International Journal of Medical, Medicine and Health Sciences
ISSN: 2517-9969
Vol:9, No:7, 2015

Relevance of the Variation in the Angulation of Palatal Throat Form to the Orientation of the Occlusal Plane: A Cephalometric Study

Sanath Kumar Shetty, Sanya Sinha, K. Kamalakanth Shenoy

***Abstract*—**The posterior reference for the ala tragal line is a cause of confusion, with different authors suggesting different locations as to the superior, middle or inferior part of the tragus. This study was conducted on 200 subjects to evaluate if any correlation exists between the variation of angulation of palatal throat form and the relative parallelism of occlusal plane to ala-tragal line at different tragal levels. A custom made Occlusal Plane Analyzer was used to check the parallelism between the ala-tragal line and occlusal plane. A lateral cephalogram was shot for each subject to measure the angulation of the palatal throat form. Fisher's exact test was used to evaluate the correlation between the angulation of the palatal throat form and the relative parallelism of occlusal plane to the ala tragal line. Also, a classification was formulated for the palatal throat form, based on confidence interval. From the results of the study, the inferior part, middle part and superior part of the tragus were seen as the reference points in 49.5%, 32% and 18.5% of the subjects respectively. Class I palatal throat form (41degree-50 degree), Class II palatal throat form (below 41 degree) and Class III palatal throat form (above 50 degree) were seen in 42%, 43% and 15% of the subjects respectively. It was also concluded that there is no significant correlation between the variation in the angulations of the palatal throat form and the relative parallelism of occlusal plane to the ala-tragal line.

***Keywords*—**Ala-tragal line, occlusal plane, palatal throat form, cephalometry.

I. Introduction

IN complete denture prosthodontics, the dentist has the task of restoring the total occlusion for patients. The restoration of an occlusion that is compatible with the functional movements of the stomatognathic system is one of the key factors in determining the prognosis of a completely edentulous patient. The most important factor that helps us in the development of this occlusion is the orientation of the occlusal plane. Occlusal plane is the average plane established by the incisal and occlusal surfaces of the teeth; it is not a plane but represents the planar mean of the curvature of the surfaces [1].

The position of the occlusal plane in denture wearers should be as close as possible to the plane that was occupied by the natural teeth. A correct orientation of this plane plays a vital role in achieving optimal esthetics and provides for a normal function of the tongue and cheek muscles, thereby, enhancing the phonetics, masticatory efficiency and stability of the dentures.

The question which arises in clinical practice is how to discover which position was occupied by the natural occlusal plane after the loss of the natural teeth. Numerous authors have proposed several landmarks to help define the level of occlusal plane such as the retromolar pad [2], [3], buccinators groove [4], [5], hamular notch- incisive papilla plane [6], [7] and the relative size and shape of the bearing area of the mandible and maxilla [8], to help orient the lost occlusal plane.

The most popular and most widely taught method is to orient the occlusal plane parallel to a line drawn from the lowest point of the ala of the nose to the tragus of the ear, due to its ease of location. This line is referred to as the Camper's line/plane and was first related to the occlusal plane in 1910 [9]. Since that time the definition of the ala tragus line has been a cause of confusion amongst different authors, with some suggesting superior [10]-[12], some middle [13], [14] and some inferior [15]-[19] as the reference point on the tragus for this line. Numerous anthropometric studies done in the past have resulted in correlation between various intraoral and extraoral features such as the size of the maxillary anterior teeth has been correlated to the intercanthal width [20]-[22], the interalar width [20]-[23], the inter pupillary width [20]-[24], the bizygomatic width [20]-[24] and the facial length [20]-[24].

So an attempt was made in this study to find if any positive correlation exists between the variation in the relative parallelism of the occlusal plane to the ala tragus line at different tragal levels and the variation in the palatal throat form.

II. Materials and Methods

This study was conducted on 200 subjects (the sample size was calculated by doing a pilot study on 25 subjects) selected randomly from the students, staff, and patients of our University. An informed consent was obtained from all the subjects participating in the study. An ethical clearance was obtained from the Ethical Committee of the University, to conduct the study.

The inclusion criteria for the study were selection of subjects between the age group of 18–25 years with a full

Dr. Sanath Kumar Shetty, M.D.S., Professor, Department Of Prosthodontics,Yenepoya Dental College, Yenepoya University, Deralakatte, Mangalore, Karnataka, India (e mail: drshetty@rediffmail.com).
Dr. Sanya Sinha, Department of Prosthodontics, Yenepoya Dental College, Yenepoya University, Deralakatte, Mangalore, Karnataka, India.
Dr. K. Kamalakanth Shenoy, M.D.S., Professor and HOD, Department of Prosthodontics, Yenepoya dental College, Yenepoya University, Deralakatte, Mangalore, Karnataka, India.

complement of healthy and natural teeth with Angle Class I molar relationship and having no history of orthodontic treatment. The exclusion criteria were the presence of periodontally compromised teeth, teeth grossly attrited or abraded, presence of fixed or removable partial dentures, gross malalignment of teeth and missing teeth.

The study was conducted in two steps. First, the relative parallelism of the occlusal plane to the ala tragus line was determined. Then a cephalogram was shot to measure the angulation of the palatal throat form. The subjects were seated on the dental chair in an upright position. Two lines were drawn on the superior most and the inferior most points on the tragus, with a marking pen. The distance between these two points was then measured. The value obtained was divided by three. The area between these two points was then divided into three parts using the value thus obtained, into the superior part, the middle part and the inferior part (Fig. 1). The intraoral part of the Custom made Occlusal Plane Analyzer (Fig. 2) was placed in the subject's mouth such that it was made to touch the incisal edges of the maxillary central incisors and the mesiopalatal cusp of the maxillary 1st molar and was held steadily with one hand. The rectangular external arm was moved up by turning the vice knob (Fig. 2) until its anterior portion coincided with the lower border of the ala of the nose and the location of the posterior portion was noted as to whether it coincided with the superior, middle or the inferior part of the tragus (Fig. 3).

Fig. 1 Tragus divided into three equal parts

After removing the custom made occlusal plane analyzer, the subject's mouth was then prepared by wiping the palate with cotton. A small cotton ball dipped in barium sulphate radiographic marker (liquid powder ratio of 1:0.95) was held with a tweezer and was used to paint a thin line across the centre of the palate extending from the incisive papilla through the hard palate and onto the soft palate (Fig. 4). Immediately, a lateral cephalometric radiograph was taken from a standardized Cephalostat machine (Planmeca Promax) on a standard 8 inch x 10 inch film (Kodak C- Mat Green Sensitive). Exposure parameters of 70 kilovolt, 10 milliampere and 1 second were used. The measurement of the angle of the soft palate and hard palate was based on the Weine concept [25] (which is advocated for measuring the curvature of root canals) (Fig. 5) [25]. A tangent was drawn across the soft palate and hard palate outlines respectively. Using NX 2.0.8400 software (Built 7.0.1102, Agfa Healthcare N.V. Septestraat 27) the angle at the point of intersection of the two tangents was measured which gave the angle of the palatal throat form (Figs. 6, 7).

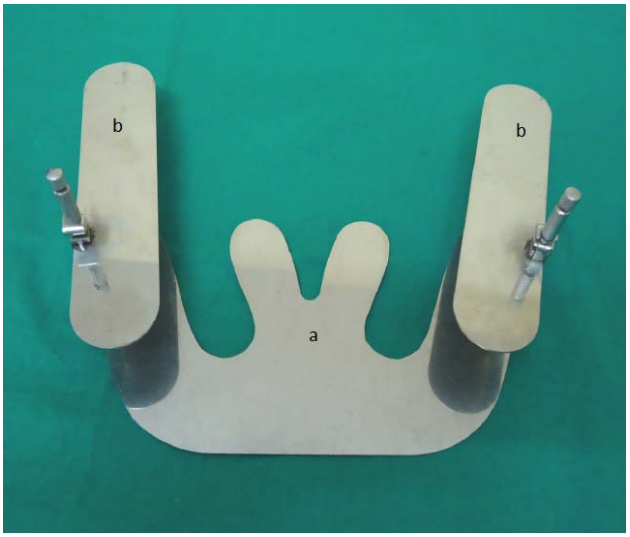

Fig. 2 Intra oral part of Custom made occlusion plane analyzer (a), rectangular external arm was moved up by turning the vice knob (b)

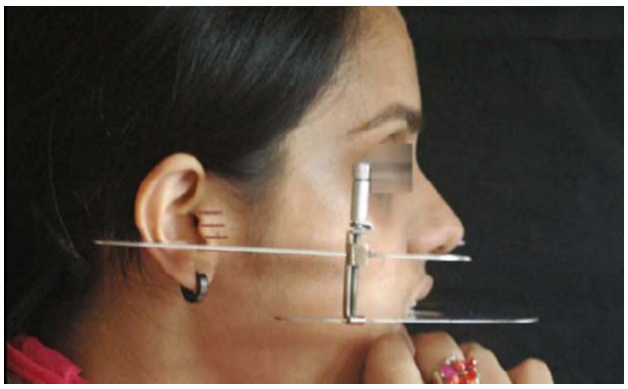

Fig. 3 Custom made occlusal plane analyzer in place showing inferior position

The data obtained for the 200 subjects was analyzed using the Confidence interval and Fisher's Exact test. The p- value was calculated to get the related level of significance, if present.

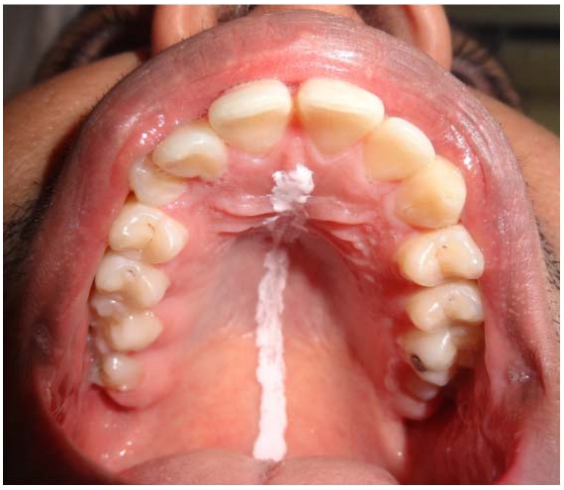

Fig. 4 Barium sulphate marking extending beyond the hard palate into soft palate

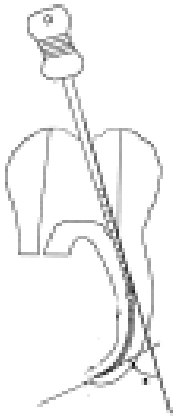

Fig. 5 Weine's Concept for measuring the root canal curvature

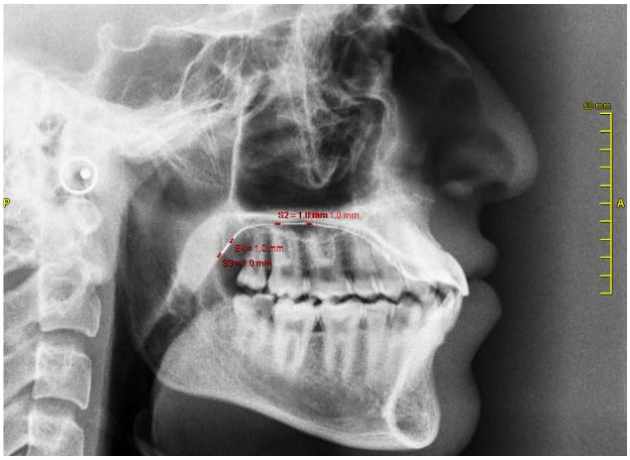

Fig. 6 Cephalogram with the radiographic marker seen as a radio opaque line

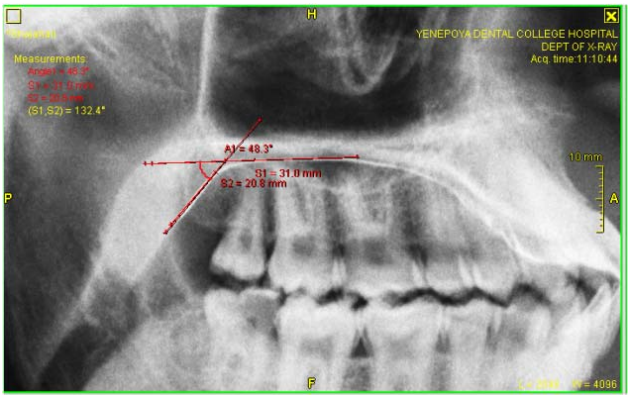

Fig. 7 Measurement of the angulation of the palatal throat form

III. Results

In the 200 subjects studied, the location on the tragus that was found to be the most common was inferior, it accounted for 49.5% of the total. The second most common location was the middle part of the tragus (32%) followed by the superior part (18.5%) (Table I). The data obtained for the angulation of the palatal throat form was divided into three classes based on the standardized scores obtained by the normal distribution curve. The scores were: Class I- <0.425, Class II- 0.425 to 1 and Class III- > 1. Based on these scores, confidence interval was used to classify the data into Class I - Below 41 degree, Class II - 41 degree – 50 degree and Class III - Above 50 degree. Out of the 200 subjects, 43% had Class II palatal throat form, 42% had Class I and 15% had Class III (Table II). According to Fisher's exact test, no significant correlation exists between variation in the angulation of the palatal throat form and the relative parallelism of occlusal plane to the ala-tragal line at different tragal levels (Table III). The p-value is 0.680 which is statistically insignificant.

TABLE I
Depicts the Percentage of Subjects Having Superior, Middle and Inferior Position on the Tragus

Position on the tragus	Percentage of subject
Superior	18.5%
Middle	32.0%
Inferior	49.5%

TABLE II
Depicts the Percentage of Subjects Having Class I, Class II and Class III Palatal Throat Forms

Palatal throat form	Percentage of subject
Class I	42%
Class II	43%
Class III	15%

IV. Discussion

The null hypothesis for the study was that there is no significant correlation between the angulation of the palatal throat form and the position on the tragus for the ala tragal line. The results of the present study fail to reject the null hypothesis.

The results of this study showed that in maximum number of subjects that is, almost 50% (49.5%) of the 200 subjects, the reference point on the tragus was found to be the inferior border, for the ala tragal line, which was in accordance to the studies done by [15]-[19] which also suggested the inferior border of the tragus as the posterior reference point for the ala tragal line in maximum number of subjects. However, the results of this study is not in accordance with the studies done by [13] and [14] which concluded the middle of the tragus as the most common reference point for the ala tragal line and also, [10]-[12] which in the respective studies concluded that the superior part of the tragus as the most common posterior reference point for the ala tragal line.

From the results of the data obtained for the angulation of the palatal throat form a classification was formulated based on confidence interval. The angulations that were recorded for the 200 subjects were classified, into Class I i.e. below 41degree, Class II i.e. between 41 degree – 50 degree and Class III i.e. above 50 degree. Out of the 200 subjects, 43% were found to be Class II, 42% Class I and 15% Class III. A review of literature shows that the palatal throat form has been classified before by [26] and [27] as Class I, Class II and Class III. These two classifications classify the palatal throat form in relation to the width of the area available for post damming.

However in the present classification palatal throat form has been classified in relation to its angulation. A horizontal position of the soft palate in relation to the hard palate is found to be the most common in the study subjects i.e. Class I and Class II in comparison to Class III.

On correlating the two sets of data, using Fisher's Exact test, it was found that, for all the three classes of the palatal throat form the inferior border of the tragus was found to be the most common location of the posterior end of the ala-tragal line, which accounted for 46.4% of the total in Class I, 53.5% in Class II and 46.7% in Class III, and these results were statistically insignificant. This suggests that no correlation exists between variation in the angulation of the. Palatal throat form and the parallelism of the occlusal plane to the ala tragal line at different tragal levels

TABLE III
DEPICTS THE CORRELATION BETWEEN THE POSTERIOR POSITION OF THE OCCLUSAL PLANE ON THE TRAGUS AND THE ANGULATION OF PALATAL THROAT FORM

Postrior position of occlusal plane on the tragus	Angulation of palatal throat form			Total
	Class I	Class II	Class III	
Inferior	39	46	14	99
	39.4%	46.5%	14.1%	100.0%
	46.4%	53.5%	46.7%	49.5%
Middle	26	28	10	64
	40.6%	43.8%	15.6%	100.0%
	31.0%	32.6%	33.3%	32.0%
Superior	19	12	6	31
	51.4%	32.4%	16.2%	100.0%
	22.6%	14.0%	20.0%	18.5%
Total	84	86	30	200
	42.0%	43.0%	15.0%	100.0%
	100.0%	100.0%	100.0%	100.0%

The limitations of the present study are that, it holds true for this particular population and that it was conducted on young dentulous subjects (18-25 years), when in actuality the need is to relate the results in edentulous subjects who are mostly in the older age group. Age changes associated with the ala of the nose, tragus of the ear, hard palate and soft palate were not considered.

V. CONCLUSION

The results of this study bring us to the following inferences. The inferior border of the tragus is the location on the tragus for the ala-tragal line in maximum number of subjects, which accounted for almost 50% (49.5%) of the total subjects. Of the 200 subjects 42%, 43% and 15% of the subjects were classified into Class I, Class II and Class III palatal throat forms respectively, based on the previously mentioned formulated classification. On correlating the two sets of data using the Fisher's Exact test, no significant correlation was found between the two variables, that is, variation of the angulation of the palatal throat form and the relative parallelism of occlusal plane to ala-tragal line at different tragal levels.

REFERENCES

[1] Glossary of Prosthodontics Terms. J Prosthet Dent 2005; 94 (1) 12- 20.
[2] Walter A. Hall Jr. Important factors in adequate denture occlusion J Prosthet Dent 1958; 8 (5): 764-776.
[3] Boucher CO Ed. Swenson's Complete Dentures, ed. 5, St. Louis, 1964, The C. V. Mosby Company, p. 246-251.
[4] Lunquist DO, Luther WW. Occlusal plane determination. J Prosthet Dent 1970; 23: 489- 498.
[5] Merkeley HJ. The labial and buccal accessory muscles of mastication. J Prosthet Dent 1954; 4: 327.
[6] Cooperman HN. HIP plane of occlusion in oral diagnosis. Dent Surv. 1975; 51: 60-62.
[7] Rich H. Evaluation and registration of the HIP plane of occlusion. Australian Dental Journal 1982; 27: 162.
[8] Swenson MG. Complete Dentures, ed. 2, St. Louis, 1947, the C. V. Mosby Company, p.180.
[9] Wilder, Harris H. Laboratory Manual of Anthropometry, Philadelphia, 1920, P. Blakiston's Son and Co., p. 4.
[10] Anthony G. Sclar. Soft tissue and Esthetic Consideration in Implant Therapy, Japan, Quintessence Publishing .Co, Inc 2003, Pg 16.
[11] Miller. Removable Prosthodontics 1st Ed., Ontario, Canada, B.C. Deckar, Inc.1988 Pg 221.
[12] Gupta RH, Singh SP. Relationship of anatomical landmarks with occlusal plane. JIPS 2009; 9(3): 142- 147.
[13] Spratley MH. A simplified technique for determining the occlusal plane in full denture construction. J Oral Rehabil 1980; 7(1): 31-33.
[14] Shingli K. Chetal B.R. and Jabade J; Validity of soft tissue landmarks in determining the occlusal plane; JIPS; 2005;5;3;139-145.
[15] Van Niekerk FW, Miller VJ, Bibby RE. Ala tragus line in complete denture prosthetics. J Prosthet Dent 1985; 53(1): 67.
[16] Rostamkhani F, Sahafian A, Kermani H.A Cephalometric Study on the relationship between the Occlusal Plane, Ala-Tragus and Camper's Lines, in patients with Angle's Class III Malocclusion. J Dent 2005; 2(2): 46-49.
[17] Sharifi E, Rostamkhani F. A Cephalometric study on relationship between occlusal plane and ala-tragus and Campers plane. Journal of Mashhad Dental School 2000-2001; 24(324): 112-5.
[18] Hartono R. The occlusal plane in relation to facial types. J Prosthet Dent 1967; 17 (6): 544.
[19] Lahori M, Nagrath R, Malik N. A Cephalometric Study on the Relationship between the Occlusal Plane, Ala-Tragus and Camper's Lines in Subjects with Angle's Class I, Class II and Class III Occlusion. Journal of Indian Prosthodontic Society Dec 2013;13:4: 494-498.

[20] Kassab NH. The selection of maxillary anterior teeth width in relation to facial measurements at different types of face form. Al–Rafidain Dent J 2005; 5(1): 15-24.
[21] Tandale UE, Dange SP, Khalikar AN. Biometric relationship between intercanthal dimension and the widths of maxillary anterior teeth. J Indian Prosthodont Soc 2007; 7(3): 123- 5.
[22] Al Wazzan KA. The relationship between intercanthal dimension and the widths of maxillary anterior teeth. J Prosthet Dent 2001; 86(6): 608-12.
[23] Rai R. Correlation of Nasal Width to Inter-Canine Distance in Various Arch Form. J Indian Prosthodont Soc. Jun 2010; 10(2): 123–127.
[24] Hasanreisoglu U, Berksun S, Aras K, Arslan I. An analysis of maxillary
Anterior teeth: Facial and dental proportions. J Prosthet Dent 2005; 94(6): 530-38.
[25] Zhu Y, Gu Y, Du R, Li C. Reliability of two methods on measuring root canal curvature. Int China J Dent 2003;3: 118-121.
[26] Millsap CH: The posterior palatal seal area for complete dentures. Dent Clin North Am 1964;8:663-673.
[27] Winkler S. Essentials of complete denture prosthodontics 2nd Ed, USA, 2004, page 204.