



Evaluation of variations in morphology and attachment of frenum in diverse population - A cross-sectional study



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ARTICLE INFO

Keywords:
Frenum
Diastema
Mucogingival problems

ABSTRACT

Background: Frenal attachments are thin folds of mucous membrane with enclosed muscle fibers that attach the lips to the alveolar mucosa and underlying periosteum. It also has septomaxillary ligament that transmits septal growth force to premaxilla. Most often, during the oral examination of the patient the dentist gives very little importance to the frenum, for assessing its morphology and attachment. However, it has been seen that an abnormal frenum can be an indicator of a syndrome or can cause severe mucogingival problems and prevalence of unaesthetic diastema.

Objective: So, the aim of the present study was to evaluate the variations in morphology and attachment of Frenum in diverse population.

Materials and methods: The present cross-sectional study enrolled 400 patients comprising both males and females within the age group of 20–40 years. The frenal attachment was recorded according to the classification by Mirko et al. (1974) and Sewerin (1971). The data was arranged in a tabulated form and analyzed using SPSS software. Chi square test was used for the analysis of the data.

Results: Around 61.3%, 30.3%, 26.7% of the population in age group 20–30 showed gingival, papillary, papilla penetrating type of frenal attachment respectively. Presence of diastema was seen in 63.6% of female population and 36.4% in male population.

Conclusion: It can be concluded that the type of frenal attachment varies with the ethnicity of the population and that diastema is more prevalent amongst females with papilla penetrating type of frenal attachment.

1. Introduction

A frenum is a mucous membrane fold which connects the lip to the alveolar mucosa, gingiva and the underlying periosteum. It exhibits inherent morphological variations. Frena are often seen in maxilla and mandible in midline or premolar region. Maxillary labial and mandibular labial and lingual frenum are most notable frenum of oral cavity. Its primary function is to provide stability of upper and lower lip and the tongue and to retain the lip in harmony with the growing bones of the maxilla.¹

The extent of their involvement in mastication is still not clear. It is histologically composed of connective tissue, elastic fibers, mucous glands with central artery and vein on either side.² It exhibits wide diversity in position and structure and is of physiological importance.³ Aberrant frenal attachment leads to diastema, promotes plaque accumulation, gingival recession, bone loss and hinders proper smiling and speaking. It also has septomaxillary ligament that transmits septal

growth force to premaxilla.³

By applying tension over frenum, abnormal or aberrant frena are noticed visually to see the movement of papillary tip or blanching produced due to ischemia of the region. Loss of papilla, recession, diastema, difficulty in brushing, malalignment of teeth and compromised the denture fit or retention are related to papillary and papilla penetrating type of frena which leads to psychological disturbances to the individual. A frenum can become problematic if tension from lip movement pulls the gingival margin away from the tooth, or if the tissue hinders the closure of a diastema during orthodontic treatment. Frenal attachment that intrude on the marginal gingiva distend the gingival sulcus, encouraging plaque accumulation, intensifying the rate of progression of periodontal recession and thereby causing recurrence after treatment. There are various syndromes associated with relatively specific frenal abnormalities, ranging from multiple, hyperplastic, hypoplastic, or an absence of frena which includes Ehlers-Danlos syndrome, Infantile hypertrophic pyloric stenosis, Holoprosencephaly,

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<https://doi.org/10.1016/j.cegh.2020.03.026>

Received 26 September 2019; Received in revised form 11 March 2020; Accepted 19 March 2020

Available online 25 March 2020

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Ellis-van Creveld syndrome, and Oro-facial-digital syndrome.⁴

Various classifications have been proposed regarding the variations in frenum, but the most widely accepted classifications were given by Mirko et al.,⁵ and Sewerin.⁶

The aim of the present observational study was to evaluate and study different types of frenum attachments in the diverse ethnic population of Central India-Nagpur.

2. Materials and methods

The present observational study enrolled 400 patients comprising both males and females within the age group of 20–40 years who visited the outpatient department of VSPM Dental College and Research Centre, Nagpur, Maharashtra. The study protocol was duly reviewed and approved from the Institutional Ethical Committee. All the patients were explained about the study, and a written informed consent was obtained from them. The patients who have had any congenital/developmental defects, trauma/injuries in the premaxillary region, history of prior orthognathic/frenal surgeries, with one or both central incisors missing and under any medication known to affect the gingiva were excluded from the study.

All the demographic details of the patients were recorded in a tabulated form. Clinical evaluation of the frenum was conducted under adequate light by a single examiner to avoid any error at examiner's end. The site of attachment of frenum with its morphology was examined by upward extension of upper lip and intraoral photographs were also taken. The midline diastema was recorded if the space between central incisors was more than 1 mm. The frenal attachment was recorded according to the classification by Mirko et al. (1974) and Sewerin (1971).

Depending upon the extension of attachment of fibers, frena have been classified as:

1. Mucosal – when the frenal fibers are attached up to mucogingival junction
2. Gingival – when fibers are inserted within attached gingiva
3. Papillary – When fibers are extending into interdental papilla
4. Papilla penetrating – When the frenal fibers cross the alveolar process and extend up to palatine papilla.

Sewerin has also classified the variations of frenum as:

1. Normal frenum
2. Normal frenum with a nodule
3. Normal frenum with appendix
4. Normal frenum with nichum
5. Bifid labial frenum
6. Persistent tectolabial frenum
7. Double frenum
8. Wider frenum

3. Statistical analysis

The data obtained was tabulated and expressed as frequency and percentage. The statistical analyses were performed using a statistical package (SPSS ver 20.0 [IBM Corp.]) and p-value < 0.05 was considered statistically significant. Chi Square test was used to compare the age and gender wise distribution of different types of the frenal attachments.

4. Results

About 400 patients were examined for the type of frenal attachment. However, the data of one of the patient was missing. So, the data analysis of 399 patients was performed. Table 1 provides the descriptive statistics for the demographic characteristics of the

Table 1

Descriptive statistics for the demographic characteristics of the individuals.

Age group in Years	Frequency	Percent
20–30	197	49.4
31–40	202	50.6
Total	399	100.0

Table 2

Gender distribution of the study population.

Sex group	Frequency	Percent
Male	205	51.4
Female	194	48.6
Total	399	100.0

Table 3

Extent of frenal attachment in percentage.

Extent of frenal attachment	Frequency	Percent
Mucosal	119	29.8
Gingival	199	49.9
Papillary	66	16.5
Papilla penetrating	15	3.8
Total	399	100.0

individuals. About 49.4% of the total study population was in the age range of 20–30 years while 50.6% were in the age range of 31–40 years. Table 2 provides the gender distribution which shows that about 51.4% of the study population were males and 48.6% were females. Table 3 exhibits the extent of frenal attachment in terms of percentage. It was found that about 49.9% of the study population had gingival type of frenum attachment, 29.8% had mucosal, 16.5% had papillary and 3.8% had papilla penetrating type of frenal attachment. Table 4 illustrates the type of frenal attachment according to Sewerin classification. A majority of study population exhibited normal frenal attachment. Table 5 describes prevalence of diastema. It was found that only 13.8% of the study population showed midline diastema. About 42.9% of the population who exhibited mucosal type of attachment were from age group 21–30 years while 57.1% were of age group 31–40 years (Table 6). Around 61.3%, 30.3%, 26.7% of the population in age group 20–30 showed gingival, papillary, papilla penetrating type of frenal attachment respectively (Table 6). The chi square value was found to be 26.05 and the p value was 0.000 which indicated highly significant differences in the two age groups. Table 7 reveals gender wise distribution of different types of frenal attachments. About 52.9%, 51.8%, 56.1% of male population showed mucosal, gingival, papillary frenal attachments while 86.7% showed papilla penetrating type. Chi Square value was found to be 9.398 and p value 0.024 which indicated statistically significant differences in frenal attachments amongst both the gender. Presence of diastema was seen in 63.6% of female population and 36.4% in male population (Table 8).

Table 4

Prevalence of type of frenal attachment according to Sewerin classification.

Type of frenum attachment	(N) Total number	%
Normal Frenum	309	77.44
Normal Frenum with nodule	63	15.79
Normal Frenum with appendix	7	1.75
Normal Frenum with nichum	7	1.75
Bifid Labial Frenum	2	0.50
Persistent Tectolabial Frenum	2	0.50
Double Frenum	3	0.75
Wider Frenum	6	1.50
Total	399	100

Table 5
Frequency of diastema.

Diastema	Frequency	Percent
Present	55	13.8
Absent	344	86.2
Total	399	100.0

Table 6
Gender wise distribution of different types of frenal attachments.

Type		Age Group		Total
		20–30	31–40	
Mucosal	Count	51	68	119
	%	42.9%	57.1%	100.0%
Gingival	Count	122	77	199
	%	61.3%	38.7%	100.0%
Papillary	Count	20	46	66
	%	30.3%	69.7%	100.0%
Papilla penetrating	Count	4	11	15
	%	26.7%	73.3%	100.0%
Total	Count	197	202	399
	%	49.4%	50.6%	100.0%

Chi Square = 26.05 p = 0.000.

Table 7
Gender wise distribution of different types of frenal attachments.

Type		Male	Female	Total
Mucosal	Count	63	56	119
	%	52.9%	47.1%	100.0%
Gingival	Count	103	96	199
	%	51.8%	48.2%	100.0%
Papillary	Count	37	29	66
	%	56.1%	43.9%	100.0%
Papilla penetrating	Count	2	13	15
	%	13.3%	86.7%	100.0%
Total	Count	205	194	399
	%	51.4%	48.6%	100.0%

Chi Square = 9.398 p = 0.024.

Table 8
Gender wise distribution of diastema.

Diastema * Sex group Crosstabulation					
		Sex group		Total	
		Male	Female		
Diastema	Present	Count	20	35	55
		% within Diastema	36.4%	63.6%	100.0%
	Absent	Count	185	159	344
		% within Diastema	53.8%	46.2%	100.0%
Total		Count	205	194	399
		% within Diastema	51.4%	48.6%	100.0%

Chi Square = 5.757 p = 0.016.

5. Discussion

The aberrant frenal attachments may cause problems in speech, mastication, esthetics, and maintenance of oral hygiene constituting a periodontal problem. If the labial frenal attachment is inserted at or near the gingival margin, it interferes with tooth brushing and encourages plaque formation by pulling or averting the gingival margin.⁴ Any developmental or acquired anomalies in the underlying labial bone margin along with high frenal pull may contribute to the initiation and progression of the gingival recession. It has also been proposed that labial frenum should be carefully examined as it may serve as potential

cofactor for peri-mucositis and peri-implantitis.^{7,8}

In the present study, it was found that a majority of study population exhibited gingival type of frenal attachment followed by mucosal type. However, most of the female population showed papilla penetrating type of frenal attachment and the presence of diastema was also more prevalent amongst females. These findings are in accordance to the findings of Jindal et al., 2016 and Mirko et al.^{5,9}

During development, the failure of the frenum to migrate apically has been implicated as the causative factor in the persistence of the midline diastema. It may be caused by the insertion of the labial frenum into the notch in the alveolar bone so that a band of heavy fibrous tissue lies between the central incisors.¹⁰

In the present study males showed greater variations and frequency in frenal attachments as compared to females. According to a study by Sewerin higher frequency of variations were seen amongst males.¹¹ Only few studies documented significant difference amongst females.⁹ The presence of diastema was more prevalent in females as compared to males. A labial frenum that is attached close to the gingival margin interferes with normal oral hygiene maintenance and mucogingival problems and can affect the growth of the maxillary alveolar process.⁹ Any interference in allocation of the continuous band of connective tissue of can lead to midline diastema and also interferes with the growth of anterior portion of the maxilla. In these cases, frenum retains its maturational arrest. Therefore, papillary and papillary penetrating varieties are regarded as pathological in the permanent dentition.¹²

The limitation of the study is its smaller sample size, its cross-sectional design and variation in population that may prejudice the results. Hence, further confirmatory studies with larger samples are required involving siblings/twins to evaluate the genetic and racial variations in the morphology and attachment site of the labial frenum.

6. Conclusion

Within the limitations of the study it can be inferred that the type of frenal attachment varies with the ethnicity of the population and that diastema is more prevalent amongst females with papilla penetrating type of frenal attachment. The gingival type of frenal attachment is more prevalent as compared to mucosal, papillary and papilla penetrating types. By determining frenal attachment before planning orthodontic treatment is of prime important so as to avoid further complications. The present study attempts to highlight the importance of prompt early diagnosis of abnormal frenum in preventing the emergence of mucogingival and thereby enhancing esthetics.

Funding sources

None.

Declaration of competing interest

Authors reports no conflict of interest.

Acknowledgement

None.

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