

The Superior Labial Frenulum in Newborns: What Is Normal?

Global Pediatric Health
Volume 4: 1–6
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DOI: 10.1177/2333794X17718896
journals.sagepub.com/home/gph



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Abstract

Introduction and Objectives: There has been an emergence of procedures to release the superior labial frenula in infants, yet little is known about the normal appearance or incidence of severe attachment, or “lip-tie.” The objective of this article was to develop a classification system for superior labial frenula and to estimate the incidence of different degrees of attachment. **Methods:** A prospective cross-sectional study. Newborns were examined and had photographs taken of their upper frenula. Relevant medical professionals rated the appearance of the labial frenula using a previously described Kotlow classification system. The raters assessed each photograph twice and were blinded to their previous rating and to other raters’ scores. **Results:** All newborns have a labial frenula, with most attached at the gingival margins (83%). Raters had poor intra- and interrater reliability (64% to 74% and 8%, respectively), using the Kotlow classification system, which improved when the classification system was simplified. **Conclusions:** The Kotlow classification of lip-tie fails to be reproducible by relevant experts. The majority of infants had a significant level of attachment of the labial frenulum. As more procedures are done to release the upper lip frenulum, it is important to understand what degree of attachment is normal, or more common.

Keywords

lip-tie, superior labial frenulum, maxillary lip-tie, upper lip-tie, breastfeeding

Received April 7, 2017. Accepted for publication May 14, 2017.

Introduction

The superior labial frenulum is the soft tissue that attaches the upper lip to the anterior surface of the maxillary gingiva. This fold of connective tissue, also known as the maxillary labial frenulum, originates at the midline of the undersurface of the lip.¹ It is made up of alveolar mucosa and arises embryologically as a posteruptive remnant of tectolabial bands.²

There is growing controversy on the identification, classification, and subsequent significance of the superior labial frenulum in newborns, and when the presence of a frenulum is “lip-tie.” The undersurface of the upper lip is not part of the routine newborn clinical examination, and as such is an area not frequently assessed by clinicians. Subsequently, the typical versus atypical appearance of this frenulum is not known. Nor is it known whether this frenulum has any functional consequences relating to its appearance or attachment.

Primarily, controversy stems from an emergence of interventions being performed on superior labial frenula,

such as surgical or laser removal, despite limited knowledge of what is “normal” or “abnormal” in relation to this frenulum. The primary justification for these procedures is to facilitate and improve breastfeeding; however, there is little evidence that certain appearances of the labial frenula have any bearing on latching or feeding. While ankyloglossia, a tight lingual frenulum, has been shown to affect breastfeeding, and improvement in latching onto the breast can be achieved with its release,^{3,4} there is no similar evidence for the superior labial frenula.

The natural history of this frenulum is also not well known. Research examining the appearance of the

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frenulum based on age (during childhood, mean age 8.5 years) has found that frenulum attachment does seem to vary depending on age, with younger children having a more prominent frenulum (inserting onto the palatal surface of the papilla) and older children having a significantly less prominent frenulum (inserting on to, or above, the mucogingival junction).⁵ An earlier study in children (focusing on 9-12 year olds only) found similar results, with 18.1% having a frenula that inserts on or above the mucogingival junction.⁶ In addition to this, epidemiological studies in adults have found a predominance of the mucosal-type attachment, with close to 50% of the 465 adult cohort having this type of frenulum.⁷ In children and adults, a particularly prominent frenulum that extends to the alveolar ridge may cause separation of the incisors, known as a diastema. The presence of a diastema is generally benign and in the vast majority of cases having no adverse outcome, but has been associated with periodontal disease in part due to difficulty with oral hygiene and trapped food.⁸

An attempt to classify the labial frenulum by Kotlow based on its appearance and location of insertion on the gingiva has been made, producing 4 grades⁹: grade 1, minimal alveolar mucosa and minimal attachment; grade 2, the frenulum attaches primarily into gingival tissue, at the junction point of the free and attached gingival margins; grade 3, the frenulum inserts just in front of the anterior papilla; grade 4, the frenulum attaches just into the anterior papilla and extends into the hard palate. The author of this classification system proposes that the higher the grade, the higher the “severity” of “lip-tie,” and the greater the association with breastfeeding problems.⁹

The superior labial frenulum has been called a “lip-tie” when it is believed to be interfering with breastfeeding. Kotlow described the problematic frenulum (the “lip-tie”) as one that interfered with the infant’s ability to flange the upper lip around the nipple and achieve a successful latch. His classification scale (described above) delineating the severity of lip-tie has been used as a clinical factor in the decision for release, but neither the relationship between grade of lip-tie and breastfeeding difficulty nor clinical outcomes after lip-tie release have been clearly demonstrated in studies. The appearance of the superior labial frenulum in the average infant is also not known. This study aims to shed light on what is the typical appearance of the superior labial frenulum in the newborn and to create a standardized classification system based on the appearance of the frenulum. We also attempt to provide epidemiological information in newborns, with an estimate of incidence and to identify any potential differences relating to gender and ethnicity.

Materials and Methods

This prospective cross-sectional study was undertaken at the Well-Baby Newborn Nursery in Lucile Packard Children’s Hospital, Stanford University, California. Institutional review board approval was obtained through Stanford University Human Subjects Research.

The recruitment period spanned 4 months, and participants were recruited on Well-Baby Newborn Nursery ward rounds 2 days per week. All new mothers who had delivered within the previous 24 hours were approached to participate. The first 100 mothers to consent to have their newborns examined and photographed were included in this study. The newborn was examined by 2 physicians and a clinical photograph was taken. Information regarding self-reported ethnicity and gender were documented. Information collected was de-identified and stored on a locked and encrypted computer. Photographs were taken on a camera used purely for clinical photographs and was stored in a locked cupboard accessible only by one of the senior authors.

Once the photographs were collated, the 6 authors utilized the previously devised classification system to grade the photographs. The 6 raters included 2 faculty pediatric otolaryngologists, an attending pediatrician specializing in newborns, a resident in otolaryngology, a pediatric dentist, and a board-certified lactation consultant. Authors graded the photographs twice using the 4-grade system previously described. They were blinded to the ratings of the other raters as well as their previous rating. This gave each photograph 12 ratings. The overall grade assigned to each photograph was whichever rating was most commonly attributed to that photograph (ie, at least 7/12 ratings for each photograph). For photographs that had an even distribution of ratings (eg, if 6 raters categorized a photograph as a “2” and 6 raters categorized it a “3”), the higher rating was recorded.

Intra- and interrater reliability were calculated. Pearson’s χ^2 and 2-sample test of proportions were used to compare the distribution of superior labial frenulum grade with ethnicity and gender.

Results

Demographics

One hundred newborns were included in this study. Ten mothers declined to participate, and 48 mothers that had delivered during the relevant time period were “missed” from being asked to participate as they were unavailable during the recruitment ward round. Fifty-six male and 44 female newborn babies were enrolled in the study. Sixty mothers self-reported as Hispanic in ethnicity

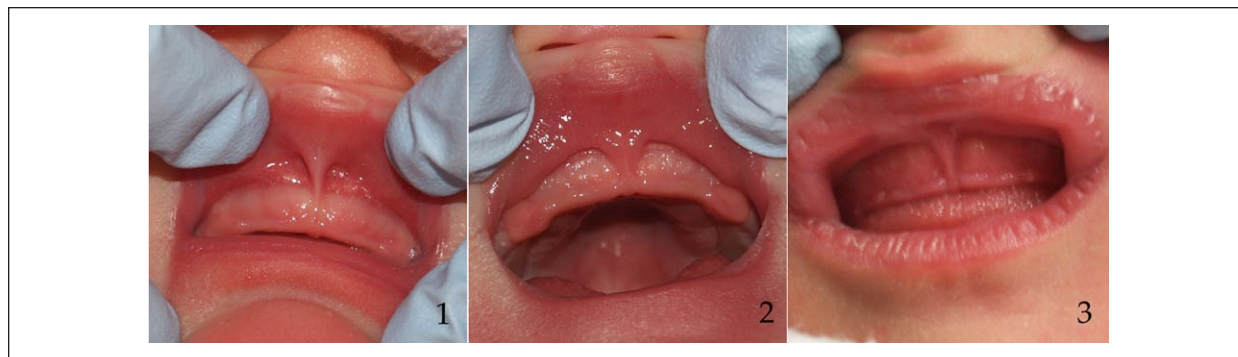


Figure 1. Stanford superior labial frenulum classification. Type 1: Insertion of the frenulum is near the mucogingival junction. Type 2: Insertion is along the mid attached gingiva. Type 3: Insertion is along inferior margin at the alveolar papilla, and can continue to the posterior surface.

(60%), 22 as Caucasian (22%), 11 as Asian (11%), 5 as African American (5%), 1 as Tongan (1%), and 1 as Pacific Islander (1%).

Classification Grade

All newborns have some degree of superior labial frenula. The spread of grades showed the majority were in the middle, with raters classifying 80% of the photographs as grade 2 or 3. Of the photographs, there were 6% rated as grade 1, 41% rated as grade 2, 39% rated as grade 3, and 14% rated as grade 4.

Raters had poor intra- and interrater reliability. The results identified very poor distinction between grades 2 and 3, with a high degree of overlap (90% of all photographs graded as a 2 or 3 had a rating of both a 2 or a 3 by different raters or different rating attempts). There was an 8% interrater reliability; only 8 of 100 photographs had the same rating all 12 times they were evaluated. The intrarater reliability was also fairly poor, with raters giving consistent ratings across attempts ranging from 64% to 74% (SD 3.4%).

The analysis of these results led to discussions between raters regarding the clinical significance of the grading system. The discussions led to the development of a new grading system consisting of 3 types: type 1, equivalent to prior described grade 1; type 2, which combined grades 2 and 3; and type 3, which is equivalent to grade 4 (Figure 1). It was felt that this rating system provided a more clinically meaningful distinction between different types of superior labial frenula.

The results were recalculated using a revised rating system with 3 categories. As indicated above, all newborns were noted to have some degree of superior labial frenulum (Figure 2). The incidence of different superior labial frenulum types are presented below, and majority of these are Type 2 (83%; Table 1). When the grades

were combined, interrater reliability increased to 38% and the intrarater reliability increased to 80% to 90% (SD 3.3%).

Distribution of gender and ethnicity by type are presented below (Table 1). No significant difference between distribution of grades by gender was found; $\chi^2 = 2.1$ ($P = .35$). There was a significant difference between the distribution of frenula grade and ethnicity, with significantly higher numbers of participants of Hispanic and Asian ethnicity with a type 2 frenulum (53/60, 88%); $\chi^2 = 21.3$ ($P = .006$) when compared to Caucasian and African Americans.

Discussion

A lack of knowledge of the superior labial frenulum is the foundation of the debate regarding appearance, structure, function, and proposed interventions on this frenulum. It is in an area of the newborn that is infrequently examined. Procedures done for lip-tie are often done in conjunction with tongue tie, making it clinically difficult to know the significance of the intervention on the lip. Newborns typically only have their upper lip and frenulum examined in the context of a breastfeeding problem. Subsequently, the assumption in the public domain is that the presence of any frenulum is abnormal. What this study highlights is that all newborns have some degree of superior labial frenulum present and that short thin frenula are actually relatively rare. Similar studies in childhood have found less than 6% of children had frenula inserting above the mucogingival junction.^{5,6}

Furthermore, there is evidence from previous research that during childhood this frenulum changes in appearance, becoming less prominent with increasing age.¹⁰ It is unclear whether the appearance of the frenulum in the newborn population has any correlation with



Figure 2. Typical representations of different frenula types from the cohort studied. Photographs of typical representations of different types of frenula from the cohort; the number assigned to each photograph indicates the authors assessment of type of frenulum (types 1 through to 3).

its appearance in childhood and later life; however, the evolving appearance over time during childhood reduces the legitimacy of performing preventative procedures on the frenulum. That is in addition to the lack of evidence of any real major sequelae with the persistence of a prominent frenulum.

The previously described rating system by Kotlow is neither reproducible nor accurate in its ability to adequately describe the frenulum. The study revealed the difficulty in distinguishing different types of superior

labial frenulum by experts in this field. In addition, the experts in this study made their assessments using high-resolution close-up images that could be magnified and viewed in a controlled manner, which is not always possible when examining newborns. The newly developed rating system, despite being better than previously devised rating scales, is still poor in providing consistent ratings (interrater reliability of only 38%). Consequently, using this or a previously devised rating system, it is difficult to extrapolate to clinical significance, frenulum

Table 1. Incidence of Different Grades of Superior Labial Frenula in 100 Newborns by Gender and Ethnicity.

	Hispanic	Caucasian	Asian	African American	Other	Total
Male						
Type 1	1	1	0	1	1	4
Type 2	29	8	7	4	0	48
Type 3	0	3	1	0	0	4
Female						
Type 1	2	0	0	0	0	2
Type 2	24	7	3	0	1	35
Type 3	4	3	0	0	0	7
Total for each grade for both genders	Type 1 = 6		Type 2 = 83		Type 3 = 11	

function, or to justify procedures to remove the superior labial frenulum, when experts fail to come to a consensus on category.

Gender and ethnicity have not been associated with frenulum type in other studies examining epidemiology in maxillary frenula in children.^{5,7} The significance of the higher proportion of type 2 in self-reported Asian and Hispanic patients in our cohort is unclear, however may reflect the small cohort size.

Conclusion

All newborn babies have some degree of superior labial frenula attachment, the majority of which extend approximately half way down the upper gingiva and anterior papilla (Kotlow grades 2-3, Stanford type 2). The previously described Kotlow grading scale had poor intra- and interrater reliability; this improved with the use of the Stanford scale. There is no significant difference in frenulum type based on gender. Given the lack of knowledge surrounding the function of the upper frenulum, the ubiquity of its presence, and level of attachment in most infants, the release of the superior labial frenulum based on appearance alone cannot be endorsed at this time.

Author Contributions

CSM: Substantially contributed to conception or design; contributed to acquisition, analysis, or interpretation of data; drafted the manuscript; critically revised the manuscript for important intellectual content; gave final approval; agrees to be accountable for all aspects of the work in ensuring that questions relating to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

JA: Substantially contributed to conception and design; contributed to acquisition, analysis, and interpretation; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

MTT: Contributed to analysis and interpretation; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

YT: Contributed to acquisition and analysis; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

SR: Contributed to analysis and interpretation; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

AM: Substantially contributed to conception and design; contributed to analysis and interpretation; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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