

**‘NAIL’ AS A DETERMINANT IN ARTIFICIAL TOOTH SELECTION CRITERIA: A
LITTLE-KNOWN FACT**

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Article Received on 20/08/2022

Article Revised on 10/09/2022

Article Accepted on 30/09/2022

ABSTRACT

Artificial teeth selection has been an important clinical procedure while processing a complete denture. Numerous intraoral and extraoral measurements are considered as landmarks for tooth selection in absence of pre-extraction records. This review focuses on using nail as one landmark in anterior tooth selection and the evidence and studies that supports it.

KEYWORDS: Incisor, MSX1 gene, Nail, Tooth Selection.

INTRODUCTION

The primary concern of patients seeking prosthodontic treatment is esthetics. In edentulous patients, esthetic restoration plays an important psychological effect. Anterior tooth selection plays a major role during fabrication of complete dentures. Placement of artificial tooth with proper size and shape helps in obtaining proper dento-facial harmony. In absence of any pre-extraction records, many parameters like intra and extraoral landmarks and other measurements have been an effective guide in anterior tooth selection.

History of Anterior Teeth Selection

During the ivory age, teeth were selected, mostly by dimensional measurements, with slight consideration given to face form or other qualities.^[1]

The geometric classification of face form and profile, which was projected by Madame Schimmelpeinik in 1815 for artist's use was considered in dentistry for esthetic teeth selection. J.W. White in 1872 put forward the "correspondence and harmony". The basis of this concept was that the temperaments called for a characteristic association of the tooth form and colour, and that harmony called for a corresponding proportion and size of tooth to that of the face, and a tooth color in harmony with facial complexion; that both form and color were modified to be in harmony with sex and age.^[1]

"Berry's biometric ratio method", was put forward in 1906. He discovered that the proportions of the upper central incisor and face had a definite ratio. The tooth

was one sixteenth of the face width and one twentieth the face length. Clapp's "Tabular Dimension Table Method," was presented around 1910. This was based upon selecting tooth size from the overall dimension of six anterior teeth and the vertical tooth space present in the patient.^[1]

"Frame Harmony Method,"^[1] introduced by the Justi Company in 1949. The basis of this method is the size and proportions of the teeth are in harmony with the general proportions of the skeleton. The overall tooth size is selected by the mathematical formula, one seventeenth the total dimension of the upper and lower bearing areas, with the dimensions of the individual anterior teeth correlated with a developed table of tooth dimensions to give the indicated overall dimension.

DISCUSSIONS

The concept of tooth selection in complete denture prosthodontics has changed from basic human temperamental theory and geometric theory to the philosophy of creating the effects of sex, personality and age. Since, most of the time an edentulous patient reports for complete denture treatment without any definitive information about his lost natural teeth. It has become necessary to look for some craniofacial landmarks and derive the information on the size of the natural teeth through biometry, to that the anterior teeth selected are in a pleasing proportion to the face. The shape and the size of the artificial teeth selected should not exhibit extreme characteristics, but harmonize with the face and profile of the patient.

Common Size Evaluation Criteria for Teeth Selection

Maxillary central incisors are reported to be the most important teeth to satisfy the esthetic requirements of the patient with width being considered more critical than length.^[11]

Some common mathematical proportions which are currently used for predicting the width of the maxillary anterior teeth are: Nasal width, intercommissural width, interpupillary width, distance between the medialis angles of the eyes, and incisive papilla.

Several authors stated that the distance between the outer surfaces of the alae of the nose seems to be the same as that between the tips of the canines. Mavroskous found that interalar nasal width is a reliable guide for selecting the size of anterior teeth. The mesiodistal width of the set of anterior teeth (four incisors and the mesial halves of the canines) can be determined by adding 7 mm to the patient's nasal width.^[4]

Hoffman et al. studied North American subjects to investigate whether the interalar width could be used as a reliable guide for the selection of suitable anterior teeth when constructing denture.^[5] Gomes et al. studied 81 Brazilian people and showed that the interalar width was significantly correlated to the mesiodistal width measured on a photo, both between the tips of the maxillary canines and between the distal surfaces.^[6]

The curve distance between the corners of the mouth, which supposedly represents the curve distance between the distal surfaces of the maxillary canines, is often used as a method for selecting the maxillary anterior denture teeth.^[6] Isa et al. studied 60 Malaysian subjects to investigate the relationships between some facial dimensions and widths of the maxillary anterior teeth. It has been reported that the width of the central incisors was highly correlated to the interpupillary distance, while the widths of the lateral incisors and canines were highly correlated to a combination of interpupillary distance and interalar distance.

Gomes et al. and Lucas et al. indicated that ICD showed a correlation to the distance between the tips and the apparent distal surface of the maxillary canines. The biometric ratios of 1:0.267 and 1:1.426 could be used to estimate the central incisor width and the combined width of the six anterior teeth, respectively.^[6]

Nails as A Landmark Determinant

Nails have always been known as a great health indicator. They are good indices for health of an individual. They have high sensitivity to internal and external environments and helps as a diagnostic tool in detecting health imbalances. Also Cigrande in 1913 used the outline form of the fingernail to select the outline form of the upper central incisor tooth.^[1] (fig 1)



Fig. 1:

According to Leonardo da Vinci an ideal human proportions were governed by the harmonious ratio that he believed in. So that the body structures have a definite correlation with each other.

There have been studies in the past as mentioned above where the outline form of the fingernail to select the outline form of the upper central incisor tooth. The size was modified to meet the requirements of tooth space and other relationship. Further studies are very few on this.

The Correlation Between The Teeth And Nail

Genetically and embryologically, nails and tooth share a common factor.^[7] Homeobox genes have been seen to be an important factor in development of nails, toenails and teeth. The gene that plays this role is MSX1 gene which is in the family of homeobox genes. Embryologically, nail and tooth share an ectodermal origin and develop during the 9-10 week intrauterine.^[3]

Role of Msx genes in tooth development

It has been proposed that tooth shape and position are specified by multiple homeobox genes expressed in

neural crest-derived mesenchyme in the mandibular and maxillary processes of the first branchial arch.^[7] These expression patterns and the dental abnormalities observed in transgenic mice of these genes support such a theory. Studies have proved that homozygous *Msx-1* deficient mice have complete failure of incisor development. A large family with missense mutation in *MSX1* gene also shows tooth agenesis.

Role of *Msx* gene in nail development

Msx1 and *Msx2*,^[9] are expressed in the developing digit tips where nails are formed. *Msx1* is expressed exclusively in the mesenchyme, while *Msx2* is found in both the mesenchyme and the epithelium in a more distal region of the digit tip when compared to *Msx1*. Digit amputations performed on both fetal and neonatal mice showed that full digit regeneration (including nail) could be obtained only when the amputation plane contained *Msx1*-positive cells, even in the absence of *Msx2*-expressing cells. These observations suggest that *Msx1*-positive cells act like an organizing center of digit tip development.

More recently, a *MSX1*,^[3] gene mutation was reported to be associated with wiktopy syndrome, which includes tooth agenesis and nail dysgenesis.

Wiktopy syndrome / Tooth nail syndrome

Wiktopy syndrome is a variant of ED.^[10] Mutations in *MSX-1* cause failure and development of dentition in this syndrome. There is hypodontia and, infrequently, anodontia of the permanent teeth; seldom more than 20 permanent teeth are missing. Absent maxillary incisors, second molars, and maxillary canines are the most common missing teeth.^[10] Defects in primary teeth may be so mild that no abnormality is noted until the permanent teeth fail to erupt.

The tooth-and-nail syndrome is also manifested by defects in the nail plates of fingers and toes. The nail defects are, however, alleviated with age and may not be easily detectable during adulthood. Typically, toenails are more severely affected than fingernails, and in some instances, nail plates are absent at birth.

Clinical Significance

Using nail as a landmark for determining the size of anterior teeth would be of great advantage for patients with facial abnormalities.^[7]

CONCLUSION

For the artificial denture to achieve an artistic and esthetic beauty, special attention must be given to the selection of tooth, the arrangement of teeth and contouring and coloring of the external form of the denture. For this, evidence shows that nail form and tooth form can be taken as two of the few factors that influence the denture harmony, both esthetically and psychologically.

Various studies have shown that teeth and nail do share genetic similarity. The presence of *MSX1* gene is the uniting factor. While various landmarks are present for determination of size of tooth, nails can be a turning point in patients with facial abnormalities.

Nevertheless further research on this can actually help in a promising outcome of having one more determinant for teeth size evaluation.

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