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RESEARCH ARTICLE

TO CORRELATE THE RELATIONSHIP OF THE DISTANCE BETWEEN LINGUAL FRENAL ATTACHMENT AND MANDIBULAR INCISAL EDGE POSITION AS AN AID IN ESTABLISHING MANDIBULAR OCCLUSAL PLANE: A CROSS-SECTIONAL SURVEY

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Abstract

Background: The determination of vertical dimension, aesthetics, phonetics and incisal guidance, depends on the placement of anterior teeth. Fewer studies are present for mandibular anterior teeth setting. Therefore this study aims at determining the correlation of distance between lingual frenal attachment and mandibular incisal edge position in dentulous subjects as an aid in establishing mandibular occlusal plane in edentulous patients.

Methodology: 318 subjects (161 males and 157 females) under the age group of 18 to 30 years, who met the requisite criteria were seleceted. A mandibular cast was obtained from irreversible hydrocolloid impression in stock trays for each subject. The distance between the incisal edge of lower central incisor and anterior attachment of the lingual frenum was measured using digital vernier caliper.

Result: It was observed that the distance between anterosuperior attachment of lingual frenumand mesioincisal edge of mandibular central incisor (CI) in female subjects was 12.19, with mean standard deviation (±SD) of 1.34. and 15.91 with mean standard deviation (±SD) 1.32 in male subjects respectively.

Conclusion: Thus, the anterior attachment of lingual frenum is a reliable anatomic landmark and shall aid in setting the mandibular central incisors in a more natural position.

Introduction:-

"When nature suffers than the notion of beauty losses its meaning, because nothing is more aesthetic than the natural beauty."

When the teeth are lost, to replicate and restore the existing lip and soft tissue support shall be one of the prime requisite for an esthetic denture. Studies have shown that the placement of teeth in the existing natural teeth position provides pleasing aesthetics. After the loss of teeth, determination of the correct occlusal plane and vertical

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dimension of occlusion for edentulous patients is one of the difficult steps in making dentures. Activity of muscles during clenching will be least, when the occlusal plane is made parallel to plane of lost natural teeth[1].

Failure in determining the correct vertical dimension has been believed to be a major factor in complete denture treatment failure[2]. The techniques to measure vertical dimension of occlusioncan be broadly classified into pre-extraction and post-extraction methods. The pre-extraction methods are as follows: measurements of intraoral dimensions, profile tracing, cephalometric tracing and pre-extraction phonetics [3, 4]. Since in most of the cases, the edentulous patients fail to present with any pre-extraction records, post extraction methods, as follows: establishment of interocclusal distance[5], swallowing[6], maximum biting force[7], closest speaking space[8], cephalometric radiographs[9]and anatomic landmarks[10]are used to determine the occlusal vertical dimension. Yet, none of them are standard or universally accepted, due to this reason; various authors have advocated the use of pre-extraction records to determine the vertical dimension of the edentulous patient [3, 11].

Various landmarks have been used to orient the occlusal plane in the mandibular arch e.g. retromolar pad, lateral borders of the tongue, the buccinators grove and commissure of the lips[15]. Unlike maxilla, the mandible however lacks a solid anatomic marker[17]. The anterior attachment of the lingual frenum, on the other hand, is placed at the midline, lingual to the mandibular central incisors and is frequently broad. This can be used in determination of positioning of mandibular central incisors.

Very few studies have been conducted for mandibular plane, as compared to maxillary plane, thus this study was undertaken. The purpose of this study is to determine whether the distance between the anterior attachment of the lingual frenumand theincisal edge of the mandibular central incisor on casts as a pre-extraction record is reliable in determining the anterior mandibular occlusal plane and thereby helping in proper position of placement of the mandibular anterior teeth.

Materials & Methodology:-

Study Design:

This study underwent a thorough review by the Institutional Review Board (IRB) at AMC Dental College. Four hundred subjects of the local population as confirmed from their Aadhar Cards were screened from September 2022 to February 2023, who visited the Department of Prosthodontics, AMC Dental College & Hospital, Ahmedabad, India. 318 subjects were selected based on the following inclusion criteria: Dentulous volunteers of age group between 18 - 30 years, with all mandibular anterior teeth present without any incisal wear and sound periodontium, Class I molar and skeletal relationship, without any obvious facial asymmetry. Subjects with previous history of orthodontic treatment, severe crowding, spaced dentition, rotated or migrated lower anterior teeth, pathology affecting mandibular dentition and tongue were excluded.

Methodology:-

Prior to the procedure, a written informed consent was obtained from all participants. Impression was made from irreversible hydrocolloid impression material (Tropicalgin; Zhermack, BadiaPolesine, Italy) using perforated metal stock trays. Trays were adjusted so that the lingual edges of the trays were approximately 2 to 3 mm short of the movable tissues of the floor of the mouth.

Fig. 1:- Armamentarium of the study.

All subjects were instructed to elevate the tongue and moisten the upper lip with the tip of the tongue, while the impressions were made (Fig. 2). The impression material was mixed according to the manufacturer's instructions. The impression was then washed under running tap water and disinfected. All impressions were poured in Dental stone type III(Goldstone; Kogland, Ernakulam, India). Casts were poured using two pour technique, and all the casts were trimmed distal to the second molars. The cast were uniformly attached to plaster base made with a base former (Fig. 3) .

Fig. 2:- Tongue movements during impression making.

For measuring the vertical distance between the anterior attachment of the lingual frenum and incisal edges of the mandibular incisors, two pen marks were placed on the mandibular casts; a lower mark was placed on the anterosuperior most point on frenum in the midline, and an upper mark was placed on an mesial incisal edge of a right mandibular central incisor for uniform measurement (Fig. 4). The distance between the two horizontal marks was recorded by divider and these divider marks were transferred to white sheet using carbon paper and the values from the carbon mark were obtained using a digital vernier caliper (Fig. 5). Each measurement was recorded thrice by the principal investigator and the mean value of all three values was calculated.

Fig. 3:- Cast obtained with marking made on mesial edge of right mandibular central incisor and apex of lingual frenum.

Fig. 4:- Measurement made on cast with the help of divider.

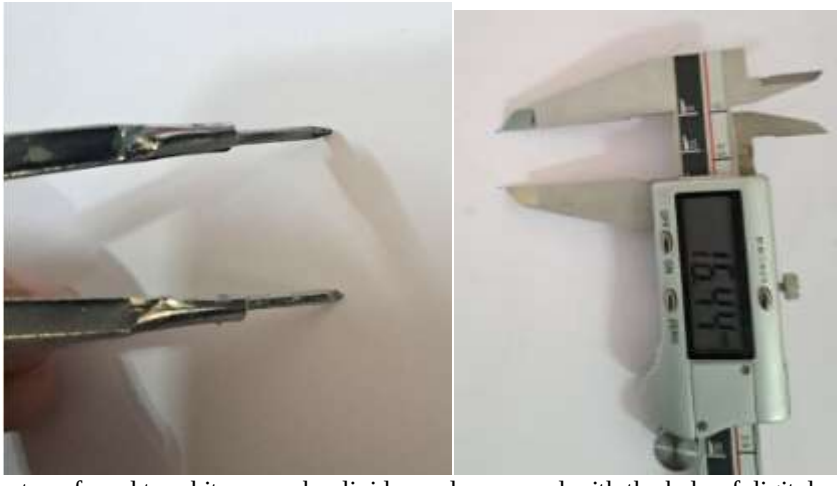

Fig. 5:- Marks transferred to white paper by divider and measured with the help of digital verniercaliper.

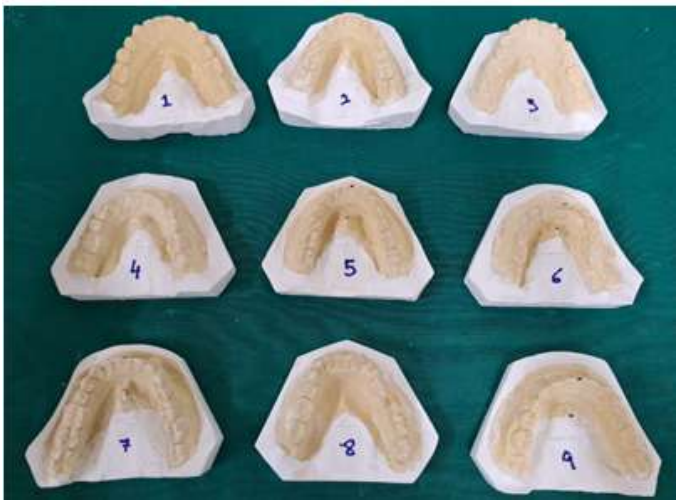

Fig. 6:- Labelled casts.

The collected data was entered at the end of the study in the master chart prepared in the Microsoft excel sheet on the computer.

Table No. 1:- Pilot study.

Serial No.	Patient No.	Age	Sex	Reading 1	Reading 2	Reading 3	Mean
1.	1	20	Male	16.43	16.44	16.42	16.43
2.	2	20	Male	16.54	16.55	16.54	16.54
3.	3	20	Male	13.75	13.76	13.75	13.75
4.	4	21	Female	14.64	14.62	14.62	14.63
5.	5	21	Female	12.96	12.95	12.95	12.95

Result:-

The distance from anterior attachment of lingual frenum and mesioincisal edge of mandibular right central incisor for females ranged between 10.3 to 16.67, with mean (±SD) being 12.19±1.34, for males, it ranged between 11.39 to 19.21, with mean ±SD 15.91±1.32 and for the total population, it ranged from 10.36 to 19.21 and mean (±SD) was 10±2.29. The mean distance from anterior attachment of lingual frenum and mesioincisal edge of mandibular right central incisor in both the gender was found statistically significant with p value 0.00.

Table No. 2:- Comparison between groups by Mann-Whitney U test.

Group	Mean±SD	Min-Max	Median	Mean Rank	Z	P value
Female (n=157)	12.19±1.34	10.36-16.67	12.02	40.90	-9.496	0.000
Male (n=161)	15.91±1.32	11.39-19.21	16.02	108.30		
Total (n=318)	14.10±2.29	10.36-19.21	14.64			

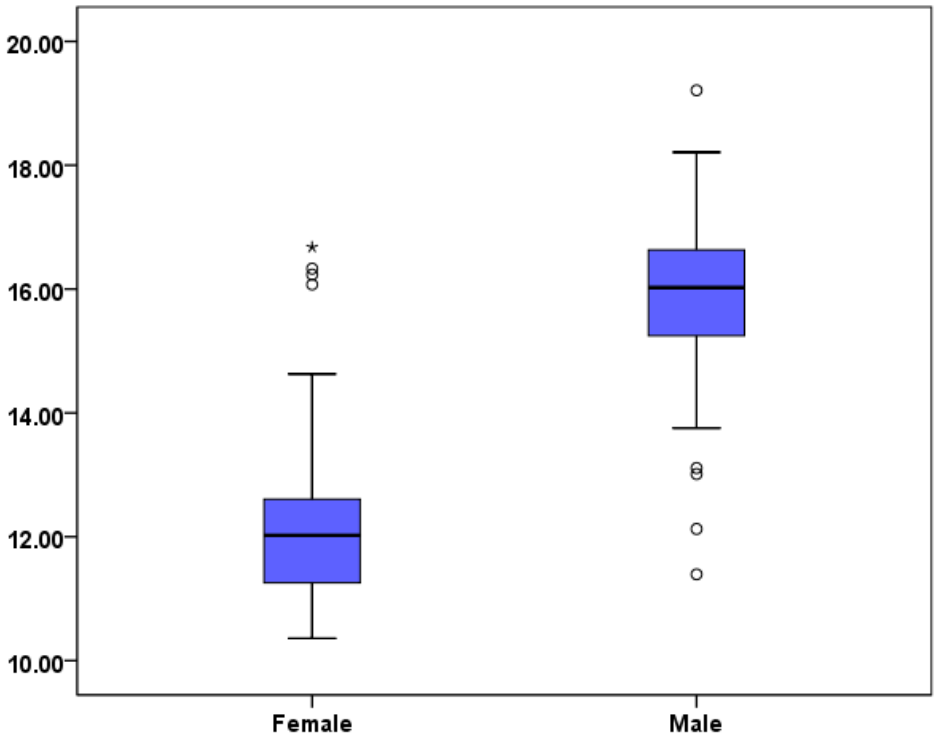

Chart: Box plot.

Discussion:-

The most important step in fabrication of complete dentures is accurate recording of the vertical dimension of occlusion. Changes in the vertical dimension of occlusion might impair the soft facial tissues' aesthetics, speech related problems, and muscular discomfort. After the loss of the last remaining natural teeth, as mentioned by Silverman, complete dentures must be made to provide the closest speaking space as measured in the natural dentition. He also added that when complete dentures are made for patients without preextraction records, one goes back to guessing the proper VDO[8].

Little information is available regarding the positions of mandibular anterior teeth, probably due to the belief that lower natural teeth are not readily visible. However, Lindquist et al suggested that in speaking, people usually display more of the lower than the upper teeth[13].

The incisive papilla is a stable anatomic landmark in the maxilla that can be utilized to assess the vertical relationship of an edentulous patient[14]. Contrary to the unambiguous proof, no comparable mandibular landmark has yet been described in the literature. A stable landmark is the one that doesn't move in alignment with the mandibular and maxilla's typical pattern of resorption. The mandibular lingual frenum was chosen as the landmark in the current study to evaluate its relationship with the incisal edge of the mandibular central incisors.

The lingual frenum is a thin sheet of fibrous connective tissue, which attaches to the floor of the mouth in the middle of the ventral surface of the tongue. Even when teeth are exfoliated or extracted, it does not significantly alter. The tongue is a bodily part that is constantly in use throughout life and does not shrink from disuse under normal physiological conditions. As the ridge resorbs, the crest moves in closer proximity to the ridge, not the frenal attachments, which remain stable relatively. Because of its anatomical location and physiological function, it is therefore suggested in this study that the lingual frenum might be employed as a stable marker in the mandible[15, 16].

The present study was previously conducted in few different ethnic groups. In the Syrian population, consisting of nine males and nine females, Bissasu[16] discovered that the average measurements of the distance between the incisal margins of the mandibular central incisor and the anterior attachment of the lingual frenum were 10.26 mm and

suggested the vertical dimension at occlusion and the position of the central incisor can be determined using this technique. In the Iraqi population of 15 males and 15 females, Rahman et al. found that the mean value of the distance between the anterior attachment of the lingual frenum and the incisal margins of the mandibular central incisor was 10.7 mm in males and 10.9 mm in females[17]. In a group of 100 dentulous subjects in Bangalore, India, Parimala and Prithviraj found that the mean vertical distance between the anterosuperior most point on the lingual frenum and mesioincisal margins of the mandibular central incisors was 12.3 mm[18]. The results of this study showed that among the 318 participants, the mean SD of the distance between the lingual frenum's anterior attachment and the mandibular central incisors was 12.19±1.34 mm for females and 15.91±1.32 mm for males. When compared to earlier investigations, the sample size is adequate to yield a statistically significant result. As all subjects had Angle's Class I molar relation, the value obtained in the present study is more pertinent for edentulous patients with class I ridge relationship. The results of the study showed that the distance from lingual frenum to incisal edge varied in different types of population, suggesting the role of ethnicity for the same.

Limitations ofThe Study:

This study is limited to population having Angle's Class I relationship, further studies need to be conducted for the significance in Class II and Class III ridge relationship. This study should be carried out in different ethnic groups, to understand in depth the role of ethnicity in deciding the vertical dimension of occlusion and and its application for various populations.

Clinical Implication ofThe Study:

Since time and again, Prosthodontists are keen on finding a stable anthropometric measurement. Replacing the tooth in the same position from where it was lost, results in more aesthetic and functional satisfaction to the patients. Thus the results obtained from this study on dentulous casts can be applied to edentulous casts, aiding in mandibular anterior plane determination and proper positioning of mandibular anterior teeth for fabrication of complete dentures.

Conclusion:-

Following conclusions were derived from this study, specifically for Class I ridge relationship:

1. The distance between anterosuperior attachment of lingual frenum and mesioincisal edge of mandibular central incisor (CI) in female subjects was 12.19, with mean standard deviation (±SD) of 1.34.
2. The distance between anterosuperior attachment of lingual frenum and mesioincisal edge of mandibular central incisor (CI) in male subjects was 15.91with mean standard deviation (±SD) 1.32.
3. The distance between anterosuperior attachment of lingual frenum andmesioincisal edge of mandibular central incisor (CI) in both male and female subjects was 14.10 with mean standard deviation (±SD) 2.29.
4. These results can be applied to edentulous patients. By positioning the mandibular anterior teeth 12 to 16 mm from the anterior attachment of the lingual frenum, the complete denture can be fabricated more effectively.
5. The value obtained aided in establishing the vertical dimension easier by making a pre-determined height of mandibular occlusal rim.

Conflicts Of Interest:

The authors declare they have no potential conflict of interests regarding this article.

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