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Relationship between 'Incisive Papilla to Posterior Vibrating Line Distance' And 'Subnasale to Inion Distance'- An In-Vivo Study

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Abstract: *There are various methods to find out the adequate posterior extension of upper dentures. However studies assessing the possibility of correlating the distance between subnasale inion distance and denture extension is lacking in Malabar region of Kerala. Purpose of this study is to find a co-relation between incisive papilla-posterior vibrating line (IP-PV) distance and subnasale-inion distance (SN-IN) which can aid in the fabrication of an adequately extended denture. A total number of 128 edentulous patients, aged above 50 years were selected for this study. Preliminary impression was made with impression compound. Anterior and posterior vibrating lines were marked and transferred to the impression and casts were prepared. Using a flexible scale distance from incisive papilla to the midpoint of posterior vibrating lines were measured and recorded. Measurement of the subnasale-inion (SN-IN) distance was carried out using a sliding caliper device with reference pointers and graduations and the obtained values were recorded. . Linear regression analysis was carried out to investigate the relationship between IP-PV distance and SN-IN distance (0.311). Age and gender has no significant influence on the regression model since significance value are 0.770 and 0.736 respectively. From the linear regression analysis, there exist a fairly good correlation between incisive papilla to posterior vibrating line distance and subnasale to inion distance. Gender and age had no relationship with the incisive papilla to posterior vibrating line distance (IP – PV) and subnasale to inion distance. (SN – IN)*

Keywords: *Posterior palatal seal area; SN IN distance; IP PV distance*

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I. Introduction

Facial anatomy is a primary characteristic by which individuals present themselves to the external world[1]. The aesthetic rehabilitation of the edentulous patient has an important psychological effect. Finding the most suitable position for artificial anterior teeth presents a new challenge with every edentulous patient. Incisive papilla is one landmark that has received a great deal of attention in dentate state. In edentulous maxilla, incisive papilla is used as a guide for arranging maxillary anterior teeth in complete denture prostheses[2]. Posterior palatal seal area is one of the most important land mark in edentulous maxilla as it enhances denture retention[3].

In dentistry, facial measurements have been more extensively used, especially since 1887, when Ivy mentioned its role in determining the lost vertical dimensions[4]. Various anthropometric measurements can be taken to obtain the length and width of anterior teeth. Biometric analysis of incisive papilla in dentate subjects serves as a guide to develop facial contour in upper occlusal rim and anterior tooth position in complete dentures[2]. Currently, more than 20 landmarks and parameters are being used by the medical and dental professionals for facial measurements[5], and 2 among them are the subnasale and the inion. The subnasale is a reference point that is located at the junction of the columella and the upper lip. The inion refers to the highest point of the external occipital protuberance at the lower rear portion of the skull.

Very few studies have been conducted for determining the relationship between the incisive papilla to posterior vibrating line distance (IP- PV) and its correlation with subnasale-inion distance (SN – IN). This in vivo study aims to find a co-relation between incisive papilla-posterior vibrating line distance (IP-PV) and

subnasale-inion distance (SN-IN), and there by aid in fabrication of maxillary complete denture that is appropriately extended.

II. Materials and method

This study was carried out over a period of 18 months after the ethical clearance. A total number of 128 edentulous patients (68males and 60 females) with age of more than 50 years, who came for complete denture treatment at the Post-graduate clinic, in the Department of Prosthodontics were selected for this study

Study design: cross sectional study.

Study location: This was conducted in the Department of Prosthodontics, Government Dental College, Calicut.

Study duration: May 2016 to October 2017

Sample size: 128 patients

Sample size calculation: Total sample size $N = [(Z\alpha+Z\beta)/C]^2 + 3$;

Where $Z\alpha = 1.96$(constant) $Z\beta = 0.84$(constant) $C = 0.5 * \log [(1+r)/ (1-r)]$; r=0.25. In this study the sample size is approximately 125

Subject and selection method: 128 edentulous patients (68males and 60 females) with age of more than 50 years, who came for complete denture treatment at the Post-graduate clinic, in Department of Prosthodontics were selected for this study. All the participants satisfying the inclusion criteria who provided informed consent were selected for the study.

Inclusion criteria:

1. The patients who are willing to participate in the study.
2. Completely edentulous patient age above 50.

Exclusion criteria:

1. Patients with palatal lesions.
2. Medically compromised patients.
3. Patients with obvious facial asymmetry or noticeable skull deformity.
4. Subjects with history of head injury and those who have undergone cosmetic surgery.

Procedure methodology

Oral examination was carried out to rule out soft and hard tissue abnormalities. Preliminary impression was made with impression compound. The patient was instructed to rinse the mouth with an astringent mouthwash and then seated in an upright position. The posterior palatal area is dried with gauze. The 'T' burnisher was then placed along the posterior angle of the tuberosity until it drops into the pterygomaxillary notch. The same procedure is performed on the other side. Posterior vibrating line is located and marked using an indelible pencil by asking the patient to say "ah" in short burst in a normal, unexaggerated fashion. Anterior Vibrating Line was located and marked with indelible pencil by asking the patient to say "ah" with short vigorous exaggerated bursts. The patient was instructed to keep the mouth open to prevent smudging of the markings .The preliminary impression made was re-inserted into the mouth and seated firmly, to transfer the indelible lines to the impression (Fig 1 and 2).

Fig 1: Posterior and anterior vibrating line located

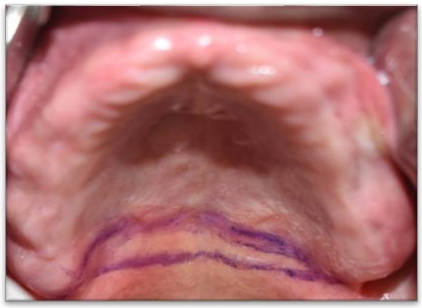


Fig 2: Markings transferred to diagnostic cast

The impression was poured with dental plaster. The markings which were transferred from the mouth to the impression were recorded in the diagnostic cast. After the plaster cast was set, the distance from the posterior margin of the incisive papilla to the midpoint of the posterior vibrating line was measured using a flexible scale and the values obtained were recorded (Fig 3).

Fig 3: Measuring distance from the cast

Measurement of the subnasale-to-inion distance (SN – IN) was carried out using a sliding caliper device with reference pointers and graduations and the obtained values were recorded (Fig 4 and 5). A sliding caliper is a vernier caliper like instrument with a main scale and 2 protruding arms: one fixed and the other movable. Both the arms are parallel to each other. The main scale is of 50 cm length, which has been reduced to 40 cm length for easy handling. The movable arm (white) and fixed arm(black) has reference pointers (for SN and IN).The movable arm with reference pointer(for subnasale) slides away from the fixed arm and the distance between the reference points can be determined from the main scale. Lock and nut mechanism of sliding was used for the movable arm and for the reference pointers. Lock and nut mechanism of sliding was used because of anatomical variations between the individuals of a given population. Posterior reference point (inion) was palpated and the reference pointer of the fixed arm was placed over the reference point. The reference pointer of the movable arm was placed over the anterior reference point (subnasale).The movable arm was locked in position using lock and nut mechanism. The distance between the reference points was measured in the main scale and recorded

Fig 4: Sliding caliper

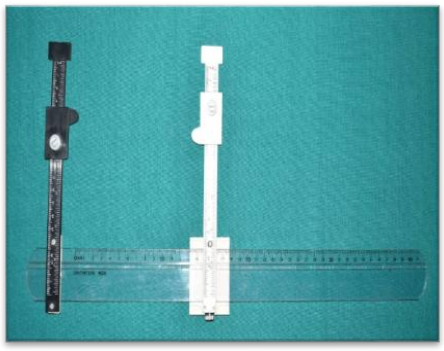


Fig 5: Recording the distance

Statistical analysis

The data obtained were statistically analysed using commercially available software (SPSS 18). Mean and standard deviation were determined for descriptive statistics. Correlation analysis by Pearson's method was used to determine a correlation between IP-PV distance and SN-IN distance. Regression analysis was determined to derive a prediction equation for calculating SN-IN distance from IP-PV distance.

III. Results

The age group of the subjects included in the study ranged from 50 to 85 years of age and the percentage of male patients were 53.1% and female patients were 46.9% respectively (table 1). Independent sample t-test was used to find the equality of means of the variables (IP-PV distance and SN-IN distance) among the male and female samples and there exist no statistical significance (table 2). ANOVA was used to determine the statistical difference between the means of the IP-PV values and the SN-IN values in the age and shows no significance. IP-PV distance is significantly and positively correlated with SN-IN distance (r=0.556) (table 4) (Graph 1). In males, correlation of IP-PV was strongest to SN-IN distance with Pearson's correlation coefficient (r) of 0.657 (table 3). The R value of 0.558 indicates a high degree of correlation. The R2 of 0.311 indicates proportion of variance in the dependent variable (SN-IN distance) that is affected by the independent variables (i.e.; IP-PV distance, Age in years, and Gender) (table 5). The β – constant in the co-efficient table, gives us the value of the slope of the regression line. The intercept value is given by α- constant.

The regression equation will take the form:
Dependent variable= (slope x independent variable) + intercept
Here the dependent variable is "SN-IN distance". From the table, the slope equals 0.543 and the intercept is 13.48. The numerical value on the first row against IP-PV value is the value of the slope for the regression equation. Thus, the regression equation can be formulated as;

Predicted value of "SN-IN" distance =0.543 x (IP-PV) distance + 13.48

Age and gender has no significant influence on the regression model since significance values are 0.770 and 0.736 respectively, which are greater than 0.05.

Table 1: mean and SD of IP PV and SN IN distance

	MEAN	SD	RANGE	MALE	SD	FEMALE	SD	P VALUE
AGE(Yrs)	65.27	6.492	50-85					
IP-PV(cm)	6.616	0.5727	5.0-7.8	6.696	.55	6.527	.59	0.096
SN-IN(cm)	16.986	0.5527	15.4-18.5	17.01	.71	16.958	.30	0.598

Table 2: Mean and SD of IP PV and SN IN distance of different age group

	Age range(yrs)	N	Mean	SD	F	Sig.
IP-PV (cm)	50-59	22	6.56	0.68	.584	.675
	60-69	76	6.65	0.53		
	70-79	27	6.59	0.57		
	>=80	3	6.77	0.77		
SN-IN(cm)	50-59	22	17.04	0.50	.314	.868
	60-69	76	16.97	0.56		
	70-79	27	17.00	0.62		
	>=80	3	16.96	0.58		

Table 3: Correlation of IP-PV distance and SN-in distance based on gender

Gender		SN-IN(cm)
Male	IP-PV(cm) Pearson Correlation Sig. (2-tailed)	0.657 0.000
Female	IP-PV(cm) Pearson Correlation Sig. (2-tailed)	0.486 0.000

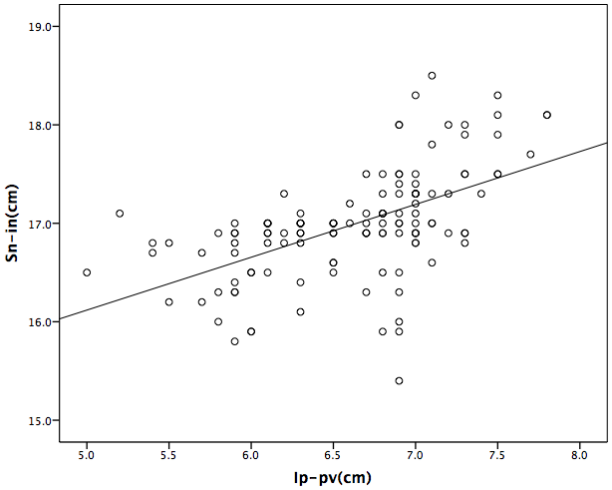
Table 4: Correlation of age of the samples with IP-PV distance and SN-in distance, Correlation between SN-in distance and IP-PV distance, regression model summary.

	IP-PV(cm)	SN-IN(cm)	R	R^2	Regression	
					F	Sig.
Age (yrs) Pearson Correlation Sig. (2-tailed)	.106 .235	.026 .772	.558[a]	0.311	18.666	.000
Ip-pv(cm) Pearson Correlation Sig. (2-tailed)		0.556 0.000				

Table 5 : Coefficients table

Model	β-constants	SD	t	Sig.
IP-PV(cm)	0.543	0.073	7.456	0.000
Age (yrs)	-0.002	0.007	-0.293	0.770
Gender	0.030	0.089	0.338	0.736

α constant=13.48, Dependent Variable=SN-IN distance



Graph 1: Correlation of ip-pv distance and sn-in distance

IV. Discussion

The aim of complete denture fabrication is to provide dentures that have a pleasing appearance with adequate retention and stability, maintain normal speech and provide good occlusal and facial support with adequate masticatory function[6]. Anthropometric values have helped in distinguishing characteristics, within as well as between races. In the facial region, numerous parameters have been utilized to obtain anthropometric information including facial length, nasal height, skull dimensions and inter pupillary distance[7]. Incisive papilla is one of the most commonly used biometric guide to determine the position of incisors and canines.[2] The most effective addition to increase retention of a complete denture is the posterior palatal seal area.[3]

The aim of the current study was to find a co-relation between incisive papilla - posterior vibrating line (IP – PV) distance and subnasale-inion distance (SN – IN). A total number of 128 edentulous patients with age of more than 50 years were selected for this study. In this study, the mean IP-PV distance was found to be 6.616 cm with a SD of 0.5727 and the mean SN-IN distance was found to be 16.986 cm with a SD of 0.5527 respectively (table 1). The mean age group of the sample selected were 65.27 years (table 1). Within the male patients selected, the mean IP-PV distance was found to be 6.696 cm with a standard deviation of 0.55 and in female patients the mean IP-PV distance was 6.527 cm with a standard deviation of 0.59.When the mean of SN-IN distance within males was calculated it was found to be 17.01 cm with a standard deviation of 0.71, and in females the mean SN-IN distance was 16.958 cm with a standard deviation of 0.30 (table 1). There was also a statistically significant difference in the mean of the IP-PV and SN-IN distance among the male and female samples (p= 0.096 and 0.598 respectively). Within the sample, the mean of the IP-PV distance for the age range from 50 to 85 yrs was calculated and it was found to be in a range between 6.56 cm to 6.77 cm. The mean SN-

IN distance for the same age range was found to be in a range between 16. 97 cm to 17.05 cm (table 2). Thus it was found that age has no significant effect on IP-PV distance and SN-IN distance. Analysis of variance showed significance value of 0.675 and 0.868 for IP-PV distance and SN-IN distance, thus showing age has no significant effect on the mean values of IP-PV distance and SN-IN distance (table 2)

The IP-PV distance and SN-IN distance correlation was more strong among the male sample(r=0.657) than the female sample(r=0.486) (table 3).The correlation was also found to be statistically significant (Sig. =0.000).The IP-PV distance and SN-IN distance was correlated based on age, and it was found that there was a weak correlation of r=0.106 and r=0.026 respectively. Moreover, the Significance value was 0.235 and 0.772 for IP-PV distance and SN-IN distance, thereby clearly showing no statistical significance (table 4). The IP-PV distance and SN-IN distance were correlated separately, and it was found that there was a strong correlation between the two distances recorded. The correlation was also found to be statistically significant (Sig. =0.000). Simple linear regression was carried out to investigate the relationship between IP-PV distance and SN-IN distance. There was a strong positive linear relationship between the two, which was confirmed with a Pearson's correlation coefficient of 0.556 (table 4). Simple linear regression showed a significant relationship between IP-PV distance and SN-IN distance (Sig. =0.000). The slope coefficient for IP-PV distance was 0.543. The R2 value was 0.31, which states that 31% of the variation in SN-IN distance can be explained by the model containing IP-PV value, age and gender (table 4). On the regression model, age and gender showed no significant influence, significance value were 0.770 and 0.736 respectively, which are greater than 0.05 (table 5).

The limitations of the study were that the subjects were not classified based on the palatal throat form. Inter operator measurements were not taken in this study, when done could have reduced the errors in the measurement. The compressibility of skin and mucosa over these selected anatomic landmarks cannot be avoided, which might have caused some degrees of errors in measurement.

V. Conclusion

Within the limitations of this in vivo study, we can conclude that; there was a fairly good correlation between incisive papilla to posterior vibrating line distance and subnasale to inion distance. Gender and age of the samples had no relationship with the incisive papilla to posterior vibrating line distance and subnasale to inion distance.

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