Midline Diastema and Frenum Morphology in the Primary Dentition

María E. Díaz-Pizán, DDS, MSc Manuel O. Lagravère, DDS, MSc
Rita Villena, DDS, MSc, PhD

ABSTRACT

Purpose: The purpose of this study was to determine the prevalence of different types and insertions of labial frenums as well as midline diastema in Peruvian children between 0 and 6 years of age.
Methods: A sample of 1,355 children was selected for the study. A clinical examination was done to classify the labial frenum, measure gingival insertion levels, and quantify midline diastema. Descriptive statistics and the Spearman test were used.
Results: The most prevalent frenums were the simple frenum (59%) and the persistent tectolabial frenum (25%). The level of gingival insertion moved apically with age. The midline diastema was wider in younger children and decreased with age. A significant inverse relationship (r=-0.27; P=.001) was found between the level of gingival insertion and the midline diastema.
Conclusion: The most prevalent frenum was the simple frenum. A significant inverse correlation between the gingival insertion level and the midline diastema was found. (J Dent 2006;26:11-14)

KEYWORDS: LABIAL FRENUM, MIDLINE DIASTEMA, PRIMARY DENTITION

The labial frenum is an anatomical structure formed by a mucous membrane and connective tissue. It has a wide and relatively deep origin or base on the interior surface of the upper lip and extends to the middle portion of the buccal surface of the alveolar process, between the central incisors. Here, it is attached to the periosteum's external layer, the maxillary suture's connective tissue, and the alveolar process.[1-7] The frenum is a dynamic and changeable structure and is subject to variations in shape, size, and position during the different stages of growth and development.[8,9] During growth, it tends to diminish in size and importance.[10] In young children, the frenum is generally wide and thick, becoming thinner and smaller during growth.[11,12]

Dr. Díaz-Pizán is professor, Department of Children and Adolescent, Dentistry Faculty, and Dr. Villena is professor, Victor Alzamora Castro Postgraduate School, both at the Universidad Peruana Cayetano Heredia, Peru; Dr. Lagravère is a PhD orthodontic resident, the Orthodontic Graduate Program, University of Alberta, Edmonton, Alberta, Canada.
Correspond with Dr. Diaz-Pizán at mariaediazp@terra.com.pe

The eruption of the primary incisors, the development of the maxillary sinus, and the vertical growth of the alveolar process make the insertion of the frenum move apically.[2] At birth, the frenum extends to the palatal papillae.[13] When alveolar growth exceeds the vertical and transversal growth of the frenum, it modifies its position buccally toward the alveolar crest.[12,14,15] This change in position during child growth was believed to be caused by the frenum's static position while the surrounding structures grow.[4,16]

It was thought that the labial frenum interfered with the closure of the midline diastema.[3,10,17-20] This belief resulted in misdiagnosis and unnecessary surgical interventions on the frenum.[10] Nevertheless, there are no studies that establish a relationship between the different types of frenums and the presence of the midline diastema in children in primary dentition.

The most frequent frenum typology used is the one established by Sewerin.[21] Using 1,430 subjects between 0 to 60 years of age, a classification system for the diverse frenums was made. These are illustrated in Figure 1. Considering the terminology used to describe the diverse frenums, there is no consensus on the different descriptions. Although many studies have been made on frenums, these present different terminologies for the

Table 1. Sample Characteristics

Age groups (mos/ys)	Gender		
	Male	Female	Total
0-6 mos	52	48	100
7-11 mos	36	31	67
1 y	98	81	179
2 y	102	78	180
3 y	90	109	199
4 y	119	133	252
5 y	111	95	206
6 y	88	84	172
Total	696	659	1,355

Table 2. Prevalence of Frenum by Morphologic Type

Labial frenum	n	%
Simple	798	59
Persistent tectolabial	334	25
Simple with appendix	49	42
Simple with nodule	163	12
Double	2	<1
With nichum	5	<1
Bifid	1	<1
2 or more variations at the same time	3	<1
Total	1,355	100

same frenums.[1,9] For purposes of this study, the same terminology used by Sewerin [21] was applied.

The objective of this study was to determine the prevalence of different types and insertions of labial frenums as well as midline diastema in Peruvian children between 0 and 6 years of age.

METHODS

A sample population consisted of 1,355 children between 0 and 6 years of age from the "San Martin de Porres" district (Lima-Peru) attending the Universidad Peruana Cayetano Heredia Pediatric Clinic. These were arranged into different age groups, as shown in Table 1. Children that presented with an erupted permanent tooth, systemic diseases, syndromes, congenital anomalies, any type of surgery or accident in the anterior portion of the maxilla, loss of maxillary anterior teeth, interproximal caries or restorations on the upper central incisors, any alteration in size and shape of the same incisors, habits, or any type of previous corrective treatment were excluded from the study.

A clinical examination was conducted by the principal researcher with the help of a dental assistant. The direct visual method under natural light was used and consisted of lifting the upper lip with the index finger and thumb of both hands. This allowed for the observation and classification of the labial frenum, according to Sewerin's typology.[21] The level of gingival insertion was measured with a ruler from the alveolar border to the frenum's point of insertion in the gingiva. The midline diastema was also determined by measuring the distance between the midpoints of the mesial surfaces of both central incisors.

This study was approved by the Ethics Committee of the Universidad Peruana Cayetano Heredia, Lima, Peru. Descriptive statistics (median, range, frequency, and percentage) were determined based on the data collected. The Spearman rank correlation test was used to correlate the level of insertion and size of the midline diastema.

RESULTS

Table 2 illustrates that the most prevalent frenums were the simple frenum, persistent tectolabial frenum, and simple with nodule frenum (59%, 25%, and 12%, respectively), representing 96% of the total frenums examined. There was no significant difference between male and female distribution for the different types of frenums in the sample ($P>.05$).

The simple frenum prevalence increased with age, while the persistent tectolabial frenum decreased proportionally (Table 3). The level of gingival insertion increased with age (Table 4). The midline diastema was very wide (mm) in younger children (7 to 11 months), decreased in children up to age 4, and presented a mild increase in children between 5 and 6 years of age (Table 4).

When applying the Spearman rank correlation coefficient correlation test to determine the relationship between the gingival insertion level and the midline diastema, a significant inverse relationship (r=-0.27; P=.001) was found. This meant that a wider midline diastema was associated with a lower gingival insertion and visa versa.

DISCUSSION

The sample in this study included subjects ranging from newborns to children with complete primary dentition. This sample differed from similar studies in which only children with primary dentition,[15] children or adolescents with mixed and permanent dentition,[22,23] and adult samples[12,21] were analyzed. Even though this was not a longitudinal study, the sample allowed for the observation of the characteristics (morphology and insertion) presented by the labial frenum and the presence of midline diastema during the primary dentition phase in children from 0 to 6 years of age.

A modified Sewerin's typology[21] of frenums was employed, since the majority of studies viewed this classification as practical, useful, and easy to use on very young children. With this, a high prevalence of the tectolabial frenum (87%) was found in infants (0 to 6 months). This prevalence decreased significantly with age, a tendency that was also corroborated by similar studies.[21,23] Vera[22] attributed this phenomenon to the vertical growth of the alveolar process, which allows the gingival insertion to change position farther away from the alveolar ridge. The tectolabial frenum's high prevalence in infants increases the possibility of making a misdiagnosis during the first few years of age. The potential for misdiagnosis is even greater if the frenum

Table 3. Percentage of Labial Frenum Type Based on Age

	0-6 mos	7-11 mos	1 y	2 y	3 y	4 y	5 y	6 y	
	n=100	n=67	n=179	n=180	n=199	n=252	n=206	n=172	Total
	%	%	%	%	%	%	%	%	%
Labial frenum									
A. Simple	13	22	31	71	70	73	67	73	59
B. Persistent tectolabial	87	78	65	21	8	6	5	0	24
C. Simple with appendix	0	0	2	1	5	4	7	5	4
D. Simple with nodule	0	0	1	7	16	17	19	20	12
E. Double	0	0	0	0	0	0	0	1	1
F. With nichum	0	0	0	0	1	1	1	1	1
G. Bifid	0	0	0	0	1	0	0	0	1
H. 2 or more variations at the same time	0	0	1	0	1	0	1	0	1

is associated with a wide midline diastema. For this reason, it is important to distinguish between a wide normal frenum and an abnormal one in young children.

The gingival insertion of the labial frenum is considered one of the most critical steps and is a determinant in distinguishing between normality and abnormality. It has been observed that the gingival insertion level increases in length and with age.[3] The gingival insertion increase and the labial frenum's decrease in size in children between 0 to 6 years of age result from the alveolar ridge's vertical growth—which is a product of the primary dentition development and intra-alveolar eruption of the permanent maxillary incisors. This indicates an apical migration of the frenum insertion when it remains in place while the alveolar process is descending by its increase in size. This agrees with the hypothesis posed by some investigators.[4,16,22,24] It is difficult for the clinician to distinguish between an abnormal and normal frenum, especially in young children where the proportion of tectolabial frenums in the process of evolving to normal is very high. This confusion[3] exists among professionals who associate the midline diastema and the frenum as being dependant on each other.[8] Although approximately 60 years have passed since Dewel[3] and Ceremello[8] stated the confusion present between professionals that associated the midline diastema with the frenum, this is still not clear between clinicians.

Table 4. Gingival Insertion Level of the Labial Frenum and Midline Diastema Based on Age

	Gingival insertion (mm)		Diastema (mm)	
Age (mos/ys)	n	Mean±SD	n	Mean±SD
0-6 mos	100	0.11±0.03	0	–
7-11 mos	67	0.25±0.07	31	1.67±0.13
1 y	179	0.97±0.11	174	0.66±0.05
2 y	180	2.77±0.13	180	0.41±0.04
3 y	199	3.98±0.11	199	0.39±0.04
4 y	252	4.42±0.1	252	0.38±0.03
5 y	206	4.53±0.11	206	0.48±0.04
6 y	172	5.04±0.09	172	0.5±0.05
Total	1,355		1,214	

The midline diastema was greater in very young children, decreased in children from 2 to 4 years old, and mildly increased in children 5 to 6 years old. These results are corroborated by a previous study[25] that sustained that the anterior sector of the maxilla had significantly more growth from birth to 6 to 8 months of age, after which time the increase was limited. In this study, it was observed that the greatest average size of the midline diastema was found in children aged 7 to 11 months and decreased in older children as a consequence of the eruption of the other primary teeth.[26]

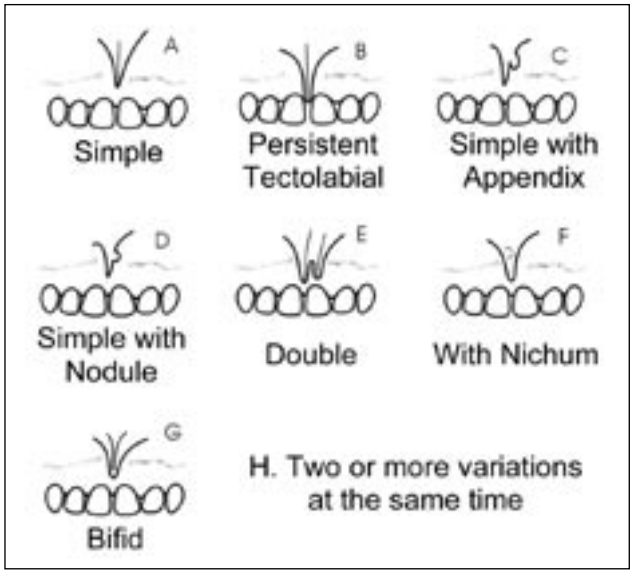

Figure 1. Frenum classification.[21]

The increase in the midline diastema at 5 and 6 years of age is explained by the approximately 5-mm increase in intercanine width observed from ages 5 to 18.[3] This is due to the fast growth in the alveolar process to accommodate the permanent teeth.[27] There are factors other than the growth and development of the child that explain the midline diastema, as indicated in the literature.[24,28,29] For

this reason, a thorough clinical examination is needed that takes into consideration all the medical and dental aspects, auxiliary exams including radiographs of the anterosuperior section, and dental casts to obtain a correct diagnosis and establish an adequate treatment plan.

The frenum could affect the presence and magnitude of the midline diastema if other oral conditions are present (wide maxilla, small teeth, hypodontia, dental caries), but it is not necessarily the most important determining factor. The presence of midline diastema in the primary dentition can be a normal condition that generally disappears after the permanent teeth erupt.[8] Surgical intervention of the labial frenum is not recommended during the primary dentition phase, and an adequate diagnosis that includes all the possible factors involved is necessary.[16]

A limitation of the present study was that x-ray exams and model casts were not taken because of the sample size (economic limitation) and management of very young children.

CONCLUSIONS

Based on this study's results, the following conclusions can be made:

1. The simple frenum, wihch increased significantly with age, was the most prevalent, followed by the tectolabial frenum—which decreased significantly with age.
2. The gingival insertion level increased with age.
3. Infants presented with a larger midline diastema, which decreased with age. Children between 5 and 6 years old showed opposite tendencies of mild increments in the interincisal space.
4. A significant inverse correlation between the gingival insertion level and the midline diastema was found.

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