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Original Article

Relationship of the lingual frenum to the mandibular central incisors

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ABSTRACT

Clinical implication: The purpose of this study is to record the vertical distance between anterior attachment of lingual frenum and incisal edge of mandibular central incisors in dentulous subjects and then determine the mean vertical distance and to suggest guidelines for positioning of mandibular central incisors in complete dentures.

Method: In this study, 150 dentulous subjects (75 males and 75 females) were chosen based on predecided inclusion criteria. A mandibular cast was obtained from irreversible hydrocolloid impression in modified stock trays for each subject. All subjects were instructed to elevate the tongue while the impressions were made. The vertical distance between the anterior attachment of the lingual frenum and incisal edges of mandibular central incisors was measured on the casts and then the values were statistically analyzed.

Result: The distance between anterior attachment of lingual frenum (AALF) mesioincisal edge of mandibular central incisor (CI) in male, female and total (male + female) subjects was measured. In males it ranged from 7.3 to 8.9 mm with mean ($\pm$ SD) 8.29 ± 0.36 mm while in females it ranged from 7.1 to 9.0 mm with mean ($\pm$ SD) 8.21 ± 0.38 mm.

Conclusion: It is believed that the application of this anatomic relation can provide a reliable point for arranging and checking the position of the mandibular central incisors for complete dentures in patients with class I ridge relationship.

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1. Introduction

The restoration of natural and pleasing lip support is one of the prime requisites of an esthetic denture. Researchers^{1,2}

have propagated the placement of artificial teeth in the same natural position from which they came, with reference to lips, cheeks and tongue so as to have a pleasing lip support. Hence, the knowledge of natural tooth position is a valuable starting point in establishing anterior tooth position for most

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of the complete denture patients.³ The proper positioning of anterior teeth is essential in determination of vertical dimension, esthetics, and phonetics and last but not the least incisal guidance.

Cade R.E.⁴ and Max Sackstein⁵ through their respective studies have shown that mandibular anterior teeth are displayed to a greater extent than the maxillary anterior teeth in various facial expressions as a person ages. But most literature related to positioning of artificial anterior teeth, emphasizes more on the positions of maxillary teeth and little information is available regarding the positioning of mandibular anterior teeth.

In the mandibular arch, lingual frenum seems to be a stable landmark which can be accurately recorded in function as proposed by Majid Bissasu.⁶ This anatomical landmark can be used for proper positioning of mandibular anterior teeth in their original position and to establish the level of lower occlusal plane in complete denture patients'. The working hypothesis formulated is that the vertical distance between anterior attachment of lingual frenum and incisal edge of mandibular central incisors in dentulous subjects is almost same. The null hypothesis was that there is no correlation between the two. Hence, the purpose of this study is to record the vertical distance between lingual frenum and incisal edge of mandibular central incisors and determine the mean vertical distance along with standard deviation. The clinical relevance of this study lies in its application to complete denture construction. The dentist and laboratory technician can use the results of this study as guidelines in fabrication of mandibular occlusal rims and also for setting of mandibular anterior teeth.

2. Material and method

The present study was conducted in the Postgraduate Department of Prosthodontics, Babu Banarasi Das College of Dental Sciences, Lucknow. The study involved 150 dentulous dental undergraduates including 75 males and 75 females between the age group of 18–25 years. One mandibular cast was prepared for each subject. Subjects were selected based on the following inclusion criteria: Minimal incisal wear on mandibular central incisors, no previous history of orthodontic treatment, no pathology affecting the mandibular dentition, tongue, surface texture and shape of teeth, subjects with Angle's class I molar relation were selected. Prior written informed consent was taken from all the subjects.

Autoclaved perforated mandibular stock tray covering all anatomical landmarks including second molar were selected. Trays were adjusted for each patient, so that the lingual flange of the tray was approximately 2–3 mm short of the movable tissues of the floor of the mouth. Overextended lingual flanges were shortened (Fig. 1) and under extended flanges were extended with impression compound (Fig. 2), if required. The subjects were instructed to elevate the tongue and moisten the upper lip with the tip of the tongue, while the impressions were made. Three tray insertion trials were performed before making the impression so as to train the subjects to correctly record the lingual frenum. Impression trays were held in place by placing the index fingers in first molar and second premolar

Fig. 1 – Overextended lingual flange of the impression tray trimmed.

regions bilaterally, to prevent the movement of the trays during impression making. The irreversible hydrocolloid impression material (Mectron, India) was mixed according to the manufacturer's instructions. The casts were made by pouring the impressions with the Type III dental stone (Pankaj enterprises, India).

Point markings were made on the dentulous cast by using sharp carbon marker, one in the mesioincisal angle of central incisors; second point was marked on the anterior attachment of the lingual frenum. In casts, where the mesioincisal angle of both the mandibular central incisors was not at the same occlusal plane, point marking was done on the higher mesioincisal angle. The occlusal plane of all the casts was made parallel to the horizontal plane using a cast paralleling device (Fig. 3) on Ney's dental surveyor (M.A dental company,

Fig. 2 – Underextended lingual flange modified using impression compound.

Fig. 3 – Cast paralleling device.

India). For this, the cast was attached on the cast holder of the dental surveyor, the paralleling device fixed to the surveying arm was lowered and adjusted to establish contact with the plate in at least three widely divergent points one anteriorly and two posteriorly on both the sides (Fig. 4).

After occlusal plane orientation, the surveying arm with analyzing rod was lowered until the tip of the analyzing rod contacted the mark on the anterior attachment of the lingual frenum (Fig. 5). A horizontal mark was made with a sharp carbon marker on the vertical arm of the surveyor where it met the horizontal arm. Similarly, a second horizontal mark was made on the vertical arm of the surveyor where it met the horizontal arm, when the tip of the analyzing rod was made to contact the mark on the mesioincisal angle of central incisors (Fig. 6). The distance between two horizontal marks on the vertical arm of the surveyor was measured (Fig. 7) using Vernier caliper (M.A dental company, India). The distance represents the vertical distance between anterior attachment of the

Fig. 4 – Cast mounted onto the surveyor.

Fig. 5 – Analyzing rod placed over the marking at anterior attachment of lingual frenum.

lingual frenum and mesioincisal edges of mandibular central incisors. The values were statistically analyzed with SPSS 17.0 for Windows (SPSS Inc., Chicago, III, USA).

3. Results

The distance between anterior attachment of lingual frenum (AALF) mesioincisal edge of mandibular central incisor (CI) in male, female and total (male + female) subjects are summarized in Table 1. The distance from AALF to CI of all (male + female) subjects ranged from 7.1 to 9.0 mm with mean ($\pm$ SD) 8.25 ± 0.37 mm. In males, it ranged from 7.3 to 8.9 mm with mean ($\pm$ SD) 8.29 ± 0.36 mm while in females; it ranged from 7.1 to 9.0 mm with mean ($\pm$ SD) 8.21 ± 0.38 mm. The mean distance from AALF to CI in both the gender was found statistically similar (8.29 ± 0.36 vs. 8.21 ± 0.38 , $t = 1.28$; $p = 0.207$)

Fig. 6 – Analyzing rod placed over the marking at mesioincisal edge.

Fig. 7 – Vertical distance measured between markings on vertical arm of surveyor.

though it was 0.08 mm (0.9%) higher in males than females (Table 2).

4. Discussion

In the present study, the mandibular lingual frenum has been taken as the landmark to assess its vertical relationship with incisal edge of mandibular central incisors. Unlike the conclusive evidence of incisive papilla^{7–9} as a stable landmark, no such mandibular landmark has been documented in the literature until now. A stable landmark is the one which does not undergo positional changes with the normal resorption pattern of edentulous maxillae and mandible. Lingual frenum^{10,11} is a thin sheet of fibrous connective tissue that attaches to the centre of ventral surface of tongue to the floor of mouth and the attachment of lingual frenum does not undergo changes, even after exfoliation/extraction of teeth. The tongue is that organ of the body which is constantly in use throughout life and therefore, in normal physiological conditions does not undergo disuse atrophy. As the ridge resorbs, the crest gets closer to the ridge and not the frenal attachments that undergo changes and hence, the positional alteration. Therefore, it is being proposed in this study that due to its anatomical position and physiological functioning, the lingual frenum can be taken as a stable landmark in mandible.

The armamentarium i.e. cast paralleling device is an occlusal plate that was modified to form an orientation device

Table 1 – Master table of values.

S. No	Patient number	Distance (mm)
Values in male subjects M = Male		
1	1	7.6
2	2	8.0
3	3	7.9
4	4	8.5
5	5	8.6
6	6	8.4
7	7	8.5
8	8	8.3
9	9	7.8
10	10	8.4
11	11	7.3
12	12	8.2
13	13	8.1
14	14	8.9
15	15	8.0
16	16	8.5
17	17	7.4
18	18	8.7
19	19	8.4
20	20	7.9
21	21	8.1
22	22	7.7
23	23	8.3
24	24	7.5
25	25	8.1
26	26	7.8
27	27	8.5
28	28	7.5
29	29	8.6
30	30	8.5
31	31	8.7
32	32	8.4
33	33	8.6
34	34	8.3
35	35	8.1
36	36	8.5
37	37	8.8
38	38	8.2
39	39	8.4
40	40	8.5
41	41	8.0
42	42	8.6
43	43	8.5
44	44	8.0
45	45	8.2
46	46	8.7
47	47	8.2
48	48	8.7
49	49	8.8
50	50	8.5
51	51	8.8
52	52	7.6
53	53	8.1
54	54	8.8
55	55	8.3
56	56	8.4
57	57	8.5
58	58	8.9
59	59	8.1
60	60	8.3
61	61	8.4
62	62	8.2
63	63	8.0

(continued on next page)

Table 1 (continued)

S. No	Patient number	Distance (mm)
64	64	8.4
65	65	8.3
66	136	8.5
67	137	8.5
68	138	8.2
69	139	8.4
70	140	8.7
71	141	8.5
72	142	8.1
73	143	8.5
74	144	8.0
75	145	8.2
Values in female subjects F = Female		
1	66	8.1
2	67	7.9
3	68	8.0
4	69	8.3
5	70	8.5
6	71	8.2
7	72	8.6
8	73	8.1
9	74	7.5
10	75	8.5
11	76	7.3
12	77	8.4
13	78	8.0
14	79	8.7
15	80	8.0
16	81	8.1
17	82	7.6
18	83	8.7
19	84	7.9
20	85	8.3
21	86	8.0
22	87	7.8
23	88	8.4
24	89	7.9
25	90	8.3
26	91	8.1
27	92	8.4
28	93	7.7
29	94	8.3
30	95	7.6
31	96	8.4
32	97	8.1
33	98	8.9
34	99	8.5
35	100	8.6
36	101	7.9
37	102	8.3
38	103	8.2
39	104	8.6
40	105	8.3
41	106	7.1
42	107	8.6
43	108	8.5
44	109	7.7
45	110	8.3
46	111	8.5
47	112	7.9
48	113	8.5
49	114	8.9
50	115	8.1
51	116	7.9
52	117	8.0

Table 1 (continued)

S. No	Patient number	Distance (mm)
53	118	8.2
54	119	8.5
55	120	8.4
56	121	7.7
57	122	7.9
58	123	8.6
59	124	8.7
60	125	8.3
61	126	8.6
62	127	8.4
63	128	8.0
64	129	8.6
65	130	8.1
66	131	7.7
67	132	9.0
68	133	8.3
69	134	8.5
70	135	8.6
71	146	8.1
72	147	8.2
73	148	7.9
74	149	7.7
75	150	8.6

for cast. It is important to orient the stone casts in a standardized manner during measurement so that the results achieved can be applied when artificial teeth are being set in complete dentures. The distance measured represents the vertical distance between anterior attachment of the lingual frenum and mesioincisal edges of mandibular central incisors.⁶ This method of measurement for calculating the distance has been used by various authors.^{6,12,13}

The value obtained in the present study is more relevant for edentulous patients with class I ridge relationship as subjects with Angle's Class I molar relation was evaluated. In this study, irreversible hydrocolloid impression material was used for recording lingual frenum in modified stock trays.

Future research in this direction should involve use of border molded custom trays for every patient with a race, region specific bigger sample size. Applying the obtained values clinically in teeth arrangement and then comparing it with a conventional technique would result in better understanding of the result. The clinical relevance of this study lies in its application to complete denture construction. The dentist and laboratory technician can use the results of this

Table 2 – Summarized distance between anterior attachment of lingual frenum (AALF) mesioincisal edge of mandibular central incisor (CI) of male and female subjects.

Statistics	Males	Females	Total	t value (DF = 148)	p value
N	75	75	150	1.28	0.207
Min	7.3	7.1	7.1		
Max	8.9	9.0	9.0		
Mean	8.29	8.21	8.25		
SD	0.36	0.38	0.37		

study as guidelines in fabrication of mandibular occlusal rims and also setting of mandibular anterior teeth.

5. Conclusions

Following conclusions were derived from the present study:

1. The distance between anterior attachment of lingual frenum (AALF) mesioincisal edge of mandibular central incisor (CI) in male, female and total (male + female) subjects was measured. In males it ranged from 7.3 to 8.9 mm with mean ($\pm$ SD) 8.29 ± 0.36 mm while in females it ranged from 7.1 to 9.0 mm with mean ($\pm$ SD) 8.21 ± 0.38 mm.
2. The value will help the dentist in estimating overbite as well.

Conflicts of interest

All authors have none to declare.

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