Evidence of Improved Milk Intake After Frenotomy: A Case Report

abstract

Ankyloglossia (tongue tie) is a well-recognized cause of breastfeeding difficulties and, if untreated, can cause maternal nipple pain and trauma, ineffective feeding, and poor infant weight gain. In some cases, this condition will result in a downregulation of the maternal milk supply. Milk-production measurements (24-hour) for a breastfeeding infant with ankyloglossia revealed the ineffective feeding of the infant (78 mL/24 hours), and a low milk supply (350 mL/24 hours) was diagnosed. Appropriate management increased milk supply (1254 mL/24 hours) but not infant milk intake (190 mL/24 hours). Test weighing convincingly revealed the efficacy of frenotomy, increasing breastfeeding milk transfer from 190 to 810 mL/24 hours. Postfrenotomy, breastfeeding almost completely replaced bottle-feeding of expressed breast milk. This case study confirms that ankyloglossia may reduce maternal milk supply and that frenotomy can improve milk removal by the infant. Milk-production measurements (24-hour) provided the evidence to confirm these findings. *Pediatrics* 2013;132:e1413–e1417

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KEY WORDS

ankyloglossia, tongue tie, frenotomy, frenulotomy, milk production, breastfeeding, lactation, nipple confusion

ABBREVIATION

EBM—expressed breast milk

Ms Garbin coordinated the assessments of the infant, completed the 24-hour milk-production analysis, and drafted the initial manuscript; Ms Sakalidis contributed to the collection and analysis of ultrasound data and reviewed and revised the manuscript; Dr Chadwick carried out the initial pediatric assessment and reviewed and revised the manuscript; Dr Whan carried out the surgical consult and frenulotomy and reviewed and revised the manuscript; Dr Hartmann provided access to the data collection equipment and critically reviewed the manuscript; Dr Geddes contributed to the data collection, coordinated and supervised data collection, and critically reviewed the manuscript; and all authors approved the final manuscript as submitted.

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Ankyloglossia is a congenital condition in which the sublingual frenulum is either short, thick, or tight, limiting tongue mobility. On occasion, no abnormality is visible; instead, there may be a tight and palpable midline filament in the soft tissue where the tongue joins the floor of the mouth. The incidence of ankyloglossia is reported to be 1% to 10%, and the association with breastfeeding difficulties is well documented. Symptoms include maternal nipple pain, slow infant weight gain, infant breast refusal, and low maternal milk supply. Complete resolution of symptoms is not usually observed in an infant following frenotomy. The condition is relatively common, with reports of 1% to 10% prevalence. Treatment generally involves frenotomy or frenulectomy. In the absence of alternative explanations, ankyloglossia is often considered when assessing breastfeeding difficulties. However, universal guidelines exist to determine when intervention is required. Current assessments do not measure factors such as infant milk transfer or maternal milk production. This case report provides the objective measurement of deficient volumes of milk removed from the breast by an infant with atypical presentation of ankyloglossia, despite successful upregulation of maternal milk supply. Complete reversal of ineffective breastfeeding occurred within 4 days postfrenotomy. This further highlights the usefulness of 24-hour milk-production studies to provide accurate information regarding the infant’s feeding skills and milk supply to the clinician.

**PATIENT PRESENTATION**

The infant was a healthy term male born by vacuum-assisted vaginal delivery with no postpartum complications and a birth weight of 3375 g (25th to 50th percentile). The mother and infant presented to the lactation consultant at 16 days postpartum. Since birth, the infant was not feeding well, was “fussy” at some feedings, and the periods between feedings were extended (5–6 hours). Subsequently, the infant received complementary infant formula feedings. The mother was concerned that bottle feedings were contributing to “nipple confusion” and that this was the cause of the feeding problem. She had previously successfully breastfed. The infant’s weight at the time of consult was 3232 g (10th percentile), which was 143 g below birth weight. Clinically, the infant’s oral cavity appeared normal, the infant attached well to the breast, the mother experienced no discomfort or pain; however, the infant appeared to spend the majority of the feeding sucking nonnutritively. The weight gain measured by test-weighing an infant before and after a breastfeeding by using a digital scale (Medela AG, Baar, Switzerland) is equivalent to the intake of breast milk. Tests weights measured 8 and 4 mL of milk consumed from the right and left breasts, respectively (feeding durations of ∼10 minutes). Both breasts were expressed post-breastfeeding, yielding 60 mL in total. This milk was fed to the infant by using a teat (Calma; Medela AG) requiring the infant to use suction rather than tongue compression to receive the milk.

After the initial consultation the mother was instructed to perform the following:

- feed the infant at least every 3 hours;
- use expressed breast milk (EBM), and formula if required, to complement the breastfeeding to ensure that the infant received increased volumes of milk to accelerate growth;
- simultaneously express both breasts after breastfeeding, 6 to 8 times per day, to increase breast milk production and
- measure milk production (24-hour) expressed and breastfeed volumes and complementary milk intake by test-weighing the infant before and after every breastfeeding for 24 hours.

Milk production (24-hour) (Table 1) showed poor transfer of milk volumes by the infant and a diminished maternal milk supply. Over the following 2 weeks of expressing frequently and taking domperidone (20 mg/8 hours), maternal milk supply increased and the infant gained weight (382 g/week). The mother continued to breastfeed and feed EBM via the Calma teat. At 41 days, a second 24-hour milk production was performed (Table 1) to reassess infant feeding and milk supply. These results showed little improvement in breastfeeding intake yet a remarkable increase in milk supply. This finding confirmed that the problem was an infant-related issue. At this point, the mother stated that she was ready to “give up breastfeeding and continue to express and feed EBM from a bottle.” At 49 days, the dyad was sent to the Hartmann Human Lactation Research Group at King Edward Memorial Hospital Perth, Western Australia, for assessment by a pediatrician who found the infant to be in good health, of appropriate size (75th percentile for weight), and nondysmorphic. General systems examination was unremarkable; in particular, there was no basal tachypnea. Visualization and palpation of the palate revealed no evidence of a cleft. The tongue movements were notable in that although the infant was able to protrude his tongue over the lower lip, the tongue assumed an unusual pointed appearance in doing so. Digital insertion revealed a weak suck
with inability to either cup or elevate the tongue to the palate. Atypical presentation of ankyloglossia was queried to be a possible cause for the poor infant breastfeeding.

The infant was referred to a pediatric surgeon the next day for further assessment of tongue mobility.

Observation of the tongue did not initially show a typical short frenulum. However, on digital examination, a tight band extending from the proximal insertion of the frenulum to the tip of the tongue was confirmed by the surgeon. Subsequently, frenotomy was performed at the consult.

Before and after frenotomy, the research group performed simultaneous ultrasound imaging of tongue movement and measurement of intraoral vacuum, respiration, oxygen saturation, and heart rate, which has been described elsewhere in detail.16 Measurement of ultrasound was performed in 2 frames when the tongue was up against the palate and when tongue was maximally lowered. This method has been validated and provides objective measurements representative of tongue movement20 (Fig 1). The measurements revealed that the infant pinched the base of the nipple prefrenotomy and placed the nipple farther away from the hard-soft palate junction compared with postfrenotomy. When feeding with the Calma teat, both tongue movement (nipple diameter) and nipple placement were between the pre- and postfrenotomy breastfeeding values (Table 2). Postfrenotomy pinching of the base of the nipple was not observed.21

The infant applied stronger baseline and peak pressures during nutritive and nonnutritive sucking prefrenotomy during breastfeeding, compared with both feeding with the Calma teat (prefrenotomy) and breastfeeding postfrenotomy, where pressures were reduced by approximately half (Table 2). Suck-burst duration was much shorter during breastfeeding prefrenotomy. Respiratory rate was also higher during nutritive and nonnutritive sucking prefrenotomy compared with both the Calma teat and postfrenotomy breastfeeding, possibly indicating that the effort of exerting higher vacuums resulted in higher respiratory rates before the frenotomy. Heart rate and oxygen saturation were unremarkable for all feedings.

Four days postfrenotomy, a third milk production (24-hour) was performed (Table 1) and revealed a dramatic improvement in breastfeeding milk intake.

### TABLE 1 Twenty-four-hour Milk-Production Profiles in a Mother of a Breastfeeding Infant With Ankyloglossia

<table>
<thead>
<tr>
<th></th>
<th>Prefrenotomy</th>
<th>Postfrenotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant age, d</td>
<td>17</td>
<td>41</td>
</tr>
<tr>
<td>Number of breastfeedingsa</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Duration of breastfeedings, minb</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>Average volume of a breastfeeding, mLc</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>Total breastfed, mL/24 hoursd</td>
<td>78</td>
<td>190</td>
</tr>
<tr>
<td>Total expressed and bottle-fed, mL</td>
<td>272</td>
<td>1084</td>
</tr>
<tr>
<td>Total intake, mL</td>
<td>350</td>
<td>1254</td>
</tr>
</tbody>
</table>

Data shown in footnotes a through d are population averages (range).23

---

![FIGURE 1](image)

A submental midsagittal ultrasound of the oral cavity during breastfeeding in an infant with ankyloglossia. Prefrenotomy at tongue up (A), the nipple is farther away from the hard-soft palate junction compared with postfrenotomy at tongue up (C). Prefrenotomy at tongue down (B), the nipple base is more compressed compared with postfrenotomy at tongue down (D).
At 63 days, the infant was reassessed. The infant was now fully breastfeeding, requiring 2 complementary feedings of ~40 mL of EBM every 24 hours, and had a weight gain of 300 g/2 weeks (Table 2).

**DISCUSSION**

This case report highlights the difficulty in diagnosing ankyloglossia by observation alone. Current classification systems do not correlate well to symptomatic severity.\(^2\),\(^12\)

The case shows the value of objective measurements, particularly of maternal milk production and infant milk intake. The milk production (24-hour)\(^2\) before frenotomy confirmed both ineffective infant feeding and low maternal milk supply initially. After conservative management to increase milk production, the second measurement confirmed that the infant was unable to remove milk from the breast, despite normal maternal milk supply. Finally, the third milk-production measurement provided evidence that the frenotomy had improved the infant’s milk transfer at the breast, most likely by improving tongue function (Table 1).

Ultrasound and vacuum measurement confirmed that the infant-sucking dynamic may be affecting milk transfer and supported previous findings by Geddes et al\(^2\) in which maternal nipple distortion and limited tongue movement in infants with ankyloglossia resulted in feeding problems, which resolved postfrenotomy along with an increase in infant milk transfer. The intraoral vacuums were within the normal range\(^2\) pre-frenotomy, suggesting that compression of the base of the nipple may have contributed to lower milk transfer.

It is interesting that the infant’s breathing appeared to be compromised pre-frenotomy, with higher respiratory rates recorded during breastfeeding than during bottle-feeding. Postfrenotomy breastfeeding respiratory rates normalized, and the duration of suck bursts became much longer. Despite this result, the infant’s oxygen saturation was not reduced, suggesting that the infant may have stopped sucking (reduced the duration of suck bursts) to limit any adverse affects. Mukai et al\(^2\) has previously reported breathing difficulties in infants with ankyloglossia, suggesting possible disturbances of the suck, swallow, breathe reflex. More research is required in this area.

“Nipple confusion”\(^2\) was a major concern of this mother and is cited as a common breastfeeding problem in both the popular and scientific literature, despite lack of evidence and a widely accepted definition. This infant was supplemented with EBM via a teat, yet effectively breastfed immediately postfrenotomy. This outcome confirms that ankyloglossia was the reason for poor milk transfer from the breast compared with the bottle rather than “nipple confusion.”

**CONCLUSIONS**

In cases of breastfed infants who experience difficulties, measuring milk production (24-hour) is a useful tool to determine both adequacy of maternal milk supply and effectiveness of infant milk removal. The presentation of ankyloglossia varied, and this case study provides further evidence of the effectiveness of frenotomy for breastfeeding.

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**TABLE 2 Ultrasound Measurements, Intraoral Sucking Pressures, Respiratory and Heart Rates, and Oxygen Saturation in an Infant With Ankyloglossia**

<table>
<thead>
<tr>
<th>Ultrasound</th>
<th>Prefrenotomy</th>
<th>Calma Teat Feeding</th>
<th>Postfrenotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Breastfeeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tongue Up</td>
<td>Tongue Down</td>
<td>Tongue Up</td>
</tr>
<tr>
<td>Nipple diameter: interval measurements from the tip of the nipple, mean mm</td>
<td>4.9</td>
<td>8.5</td>
<td>6.2</td>
</tr>
<tr>
<td>2 mm</td>
<td>6.9</td>
<td>9</td>
<td>8.7</td>
</tr>
<tr>
<td>5 mm</td>
<td>9.8</td>
<td>10.3</td>
<td>9.9</td>
</tr>
<tr>
<td>10 mm</td>
<td>ND</td>
<td>11.1</td>
<td>10.7</td>
</tr>
<tr>
<td>15 mm</td>
<td>10.0</td>
<td>8.1</td>
<td>6.9</td>
</tr>
<tr>
<td>Nipple to HSPJ, mm</td>
<td>15</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>

Intraoral sucking pressures

**Nutritive sucking**

<table>
<thead>
<tr>
<th>Duration of suck burst, s</th>
<th>Prefrenotomy</th>
<th>Calma Teat Feeding</th>
<th>Postfrenotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline pressure, mm Hg</td>
<td>−80.8 ± 25</td>
<td>ND</td>
<td>−33.6 ± 6.6</td>
</tr>
<tr>
<td>Peak pressure, mm Hg</td>
<td>−107.7 ± 30.9</td>
<td>ND</td>
<td>−49.8 ± 10.7</td>
</tr>
<tr>
<td>Suck rate, sucks per minute</td>
<td>108.6 ± 17.2</td>
<td>ND</td>
<td>124.2 ± 12.1</td>
</tr>
<tr>
<td>Respiratory rate, breaths per minute</td>
<td>71.2 ± 10.6</td>
<td>ND</td>
<td>54.1 ± 11.2</td>
</tr>
</tbody>
</table>

**Nonnutritive sucking**

<table>
<thead>
<tr>
<th>Duration of suck burst, s</th>
<th>Prefrenotomy</th>
<th>Calma Teat Feeding</th>
<th>Postfrenotomy</th>
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<td>ND</td>
<td>54.1 ± 11.2</td>
</tr>
</tbody>
</table>

Data are presented as raw data or mean ± SD. HSPJ, hard-soft palate junction; ND, no data.
REFERENCES


22. Kent JC, Mitoulas LR, Cregan MD, Ramsay DT, Doherty DA, Hartmann PE. Volume and frequency of breastfeedings and fat content of breast milk throughout the day. Pediatrics. 2006;117(3). Available at: www.pediatrics.org/cgi/content/full/117/3/e387


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