

Age-related Changes in the Morphological Types of Ankyloglossia in Infants with Feeding Problems

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Research Article

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Abstract

Purpose

To evaluate age-related differences in the distribution of morphological subtypes of ankyloglossia and to assess whether simple spontaneous improvement can be assumed during infancy.

Methods

A retrospective review was conducted of 404 infants with feeding problems who underwent frenotomy between 2019 and 2024. Patients were classified at the first visit according to the morphological classification system and were stratified into three age groups: early infancy (0–3 months), middle infancy (4–7 months), and late infancy (8–11 months). Age-related trends in each subtype were examined using the Cochran-Armitage trend test.

Results

The proportion of the anterior membrane type decreased with age, from 64.8% to 57.1% and then to 37.7%, whereas the proportion of the tower type increased from 21.0% to 24.9% and then to 37.8%. The Cochran-Armitage trend test showed a significant decreasing trend for the anterior membrane type ($p = 0.001$) and a significant increasing trend for the tower type ($p = 0.024$).

Conclusion

The distribution of morphological subtypes of ankyloglossia differed by age during infancy. These findings suggest possible structural remodeling between subtypes rather than simple elongation of the frenulum. In symptomatic infants, postponing surgical treatment solely in anticipation of spontaneous anatomical improvement may not be appropriate.

Introduction

There has long been debate as to whether the lingual frenulum elongates or undergoes spontaneous rupture over time [1, 2]. If such changes occur, the severity of tongue-tie and the degree of restriction in tongue mobility would be expected to decrease as children grow.

This assumption has contributed to recommendations to avoid frenotomy or frenuloplasty in young children, particularly in those younger than 4 years [1]. However, objective clinical evidence demonstrating spontaneous elongation of a short lingual frenulum with age remains limited.

In contrast, a longitudinal study by Martinelli et al. reported that the anatomical characteristics of the lingual frenulum in infants with ankyloglossia did not change during the first year of life [3].

To address these discrepancies, the present study examined age-related differences in the distribution of ankyloglossia subtypes among infants with feeding problems. If frenulum morphology remains stable during infancy, the relative proportions of each subtype would be expected to remain constant across age groups.

Methods

Patient population

A retrospective case review was conducted of 404 infants with feeding problems who underwent frenotomy under topical anesthesia at Shin-Yurigaoka General Hospital between July 2019 and December 2024. Feeding-related problems included poor latch, maternal nipple pain, and breast-related problems.

This study was approved by the Institutional Review Board of Shin-Yurigaoka General Hospital (approval no. 20200929-2-4). Participation was based on an opt-out consent process.

Study design

Patient age, sex, presenting symptoms, and ankyloglossia subtype were evaluated. Patients were stratified into three age groups: early infancy (0-3 months), middle infancy (4-7 months), and late infancy (8-11 months). Subtype frequencies were compared across age groups.

All classifications were performed at the first visit by the author to minimize interobserver variability.

Classification

Ankyloglossia subtype was determined using the author's morphological classification system (Fig1) [4], which was modified from the criteria described by Kotlow [5]. Four morphological types were defined: tongue-tip type, anterior membrane type, tower type, and posterior type.

The tongue-tip type corresponds to Kotlow class 4, whereas the anterior membrane type is similar to Kotlow class 3. A distinctive feature of this system is the tower type, which represents an intermediate form between the anterior and posterior types. Posterior membrane and submucosal cord types in the Kotlow classification are grouped together as the posterior type.

Statistical analysis

The distribution of ankyloglossia subtypes among age groups was compared using the chi-square test for a 3 x 4 contingency table. In addition, the Cochran-Armitage trend test was performed to evaluate age-related trends in the proportion of each subtype. A p value of <0.05 was considered statistically significant.

Results

A total of 404 patients (273 boys and 131 girls; male-to-female ratio, 2.1:1), ranging in age from 14 days to 11 months, were included (Fig2).

The presenting breastfeeding-related problems were poor latch in 362 cases, maternal nipple pain in 166 cases, and breast-related problems in 130 cases. Symptoms overlapped in most patients.

Overall subtype distribution

The overall subtype distribution was as follows: tongue-tip type, 40 cases (9.9%); anterior membrane type, 233 cases (57.7%); tower type, 101 cases (25.0%); and posterior type, 30 cases (7.4%) (Fig3).

Subtype distribution by age

The distribution of patients by age group was as follows: early infancy, 162 cases; middle infancy, 189 cases; and late infancy, 53 cases. The frequency of morphological subtypes by age group is shown in Table 1 and Fig4. As age increased, the proportion of the anterior membrane type decreased from 64.8% to 57.1% and then to 37.7%, whereas the proportion of the tower type increased from 21.0% to 24.9% and then to 37.8%.

Table 1 Morphological subtypes by age group

Age group		tongue-tip	anterior membrane	tower	posterior
	total n	n (%)	n (%)	n (%)	n (%)
0-3 m/o	162	13 (8.0)	105 (64.8)	34 (21.0)	10 (6.2)
4-7 m/o	189	19 (10.1)	108 (57.1)	47 (24.9)	15 (7.9)
8-11 m/o	53	8 (15.1)	20 (37.7)	20 (37.8)	5 (9.4)
Cochran–Armitage trend test		p = 0.001	p = 0.024	p = 0.155	p = 0.386

When the distribution of morphological subtypes was compared across age groups, the chi-square test for the 3 x 4 contingency table did not reach statistical significance at the 5% level (chi-square = 12.30, df = 6, p = 0.056). In contrast, when the Cochran–Armitage trend test was performed using age group as an ordinal scale, the proportion of the anterior membrane type decreased significantly with increasing age (p = 0.001), whereas the proportion of the tower type increased significantly with increasing age (p = 0.024). The tongue-tip and posterior types showed modest increases with age, but these trends were not statistically significant (Table 1). These findings suggest that, among infants with feeding problems associated with tongue-tie, the distribution of morphological subtypes differs by age.

Discussion

The optimal timing of surgical intervention for ankyloglossia remains controversial. A commonly held assumption is that the lingual frenulum elongates with age, allowing treatment to be postponed. However, objective clinical evidence supporting this assumption remains limited.

In the present study, significant age-related trends were observed in the distribution of morphological subtypes during infancy. The anterior membrane type decreased significantly during the first year of life, whereas the tower type increased significantly. These findings suggest that structural remodeling between subtypes may occur during early development.

One possible explanation is that the thin membranous component of the anterior membrane type may tear or remodel during feeding activity, tongue movement, or tooth eruption, resulting in a morphology resembling the tower type. In clinical practice, tears at the anterior edge of the lingual frenulum are occasionally observed after minor trauma or contact with erupting teeth (Fig. 5).

Left: 8-month-old girl; right: 10-month-old boy.

Such changes would represent structural remodeling rather than true elongation of the frenulum. This interpretation may help reconcile discrepancies between parental or empirical observations of improvement and the longitudinal findings reported by Martinelli et al. [3], who observed no morphological changes during infancy. The difference may reflect differences in classification systems. The Kotlow classification, which is widely used internationally, does not distinguish between the anterior membrane and tower types. By identifying the tower type as a distinct category, the present classification may detect transitional morphologies that would otherwise be overlooked.

Several limitations should be considered. First, because the study population consisted exclusively of surgically treated patients, the findings should be interpreted as reflecting clinically significant ankyloglossia rather than the broader population of affected children. In addition, the cross-sectional design cannot prove within-patient morphological transition. Longitudinal observation of untreated patients would provide stronger evidence, although such a study may be ethically difficult to implement in symptomatic infants.

Second, classification was performed by a single evaluator, which minimized interobserver variability but may limit generalizability. Future multicenter validation studies are warranted.

Despite these limitations, this clinical cohort study used a detailed morphological classification system and provides new insight into structural changes that may occur during infancy, as reflected by age-related differences in subtype distribution.

Importantly, even subtypes considered less restrictive may be associated with functional impairments, including feeding-, speech-, and sleep-related disorders [6–8]. Therefore, clinical decision-making should be guided by functional impairment rather than by the expectation of spontaneous anatomical improvement.

Taken together, these findings suggest that postponing surgical intervention solely on the assumption of frenulum elongation may not be justified. Early evaluation and individualized management may be more appropriate for symptomatic patients.

Conclusions

The proportion of the anterior membrane type decreased significantly during the first year of life, whereas the proportion of the tower type increased significantly during the same period. These findings suggest age-related differences in the distribution of morphological subtypes of ankyloglossia and may reflect structural remodeling rather than simple elongation of the frenulum.

Because functional impairment may persist even in relatively mild forms of ankyloglossia, postponement of surgical intervention solely in anticipation of spontaneous improvement may not be appropriate. Clinical management should instead be guided by functional symptoms and individualized assessment.

Declarations

Author Contributions

Y. Ito conceived and designed the study, performed the surgical procedures, analyzed the data, and drafted the manuscript.

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Data availability No datasets were generated or analyzed during the current study.

Conflicts of interest The author declare no competing interests.

Ethical approval This study was approved by the Institutional Review Board of the study institution (approval No. 20200929-2-4).

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Figures

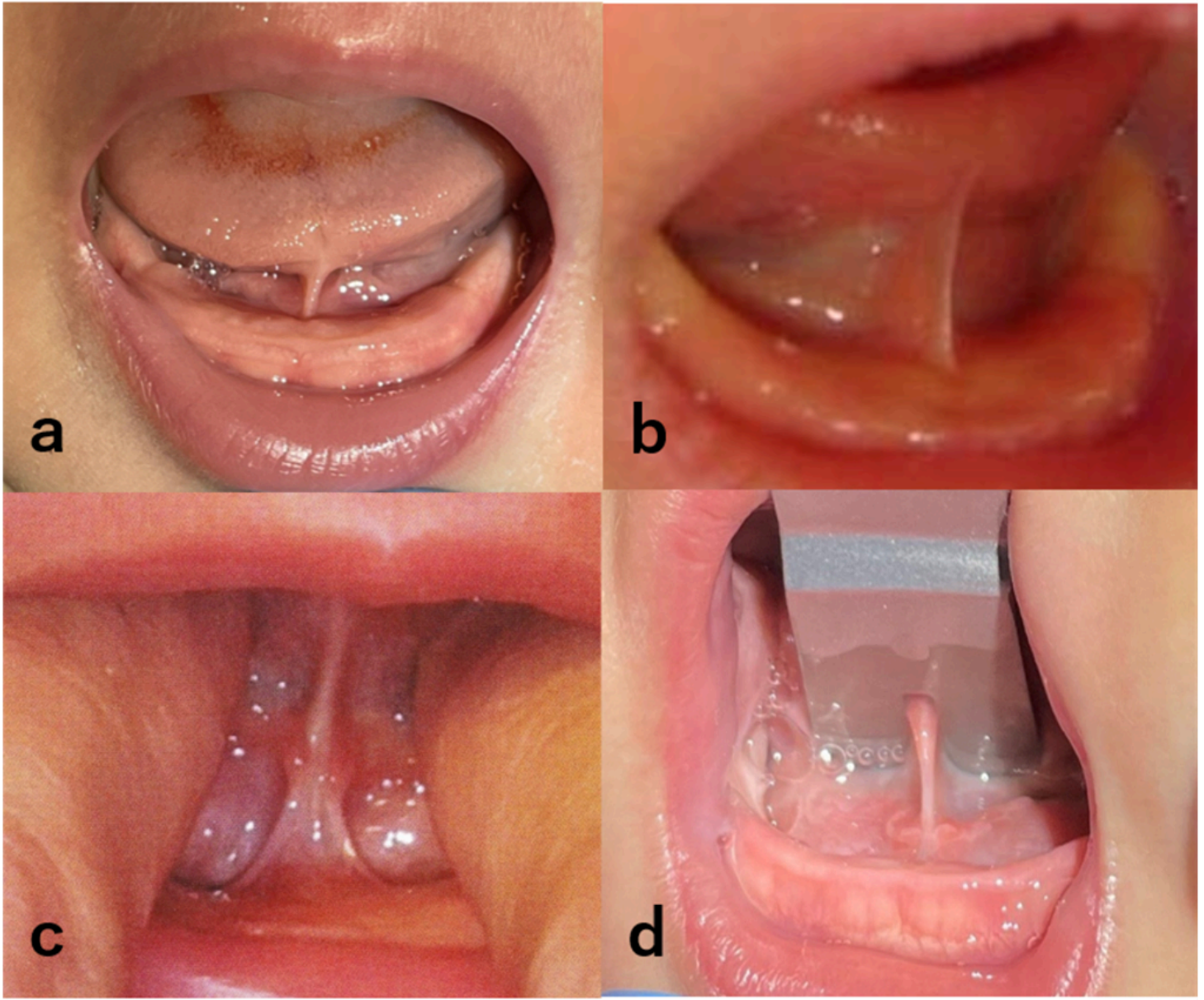


Figure 1

Illustrated classification of ankyloglossia (Ito Y [4]).

(a) Tongue-tip type; (b) anterior membrane type; (c) tower type; (d) posterior type. The tower type is defined as an intermediate form between the anterior and posterior types.

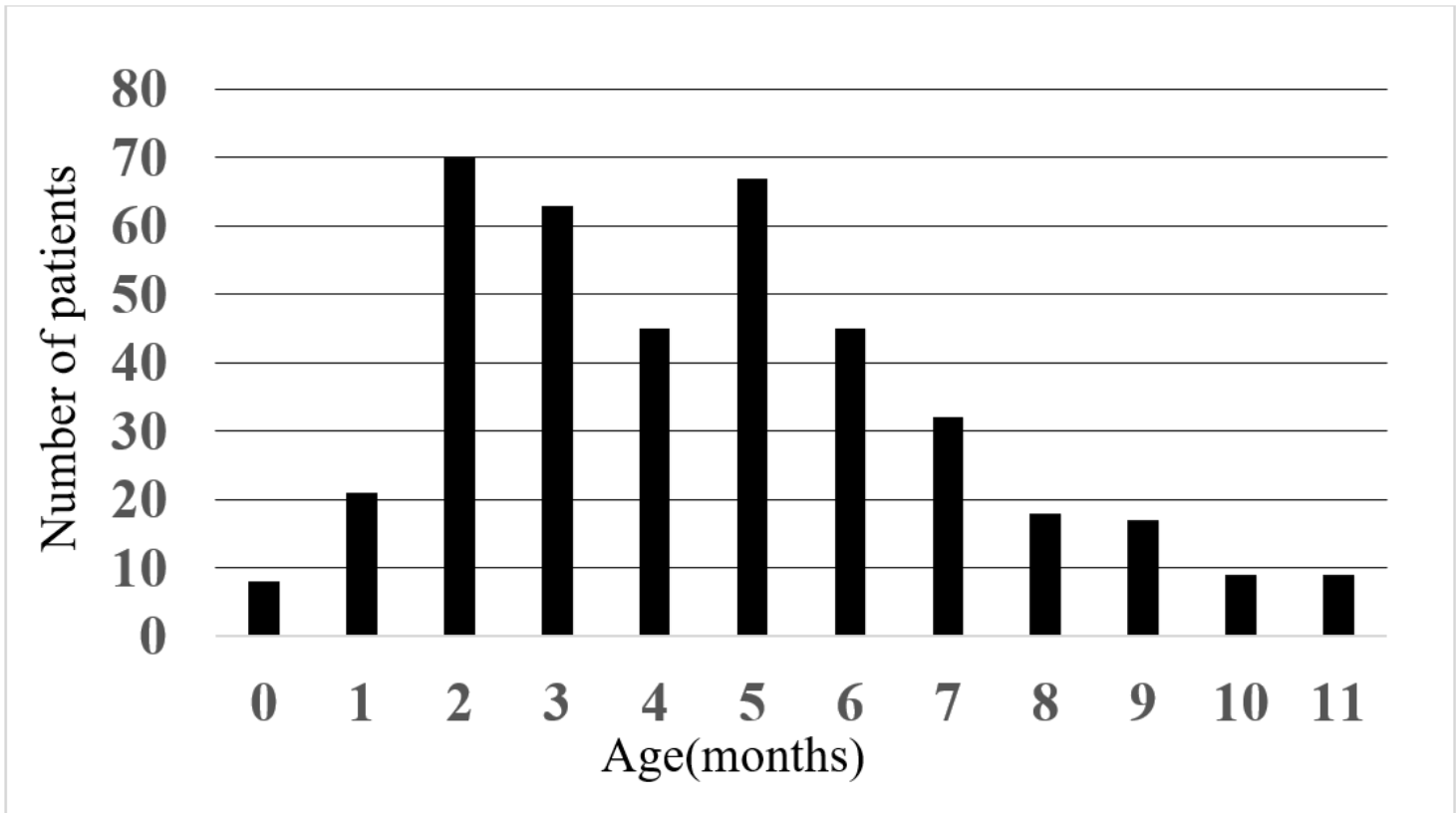


Figure 2

Age distribution of the study population (n = 404).

Patient ages ranged from 14 days to 11 months.

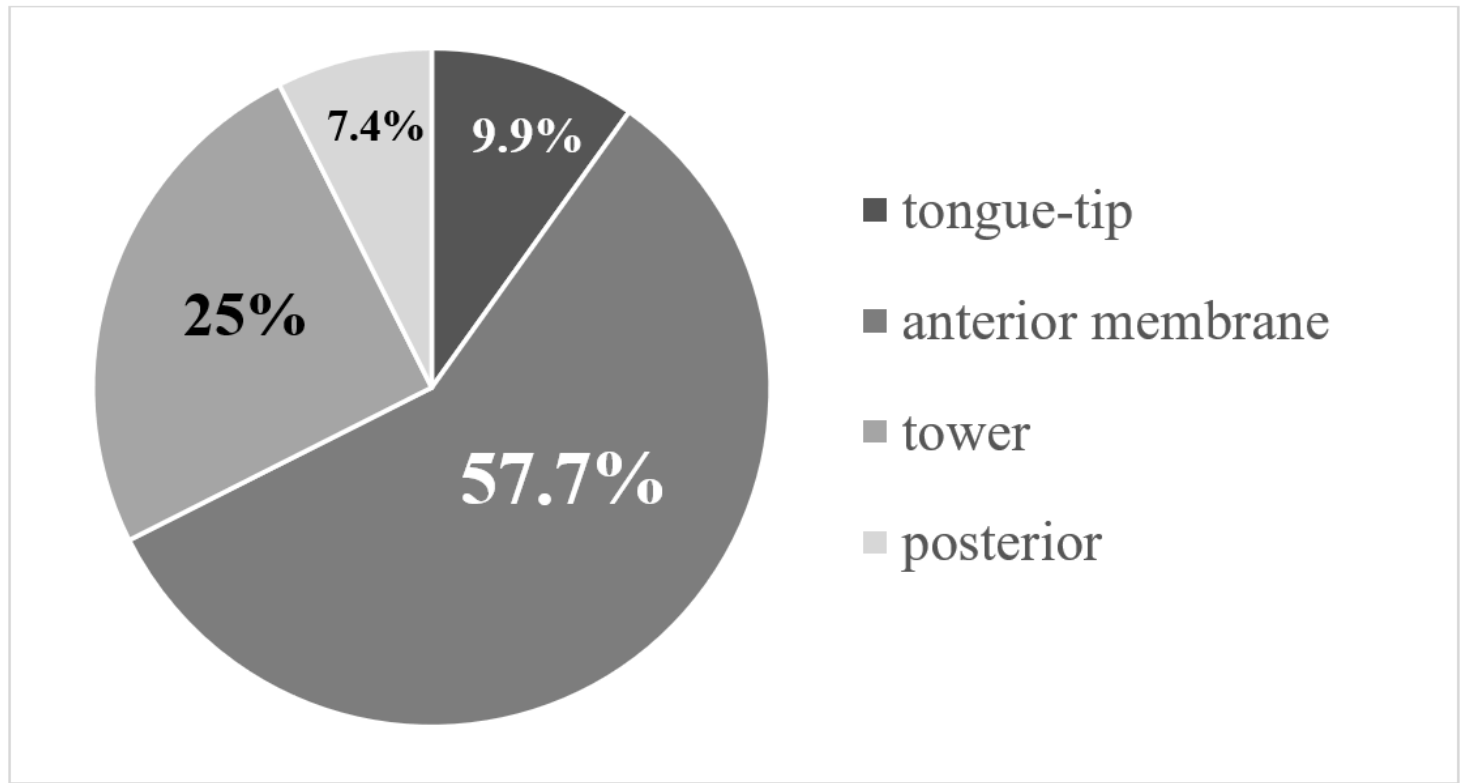


Figure 3

Distribution of morphological subtypes in the study population (n = 404).

The anterior membrane type accounted for the majority of cases.

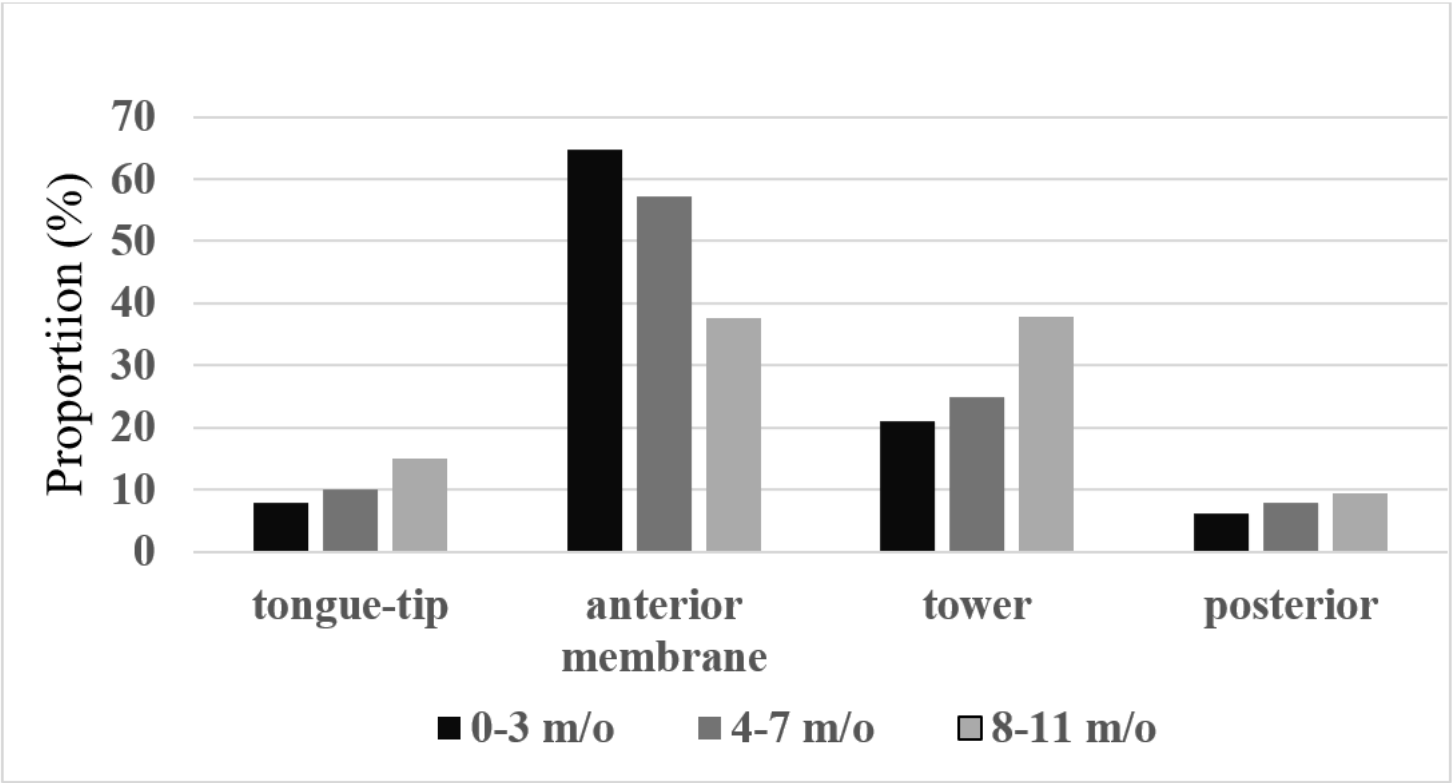


Figure 4

Proportions of morphological subtypes by age group.

The anterior membrane type decreased with age, whereas the tower type increased.



Figure 5

Tearing of the frenulum, possibly caused by contact with erupting teeth.

Left: 8-month-old girl; right: 10-month-old boy.