to be developed. If the teeth are to be balanced in the centric and eccentric positions, a cusp form tooth is indicated. If the posterior teeth are to be disocclude when an eccentric jaw movement occurs, either cuspless or monoplane teeth can be used. If the posterior teeth are to be arranged on a flat plane and balanced in the centric occlusion position only, monoplane teeth are used⁴

According to Lang posterior tooth moulds are of four types⁷.

According to the Glossary of Prosthodontic Terms, the following definitions apply to each type⁸

1. **Anatomic:** teeth that have cuspal inclinations greater than 0° and tend to replicate occlusal anatomy. Such teeth may have cuspal angles set to 20°, 30°, 33° or 45°.
2. **Non-anatomic:** teeth designed in accordance with mechanical principles rather than from the anatomic standpoint.
3. **Zero-degree teeth:** posterior teeth that have 0° cuspal angles.
4. **Cuspless teeth:** teeth designed without cuspal prominence on the occlusal surface ie inverted cusp teeth.

We would suggest, in the interests of clarity, that three types of posterior tooth form be considered, namely teeth with cusps, teeth without cusps and teeth which exhibit both characteristics (hybrid moulds). Such teeth typically have upper teeth with cuspal angles of 20° with modified buccal cusps and lower non-anatomic teeth which have been rendered essentially cuspless. The decision the clinician has to make should be determined out of the needs of the patient.

Selection of Material for Artificial Teeth:

The following are the types of artificial teeth⁹ - Acrylic, Porcelain, Composite resin teeth, artificial teeth with metal occlusal, Radio opaque artificial teeth.

Maxillary Teeth Arrangement :

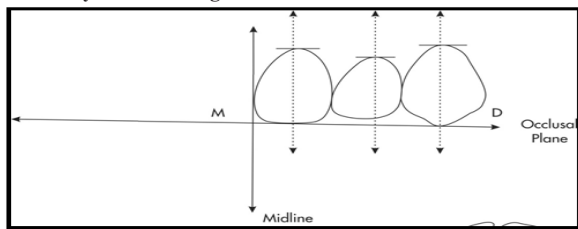


Fig.1 Maxillary anterior teeth in relation to horizontal axis

Anterior Teeth Arrangement:

Teeth arrangement should be done in three relation[Fig.1] :

1. Mesio-distal relation / Front view^{12,13}:- Long axis of central incisor should be parallel to the midline and perpendicular to the horizontal plane¹²

Long axis of lateral incisor :- Incisal portion inclines towards midline and cervical portion away from the midline

Long axis of canine should be parallel to the midline i.e. straight without inclination and mesial surface more visible than distal surface

2. Cervico-incisal Relation (Occlusal /Horizontal view/ glass plate Relation)^{12,13}:- central incisor Incisal edge should be touching to the occlusal plane.

Lateral incisor Incisal edge should be 0.5 to 1.5mm¹² / 1 to 2mm¹³ and Cervical neck should be depressed.

Maxillary canine Incisal edge of the canine should be touching to the occlusal plane and cervical neck should be prominent

3. Labio-lingual / palatal relation¹² :- central incisor and lateral incisor should proclined 2mm without affecting esthetics and lip support

- long axis of central incisor tooth inclines labially by about 15 degree
- long axis of lateral incisor inclines labially by about 20 degree.

Maxillary anteriors should be arranged in accordance with the shape of the arch

Examples:- Ovoid arch,tapered shape arch,ovoid / squarish Maxillary anteriors should be arranged on the centre of the crest¹⁴.

Posterior Teeth Arrangement:-

- 1] Mesio-distal relation [front /buccal view] :-
 - long axis of the first premolar should be parallel to midline .
 - long axis of second premolar should be parallel to midline or vertical axis .
 - long axis of first molar is buccally tilted at occlusal third
 - long axis of second molar is buccally tilted at occlusal third more steeply than the first molar .

- 2] cervico-occlusal view/ relation :-
 - first premolar follows the curvature /contour of occlusal rim in line with the canine central groove coincides with canine tip
 - central groove of second premolar coincides with first premolar
 - central groove of first molar coincides with premolar
 - labial ridge of the canine ,buccal ridge of premolar and mesiobuccal ridge of molar should align in straight line .
 - Distobuccal ridge at first molar, and the buccal ridge at second molar should align in a straight line slightly palatal to above line .

- 3] Buccolingual relation
 - buccal cusp of first premolar is in contact with horizontal /occlusal plane and palatal cusp is (0.5 to 1.00 mm)short of occlusal plane .
 - In second premolar – both buccal and palatal cusp are in contact with occlusal plane
 - in first premolar :- mesiopalatal cusp contact with occlusal plane and distobuccal 1mm above the occlusal plane.
 - In second premolar :- long axis slope distally at occlusal third

All four cusp are short of occlusal plane, but ' mesiopalatal cusp is nearest to the horizontal plane'¹².

Mandibular Teeth Arrangement :

Anterior Teeth Arrangement

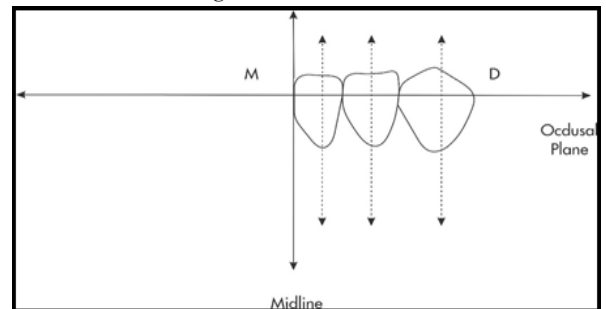


Fig.2 Labial view of mandibular anteriors in relation to horizontal Plane

1. Mesio-distal relation (front /buccal view)^{12,13}(Fig.2): long axis of central incisor should be parallel to the midline and incline mesially long axis of the lateral incisor incisally inclined towards midline and cervically inclined away from the midline canine should be arranged like lateral incisor but the degree of the inclination is less and it is mesially tilted [sleeping canine]

2. Cervico-incisal relation [occlusal/ horizontal view/ glass plate relation]¹³: mandibular anteriors are 1 to 2 mm above the mandibular occlusal plane and cervically canine neck should be prominent .

3. Labio-lingual relation [side view/lateral view/proximal view]¹²-
 - labio-lingually anterior teeth should be upright and teeth should be arranged in accordance with the shape of the arch. For example :- squarish ,ovoid and tapered shape arch

Mandibular anteriors should be arranged in a 'saftey zone '

Safety zone is that zone which is present between centre of the crest of the ridge and internal part of the ledge of the cast. (Fig.3)

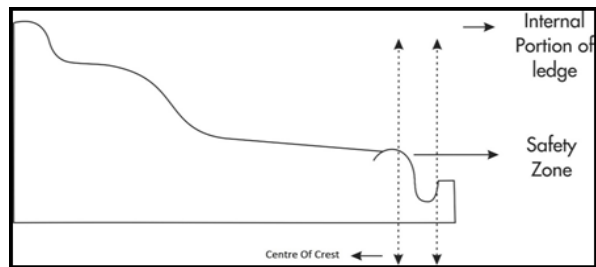


Fig.3 Safety Zone:- Area between centre of the crest of the ridge and internal part of the ledge of the cast.

Overjet and Overbite: The amount of the overbite and overjet in anterior natural dentition is in harmony with the prominence of compensating curve and inclination of the condylar guidance in dentate arch. Overjet (horizontal overlap) should be 2mm, Overbite (vertical overlap) should be 2mm¹³

2. Posterior teeth arrangement :

1] Mesio-Distal Relation [Facial View /Frontal/Buccal] :-

- Long Axis of First premolar should parallel to long axis.
- Long Axis of Second premolar should parallel to long axis.
- Long Axis of First molar is lingually tilted at occlusal third.
- Mesiobuccal groove is in line with the tip of mesiobuccal cusp of upper first molar.
- Long Axis of second molar is lingually tilted at occlusal third more steeply than first molar.

2] Cervico-occlusal view / Relation :-

- First premolar : The central groove is positioned in line between the cusp tip and the middle of the retromolar pad.
- Second premolar : The central groove is positioned on a line between the cusp tip central groove at the first premolar and the middle at the Retromolar pad.
- First Molar : Follows the contour of upper arch , slight angulation from canine to premolar line and the central groove at the first molar is positioned on a line between cusp tip at canine, central groove at premolars and the centre of the retromolar pad.
- Second Molar : Falls within the line formed by the angle at first molar. ends well before the raise in the retromolar pad and central groove of second molar coincides with cusp tip at the canine ,central groove at premolars and first molar.

3] Buccolingual Relation :-

- First Premolar :
 1. Long axis is parallel to the vertical axis.
 2. Lingual cusp is below the horizontal plane.
 3. Buccal cusp is 2mm above the horizontal plane.
- Second Premolar : Long axis is parallel to the vertical axis and both cusps are 2mm above the horizontal plane.
- First Molar : Long axis is mesially inclined at the occlusal third and Mesiopalatal cusp of maxillary first molar sit on the central fossa of first Molar.
- Second Molar : Long axis is lingually tilted at the occlusal third more steeply than the First molar and Lingual cusp of maxillary second molar fits into central fossa of Mandibular second molar^{13,15}

Errors that occur during teeth arrangement :

The common errors that occur during the arrangement of artificial teeth:

1. Interarch errors
2. Intra-arch errors

Interarch Errors: Cross-bite, Increased or decreased horizontal overlap, Increased or decreased vertical overlap, Midline shift ,Edge-to-edge contact of anterior teeth.

Intra-arch Errors: Errors exclusive for maxillary arch, Errors exclusive for mandibular arch, Errors common to both the arches¹³

CONCLUSION:

Dental art does not occur automatically. It must be purposely and

carefully incorporated into the treatment plan by the dentist. Hence Esthetic replacement and physiological tooth arrangement made the complete denture biologically compatible and desirable.¹⁷

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