DR Cyril Nyalik Ogada BDS, MDS(NBI), Department of Conservative and Preventive Dentistry, University of Nairobi.DR. Regina Mutave James BDS (NBI), MRes (ST ANDREWS), PGD-RM (NBI), PhD (NBI) Department of Periodontology and Community Dentistry, University of Nairobi.

FACTORS THAT INFLUENCE USE OF THE INCISIVE PAPILLA AS REFERENCE TO MAXILLARY ANTERIOR TOOTH POSITIONS

OGADA C.N, and MUTAVE R.J

ABSTRACT

Objective: **To describe some factors that may influence the use of the incisive papilla as reference to maxillary anterior tooth positions.**
Design: **Descriptive cross-sectional study.**
Setting: **The Department of Conservative and Prosthetic Dentistry, School of Dental Sciences, University of Nairobi.**
Results: **112 maxillary casts generated from participants aged 18-35 years, with well aligned arches were studied. The distance from the posterior limit of the incisive papilla and the most labial aspect of maxillary central incisor (pap11) did not vary with the gender, facial profile, or somatotype. There was a weak correlation between pap11 and age. Pap11 varied with arch form. There was weak correlation between age and the distance from the posterior margin of the incisive papilla to the inter-canine line (papintcan). There was no variation in the relationship between papintcan and gender, facial profile or somatotype. Papintcan varied with the arch form. There was no variation in the inter-canine width with age, facial profile or somatotype. There were correlations between the inter-canine width and papintcan, between the inter-canine width and pap11, and between papintcan and pap11.**
Conclusion: **Arch form is a significant factor to consider while using incisive papilla as reference to maxillary anterior tooth positions. Age, gender, facial profile and somatotype have no effect on the relationship between the incisive papilla and maxillary anterior teeth.**

INTRODUCTION

Complete denture aesthetics is key in patient satisfaction with complete denture treatment1. It is affected by the appearance of the denture base as well as the prosthetic teeth. The use of acrylic resin, which is easy to stain, has considerably enabled clinicians to improve the appearance of the denture base2. The aesthetic appearance of the teeth in complete dentures is determined by the tooth display, shape, size and proportion, and arrangement. Tooth arrangement remains to be a challenge to achieving denture aesthetics. Tooth arrangement is the major determinant of tooth-mold appearance and, therefore, more important to overall denture aesthetics3-6. Maxillary anterior teeth are mostly visible during speech and when the person smiles. The positions of the maxillary central incisors and canines are, therefore, crucial in determining the aesthetics of complete dentures.

However, minimal adjustments are often necessary to compensate for resorption and for stability of removable prosthesis. Determining this natural position of the teeth after morphological changes caused by resorption may present a challenge. In such situations, biometric guides that remain relative unchanged despite resorption may be of help7. One such guide is the incisive papilla8. Although the use of the incisive papilla as a biometric guide to determining the positions of maxillary central incisors and canines has been described among many people groups, the factors that may influence the relationship between the incisive papilla and these key teeth may be poorly understood.

Ehrlich and Gazit while investigating the relationship between incisive papilla and maxillary canines and central incisors realized that in ovoid and tapering arches the inter-canine line passed predominantly through the centre of the papilla or 1-3 mm posteriorly to the centre of the papilla. In the square arches the inter-canine line passed either through the centre of the papilla or 1-2 mm anterior to the centre of the papilla9.

The relationship between the incisive papilla and maxillary anterior teeth may thus differ with arch form. There is a decrease in tooth sizes with age, a factor attributed to interproximal wear and loss of tooth structure at the incisal edge through attrition and abrasion. How this change affects the relationship between these teeth and the incisive papilla is largely unknown. This study sought to describe some factors that may influence use of the incisive papilla as reference to maxillary anterior tooth positions.

MATERIALS AND METHODS

This study was approved by the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (Ref No KNH-ERC/A/108). Altman's monographs for calculation of sample size were used to determine the sample size.

This study included 112 participants of African descent who were students at the College of health sciences, University of Nairobi. The age and gender for each participant was obtained from the national identity card. Each subject was instructed to stand upright and place his/her head in the physiologic natural head position looking at the horizon. With the head in this position, the relationship between two lines was noted; one line dropped from the bridge of the nose to the base of the upper lip and a second one extending downward to the chin. The profile was judged as straight if the three points were on a straight line, convex if the middle point (base of upper lip) was anterior to the two other points and concave when the middle point was posterior to the other two points.

The somatotype was categorized by the principal investigator based on the general body build of the subject as ectomorphic (tall and thin), mesomorphic (average) and endomorphic (short and fat).Maxillary impressions were recorded from all participants in Irreversible hydrocolloid (Blueprint® 20+, Dentsply Detrey GmbH, Konstanz Germany, batch no. 1207151573) using stock trays (GC Europe, Leuven, Belgium). The impressions were rinsed under cold running water and disinfected by immersion in Zeta 7 solution (Zhermack® clinical, Badia Polesine, Italy).

Type IV gypsum (Kaldent by Kalabhai, Mumbai, India, batch no. 121001) was used to pour the impressions to generate casts. The casts generated were trimmed using a model trimmer (Manfredi, Dentalcon Trading Ltd, Nicosia – Cyprus) under wet conditions, bench dried and stored in polythene bags in a dry environment. The casts were evaluated for details which included the tip of the canine, the most posterior point of the incisive papilla and the most labial aspect of the maxillary right central incisor which were identified on the casts and marked using a marker pen with a fine point (1.0mm tip diameter,

Guangdong Baoke stationary co, LTD, Guangdon, China.). A photocopy of each cast was made using a photocopier (Kyocera Corporation, Kyoto, Japan.) to generate an image of the occlusal surfaces of the teeth in one plane at a ratio of 1:1 (the occlusal plane was used as the reference plane).

The position of the casts on the photocopier was standardized by placing cellotape to form a square frame within which each cast was placed facing the same direction. Each cast was placed with the occlusal surface downwards, resting on the photocopier. On each photocopy, the tips of the canines were joined with a straight line (the inter-canine line). Lines parallel to the inter-canine line were drawn passing through the most posterior margin of the incisive papilla and the most labial aspect of the right maxillary central incisor.

A perpendicular line joining these three lines was drawn to allow measurement of the distance between the lines. The same fine point pencil (Push 0.7, Pelikan, Schindellegi, Switzerland) was used to draw all the lines for standardization on the thickness of the lines. The following measurements were obtained from each photocopy using a digital caliper (CEN-TECH, Model 47256, Calabasas, CA) to the nearest 0.01 mm.

a)   The distance between the cusp tips of the canines (inter-canine width).
b)   The distance between the line joining the canine cusp tips and the tangent to the posterior margin of the incisive papilla (papintcan).
c)   The distance from the posterior margin of the incisive papilla and the most labial aspect of the right maxillary central incisor (pap11).
All the measurements were repeated thrice on three separate occasions and the mean of the sum of the three taken as the correct measurement. All the data was entered onto the data collection sheet. Data were analysed using the statistical package for social sciences (SPSS) Version 17(SPSS Inc., Chicago IL).

RESULTS

There was a weak correlation between age and pap11 (p=0.061). Pap11 varied with the arch form (p=0.006). Post-hoc comparisons using the Tukey's HSD test indicated that the variation for ovoid arches was significantly different from that of tapering and square arches.

Tapering arches did not differ significantly from square arches. Pap11 incisor did not vary with somatotype (p=0.35), gender (p=0.61), nor facial profile (p=0.35) of participants. There was weak correlation between age and papintcan (p= 0.15). Papintcan varied with the arch form (p= 0.04). Post-hoc comparisons using the Tukey's HSD test indicated that all the three types of arch forms were unique from each other in how they influenced the relationship between the posterior margin of the incisive papilla and the inter-canine line. Papintcan did not vary with the somatotype (p= 0.61), gender (p=0.89) nor facial profile (p= 0.68). There was negative, non-statistically significant correlation between the inter-canine width and papintcan (p=0.34). There was weak positive correlation between the inter-canine width and pap11 (p=0.88).Papintcan was very strongly positively correlated to pap11 (p< 0.05).

DISCUSSION

The distance between the central incisor and the incisive papilla did not vary with gender in this study, which was consistent with the findings of most earlier studies10,11. The weak, non-statistically significant correlation between age and the distance from the posterior margin of the incisive papilla to the most labial aspect of 11 was similar to findings from a Chinese study12.

The distance from the posterior limit of the incisive papilla to the most labial aspect of the 11 varied with the arch form, contrary to a similar study conducted in Nepal11.This may be explained by the high number of tapering arch

forms in this study contrary to the other study where the number as much lower. The correlation between age and the distance from the posterior margin of the incisive papilla to the inter-canine line was not statistically significant, similar to a previous study12. The distance between the posterior margin of the incisive papilla to the inter-canine line varied with the arch form in the present study, contrary to an earlier finding13.The difference may be due to variations in methods of measurement. The distance between the posterior margin of the incisive papilla to the inter-canine line did not vary with gender, similar to earlier studies11,13. The distance from the posterior limit of the incisive papilla to the inter-canine line was very strongly positively correlated to the distance from the posterior limit of the incisive papilla to the most labial aspect of the 11. A study in Taiwan14 found only a weak correlation in this relationship although the reference point was the middle of the papilla as opposed to the posterior margin of the papilla in the present study. The method of measurement was also different. These may explain the differences in the findings.

ACKNOWLEDGEMENT

DECLARATION OF CONFLICT OF INTEREST

The authors declare that there are no competing financial interests.

STUDY FUNDING

REFERENCES

1. Carlsson, G., A. Otterland, and A. Wennstro, Patient factors in appreciation of complete dentures. J Prosthet Dent, 1967; 17: 322-328.
2. Al Wazzan, K.A. The relationship between intercanthal dimension and the widths of maxillary anterior teeth. J Prosthet Dent, 2001; 86: 608-612.
3. Nelson, A.A., The esthetic triangle in the arrangement of teeth. Natl Dent Assoc J, 1922. 9: 392-401.
4. Nelson, A.A., Selecting mould and hue of teeth for artificial restorations. Dent Items Interest, 1925. 47: 767-777.
5. Nelson, A.A., Optical illusion and the aesthetic triangle in the arrangement of teeth. Dent Items Interest, 1925. 47: 915-923.
6. Keng, S. and K. Foong, Maxillary arch and central incisor dimensions of an ethnic Chinese population in relation to complete denture prosthodontics. International Dental Journal, 1996. 46(2):103-107.
7. Waliszewski, M., Restoring dentate appearance: a literature review for modern complete denture esthetics. J Prosthet Dent, 2005. 93: 386-394.
8. Harper, R.N. The Incisive Papilla The Basis of a Technic to Reproduce the Positions of Key Teeth in Prosthodontia. J Dent Res, 1948; 27: 661-668.
9. Ehrlich, J. and E. Gazit, Relationship of the maxillary central incisors and canines to the incisive papilla. J Oral Rehabil, 1975. 2:309-312.
10. Park YS, Lee SP, Paik KS. The three-dimensional relationship on a virtual model between the maxillary anterior teeth and incisive papilla. J Prosthet Dent. 2007; 98: 312-8.
11. 11. Shrestha S, Joshi SP, Yadav SK. Relationship of Incisive Papilla to Maxillary Incisors and Canines. J Contemp Dent Pract 2016;17: 306-312

12. Liu J, Yang A, Fang Z, Tan Y, Sun J. Experimental research of the positional relationship between the incisive papilla and maxillary anterior teeth based on three dimensional vision measurement. Shanghai Kou Qiang Yi Xue. 2013; 22: 202-5.

13. Grove H, Christensen L. Relationship of the maxillary canines to the incisive papilla. The J Prosthet Dent, 1989; 61: 51-53.

14. Fu PS, Hung CC, Hong JM, et al Three-dimensional relationship of the maxillary anterior teeth to the incisive papilla in young adults. Kaohsiung J Med Sci. 2007; 23: 519-25.