10.5005/jp-journals-10024-2308

REVIEW ARTICLE

A Comprehensive Review on the Errors That occur during Ideal Teeth Arrangement for Complete Denture Prosthesis

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ABSTRACT

Aim: The aim of this article is to present a comprehensive review and a classification system on the various errors that occur during the ideal arrangement of artificial teeth for complete denture prosthesis.

Materials and methods: Assessment of various classification systems presented for errors in artificial tooth arrangement and identifying the lacunae in each system.

Results: A comprehensive review and a classification system on the various errors that occur during the ideal arrangement of artificial teeth for complete denture prosthesis have been presented.

Conclusion: This classification system is aimed toward dental students and dental practitioners to aid in the arrangement of artificial teeth for complete denture prosthesis.

Clinical significance: The proposed classification system helps the operator to identify the various errors which may occur during the arrangement of artificial teeth for complete denture prosthesis. It also aids in providing a detailed insight into the role played by artificial teeth in restoring the form and function of completely edentulous patients.

Keywords: Artificial teeth arrangement, Complete denture prosthesis, Denture occlusion.

How to cite this article: Balaji SS, Bhat V. A Comprehensive Review on the Errors That occur during Ideal Teeth Arrangement for Complete Denture Prosthesis. J Contemp Dent Pract 2018;19(5):624-627.

Source of support: Nil

Conflict of interest: None

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INTRODUCTION

Based on Payne's statement that "set the teeth where they grew" in removable prosthodontics, the aim of teeth arrangement is to place the artificial teeth in the original position of the missing natural teeth.[1] Proper positioning of the anterior artificial teeth, their shape, size, and shade help to achieve two major functions of a prosthesis, which are esthetics and phonetics. Esthetics and phonetics are like two sides of a coin and a compatible balance must be provided between them. They also act as a guide to establish proper vertical dimension of the patient.

Ideal positioning of posterior artificial teeth facilitates efficient mastication and thereby restoration of the health of the patient. According to Swenson,[2] the main principles dictating teeth arrangement are arch position, arch contour, orientation of occlusal plane, inclination of teeth for occlusion, and positioning for esthetics. In the end, the entire teeth arrangement should be functionally as well as esthetically pleasing.

During the replacement of the missing teeth, it is imperative that consideration should also be given to the amount of soft tissue which needs to be restored. A restoration can be termed functional only when it provides sufficient support to the extraoral and intraoral tissues while assisting proper speech, esthetics, and mastication. Hence, during the process of artificial teeth arrangement, the handling of the wax around them also plays a crucial role in the amount of support provided for the muscles around the oral cavity. The area of the lost soft tissue due to extraction and resorption has to be accurately filled and contoured for improving the appearance and functions of the patient.[3] The position of artificial teeth also plays a major role in crack propagation in dentures because of development of stress patterns.[4]

The process of teeth arrangement can never be underestimated due to the aforementioned factors. In the literature, several rules and principles exist which guide

us to achieve the above goals during the artificial teeth arrangement for removable prosthesis. However, due to lack of proper understanding of the biological concepts behind this procedure, numerous errors occur, jeopardizing esthetics and function.

MATERIALS AND METHODS

Many authors like Swenson[2] and Morrow et al[5] have proposed classifications of errors which occur during the placement of artificial teeth. Swenson does not consider the role played by various anatomical landmarks in guiding the placement of artificial teeth. Morrow, Rudd, and Rhoads have taken the space availability for arranging tooth as a major determinant and other factors have been omitted. Also, a complete electronic and hand search was done on the topic, which revealed lack of adequate data in the current scenario. Hence, an attempt has been made to provide a comprehensive classification of the errors that are usually seen during artificial teeth arrangement for rehabilitation of edentulous mouth.

RESULTS

The common errors that occur during the arrangement of artificial teeth for complete dentures are grouped under two broad categories:

1. Interarch errors
2. Intra-arch errors

The intra-arch errors can further be classified into

- Errors exclusive for maxillary arch
- Errors exclusive for mandibular arch
- Errors common to both the arches.

Interarch Errors

The most commonly occurring interarch errors are as follows:

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

Cross-bite

Artificial teeth must never be arranged in cross-bite relation unless otherwise deemed necessary. Cross-bite relation also causes unfavorable leverage on the upper denture during function. The cross-bite relation in posterior teeth violates the natural set-up of posterior teeth and results in cheek biting in the patient.[2,6]

Increased or Decreased Horizontal Overlap

Orbicularis oris along with muscles of facial expression controls expression and esthetics and reflects the personality in complete denture wearers. Reduction of horizontal overlap causes dropping of orbicularis oris and other muscles of facial expression toward their origin and makes them ineffective to perform their intended functions. Also, when the horizontal overlap is reduced, it causes unfavorable occlusal leverage on the anterior part of residual ridges. Increased horizontal overlap causes strain on the perioral musculature and gives unaesthetic appearance.[2]

Increased or Decreased Vertical Overlap

Excessive vertical overlap of teeth causes more exposure of upper anteriors and it will be unaesthetic, and too little a vertical overlap will cause turning in and lengthening of upper lip, which causes a straight and expressionless face.[7]

Midline Shift

According to a study conducted by Jayalakshmi et al,[9] the acceptable deviation between the facial and dental midline in dentate subjects is in the range of 0 to 1 mm. But in the case of an edentulous patient, the operator must ensure that facial and dental midlines do coincide.

Edge-to-edge Contact of Anterior Teeth

Edge-to-edge contact of anterior teeth must be given only when mandible is in a prognathic relation. This will cause a seating effect on the maxillary denture.[7]

Intra-arch Errors

The intra-arch errors are:

- Errors exclusive for maxillary arch
- Errors exclusive for mandibular arch
- Errors common to both the arches.

Errors Exclusive for Maxillary Arch

The errors that occur in maxillary arch are

- Failure to establish the occlusal plane
- Asymmetrical arch form
- Placing the teeth on maxillary tuberosity
- Placing the incisors on the incisive papilla.

Establishing the Occlusal Plane: The prescribed glass plate relationship must be followed while arranging the maxillary teeth. Glass plate represents the occlusal plane and it helps to orient the plane according to the needs of the patient. When the occlusal plane is too high, the patient may bite the papilla and when the occlusal plane is too low, the tongue will interfere with an overlap of mandibular teeth and cause tongue biting.[6] Also, when mandibular artificial teeth are arranged so high, it causes difficulty for the tongue to collect food from the labial/buccal vestibule

and when arranged too low, lateral borders of the tongue will lose support.[8] Also studies have been done to use cephalometric landmarks to orient the occlusal plane in the maxillary arch for completely edentulous patients.[10]

Asymmetrical Arch Form: Failure to follow the arch form while arranging artificial teeth will result in asymmetrical arch in both anterior and posterior regions. This will lead to deficiency of arch length and also occlusion will be tough to achieve. In order to achieve a proper arch symmetry, measurements taken from gothic arch tracing can be used to calculate the inter-ridge width in the canine region and first molar region.[11]

Teeth on the Maxillary Tuberosity: When maxillary second molars are placed on the tuberosity, it will result in shunting of dentures. Care must be taken while selecting the teeth size for the patient to avoid this error.

Teeth on the Incisive Papilla: Maxillary anterior denture teeth must always be arranged anterior to the incisive papilla by 8 to 10 mm irrespective of the position of incisal papilla to the residual ridge. This is to maintain the upper lip position and also maintain the distance between the anterior surface of labial flange of maxillary denture and the anterior surface of labial surface of maxillary denture teeth.[7]

Errors Exclusive for Mandibular Arch

The errors that occur in the mandibular arch are:

- Labial/lingual tilt of mandibular anterior teeth
- Violation of Pound's triangle in posterior teeth.

Labial/Lingual Tilt of Mandibular Anterior Teeth: When mandibular anterior teeth are tilted more labially, there will not be any mechanical advantage. This position also will be incompatible to the lips, cheeks, and tongue, and also may not look appealing to the patient.[2]

Violation of Pound's Triangle in Posterior Teeth: Pound's triangle serves as a reliable guide for arranging the mandibular posterior teeth. Arranging mandibular posterior teeth more lingually leads to loss of denture stability arising from the interruption of normal tongue positioning. Mandibular posterior teeth placed buccal to Pound's triangle cause denture dislodgement due to disruption of cheek musculature and violation of buccal corridor space. The accurate placement of mandibular posterior teeth is very essential while doing arrangement for extremely resorbed mandibular ridges.[12] Also, stresses are well distributed only when the artificial teeth are arranged on the alveolar ridge.[13]

Errors Common to Both the Arches

Errors common to both the arches are

- Failure to make canines turning point of the arch
- Changing the sides of the teeth
- Crowding of anterior teeth while arranging posterior teeth
- Spacing between the teeth
  Unaesthetic finishing

Failure to Make Canines Turning Point of the Arch: The mesial incline of maxillary canine must coincide with the distal incline of mandibular canine. If the lower anterior teeth are arranged widely, mandibular canines are distal to maxillary canine, which will result in spacing between maxillary canine and premolar. If the lower anterior teeth are arranged narrowly, mandibular canines are mesial to maxillary canine, which will result in spacing between mandibular canine and premolar, but this spacing will be esthetically acceptable to the patient.[6] The operator can also take the intercondylar width as a trustworthy guide for arranging maxillary canines.[14]

Crowding of Anterior Teeth while Arranging Posterior Teeth: Improper cooling of wax results in difficulties in stabilizing the already placed teeth while additional teeth are being arranged. Use of hard wax can reduce this error to an extent.

Changing the Sides of the Teeth: Changing the sides of the teeth and interchanging of maxillary and mandibular teeth while arrangement raises a serious question on the operator's knowledge of dental anatomy. Such a problem should be addressed immediately and additional training must be given for teeth identification.

Spacing Between the Teeth: Spacing must never be provided during artificial teeth arrangement unless insisted by the patient as it renders an unaesthetic appearance.

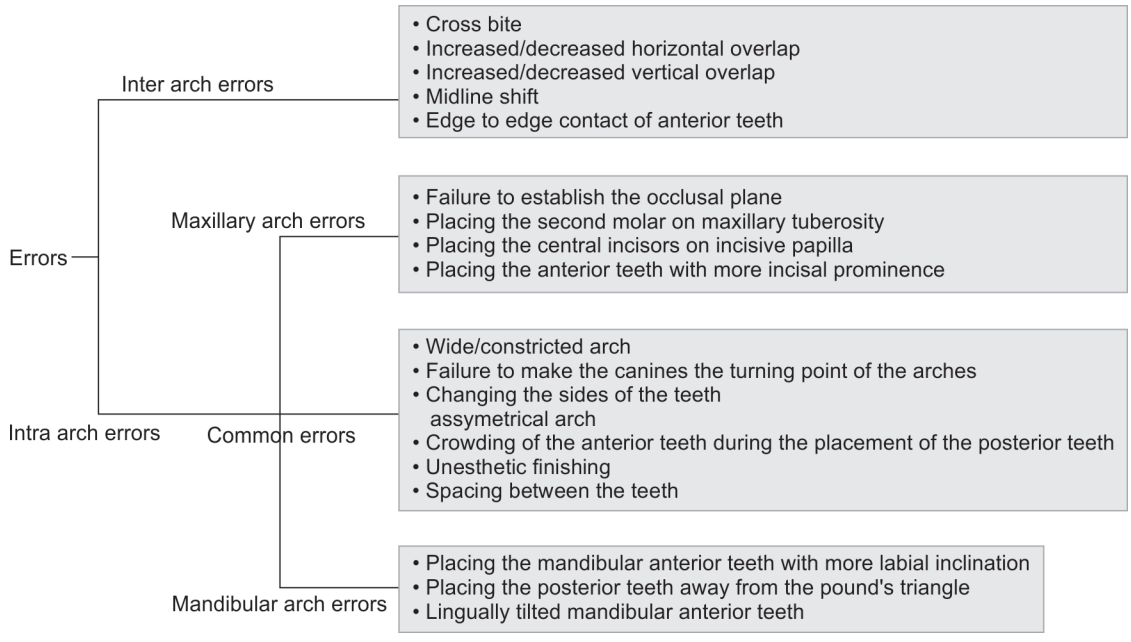
Unaesthetic Finishing: Improper finishing and polishing following teeth arrangement may render a perfectly done artificial teeth arrangement unappealing to the patient. Proper root carving and festooning support perioral and intraoral structures and also accentuate the esthetics, stability, and retention of denture.

The summary of common errors which occur during arrangement of artificial teeth is mentioned in Flow Chart 1.

CONCLUSION

A well-fabricated complete removable denture should allow to function well, allow to speak normally, esthetically pleasing, and must not abuse the soft tissues and residual ridges. Arrangement of the artificial teeth according to the scientific assessment plays a major role in achieving success in these prostheses. The factors governing the positioning of teeth are: functions of surrounding structures, cellular structures of basal seat tissues, anatomical limits, and mechanical aspects.[8] The success of the scheme of occlusion also depends on the proper positioning of the artificial teeth.[15]

Flow Chart 1: Errors in teeth arrangement



In the clinical situation, teeth arrangement varies from arch form, ridge form, patient profile, tooth form, and many other factors which vary between patients. The present classification system proposed by us has been designed keeping the ideal conditions. Any deviation from the ideal situation should be accommodated as per the needs, expectations, and demands of the patients.

CLINICAL SIGNIFICANCE

The proposed classification system helps the operator to identify the various errors which may occur during the arrangement of artificial teeth for complete denture prosthesis. It also aids in providing a detailed insight into the role played the artificial teeth in restoring the form and function of completely edentulous patients.

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