

# The effect of ankyloglossia on speech in children

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**OBJECTIVE:** We wanted to determine whether ankyloglossia is associated with articulation problems and the effect of frenuloplasty on speech and tongue mobility.

**STUDY DESIGN:** We conducted a prospective study of 30 children aged 1 to 12 years with ankyloglossia undergoing frenuloplasty. Outcomes were assessed by measurements of tongue mobility, speech evaluation, and parent questionnaires.

**RESULTS:** Mean tongue protrusion improved from 14.2 mm preoperatively to 25.8 mm postoperatively ( $P < 0.01$ ). Similarly, mean tongue elevation improved from 5.2 to 22 mm ( $P < 0.01$ ). Preoperative speech pathology evaluation documented articulation problems thought due to ankyloglossia in 15 of 21 children. Postoperative evaluation in 15 of these children showed improvement in articulation in 9, no change in 4 who had normal speech preoperatively, and an ongoing articulation disorder in 2. Parent perception of speech intelligibility on a scale of 1 to 5 improved from 3.4 to 4.2 ( $P < 0.01$ ).  
**CONCLUSION:** Tongue mobility and speech improve significantly after frenuloplasty in children with ankyloglossia who have articulation problems. (Otolaryngol Head Neck Surg 2002;127:539-45.)

The diagnosis and management of ankyloglossia in the pediatric population have long been controversial topics.<sup>1</sup> Ankyloglossia, commonly known as “tongue-tie,” is a congenital oral anomaly characterized by an abnormally short lingual frenulum and may result in a varying degree of decreased tongue tip mobility. Opinions range widely regarding the significance of this anomaly; some

believe ankyloglossia is only rarely symptomatic,<sup>2,3</sup> whereas others believe it may lead to a host of problems, including infant feeding difficulties, speech disorders, and various mechanical and social issues related to the inability of the tongue to protrude sufficiently.<sup>4-7</sup>

The goal of the present investigation was to prospectively study children aged 1 to 12 years with a diagnosis of ankyloglossia to determine (1) the frequency of speech problems in these children compared with normative data, (2) the effect of frenotomy/frenuloplasty on speech, (3) the effect of frenotomy/frenuloplasty on tongue mobility, and (4) the incidence of any surgical complications.

## METHODS

From June 1997 through June 2001, patients aged 1 to 12 years with ankyloglossia seen in the otolaryngology clinics at Lucile Salter Packard Children’s Hospital at Stanford or at Santa Clara Valley Medical Center were asked to participate in the study. Patients were eligible for inclusion if they were being seen for a primary complaint of ankyloglossia or if the ankyloglossia was an incidental finding. Ankyloglossia patients with other associated problems that might affect speech articulation were excluded (eg, cleft palate, generalized developmental delay). Human Subjects Committee approval was obtained for this investigation, and informed consent was obtained for all those who elected to enroll.

At the first visit, the parents and child (when age-appropriate) completed a written questionnaire regarding feeding history, speech development, and medical and family history. The child underwent a routine head and neck examination, at which time the ankyloglossia was evaluated with particular attention to tongue mobility for elevation and protrusion. Tongue elevation was recorded by measuring interincisal distance with the mouth maximally open, while maintaining contact of the tongue tip with the upper dentition (Fig 1). Tongue protrusion was measured as maximum protrusion of the tongue tip past the lower teeth. If

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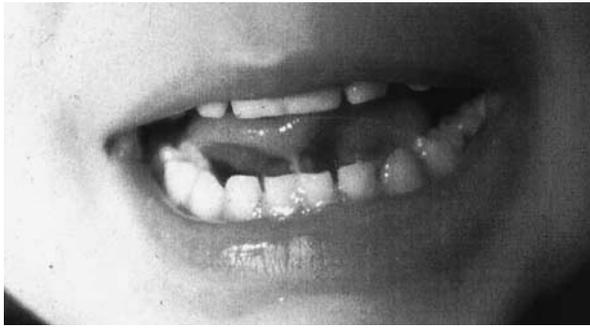
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**Fig 1.** Interincisal distance. The patient is asked to open his or her mouth as wide as he or she can and touch the edge of the upper teeth with his/her tongue. Measurement is obtained between the edge of the lower and upper teeth.

the child had been seen by a speech pathologist within the year before study entry, a copy of the most recent speech pathology evaluation was requested. The speech pathologist was also asked to complete a questionnaire regarding the child's speech. If the child had not previously been seen by a speech pathologist, he or she was referred for a speech evaluation.

If the child was a surgical candidate, the option of frenotomy/frenuloplasty was discussed. A child was considered a surgical candidate if he or she was found on physical examination to have a tight lingual frenulum with associated feeding, speech, or social difficulties or if it was anticipated that such difficulties would be likely to develop. If surgical repair of the frenulum was performed, follow-up oral examination with measurement of interincisal distance and protrusion was performed during clinic visits 1 week, 1 month, and 3 months postoperatively. Parent questionnaires were completed at these visits as well. All children were instructed to perform tongue exercises for 1 month after surgery (Table 1). A follow-up speech evaluation was requested 3 months postoperatively. Statistical analysis was performed using a paired *t* test.

## RESULTS

Thirty children (19 boys and 11 girls) aged 1 to 12 years (mean, 4.1 years) were enrolled in the study. The mean age at diagnosis as reported on intake questionnaires was 1.9 years, with 11 diagnosed at less than 1 year of age. Of 25 mothers

**Table 1.** Postfrenuloplasty tongue exercises

Do each exercise 5 times a day.

1. Push tongue in and out of mouth—5 repetitions.
2. Open your mouth as far as you can. Try to touch tongue to the back of your upper teeth—5 repetitions.
3. With tongue in mouth, move tongue side-to-side 5 times (try to keep jaw in middle position).
4. Place food of choice in your mouth, between your back teeth and cheek. Move food to other side of mouth using your tongue and then move it back—5 repetitions.

who attempted to breastfeed, 21 reported no problems. Four mothers reported that they had been unable to breastfeed: in 3 cases, because the newborn was unable to latch onto the breast and in 1 case because of severe nipple pain in the mother. A positive family history of ankyloglossia was reported for 3 patients. Parents noted a number of problems related to their child's ankyloglossia (Fig 2), most commonly speech issues, and mechanical issues including difficulty licking the lips and licking an ice cream cone. Twenty (83%) of 26 parents whose child was aged 2 years or older believed that the child's speech was adversely affected by the ankyloglossia.

All 30 children underwent surgical correction of their ankyloglossia. Surgery was performed under general anesthesia in 26 children and with local anesthesia alone in 4. Eleven children had frenuloplasty performed at the time of another surgical procedure (most commonly pressure-equalizing tube placement). Of the 4 children who were less than 2 years of age, 3 underwent frenuloplasty under general anesthesia at the time of another procedure, and 1 had a frenotomy performed in the clinic. Except for the child undergoing the frenotomy, all children underwent a horizontal-to-vertical frenuloplasty.<sup>8</sup> Two children did not return for postoperative follow-up. Follow-up for the other 28 children after frenulum repair ranged from 7 days to 8.5 months, with a mean of 3.1 months. Twenty of 24 children who were old enough to perform the recommended tongue exercises reportedly did so, at least occasionally. There were no surgical or postoperative complications.

Tongue elevation, as measured by interincisal distance, improved significantly, from a mean of

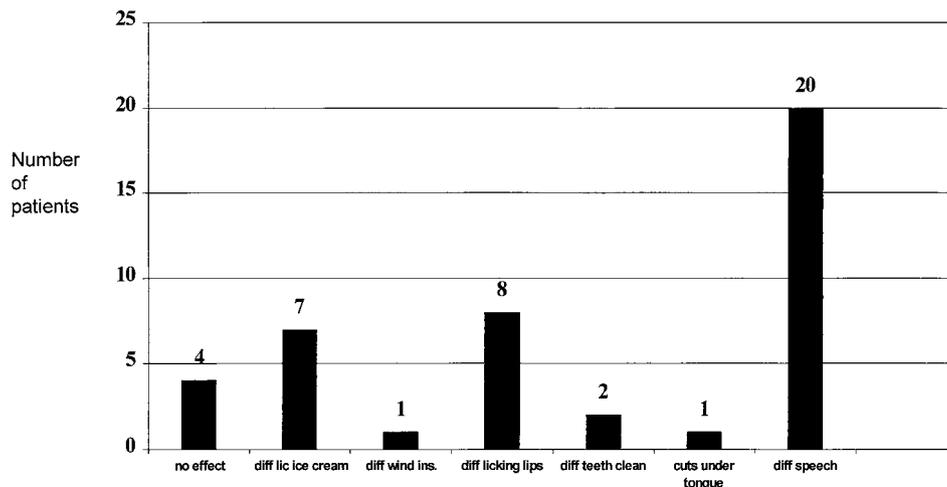


Fig 2. Parent perception of problems due to ankyloglossia. Diff, difficulty; lic, licking; ins, instrument.

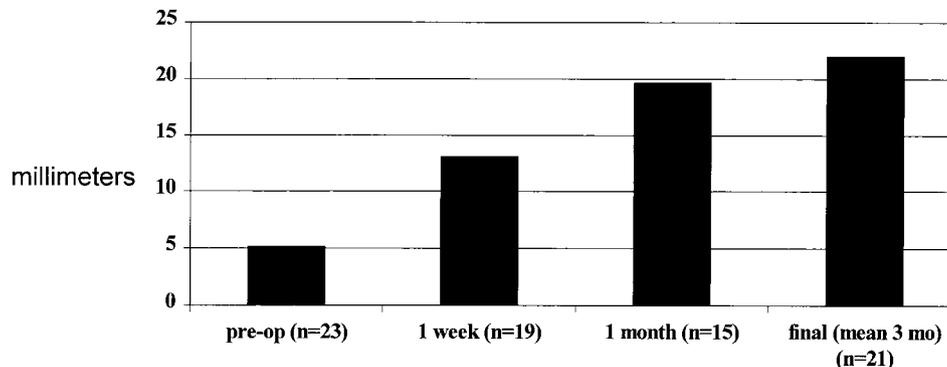


Fig 3. Interincisal distance.

5.2 ± 5.6 mm preoperatively to 22 ± 8.7 mm postoperatively ( $P < 0.01$ ). Tongue protrusion improved from a mean of 14.2 ± 5.5 mm to 25.8 ± 7.8 mm ( $P < 0.01$ ) (Figs 3 and 4). The mean gain in tongue mobility measurements after surgery was 17.1 ± 8.5 mm for elevation and 11.3 ± 9.1 mm for protrusion. Parents noted improvement in patient tongue mobility as well, from a score of 2.3 preoperatively to 4.6 postoperatively on a scale of 1 to 5 ( $P < 0.01$ ) (Fig 5).

Twenty-one of the 26 children who were aged 2 or older underwent formal speech evaluations preoperatively. A total of 12 individual speech pathologists participated in the study. These evaluations documented articulation errors believed to be due to decreased tongue mobility in 15 (71%) of 21 children and age-appropriate speech in 6 (29%). All of those with abnormal speech were

able to protrude the tongue past the lower incisors, with protrusion measurements ranging from 3 to 25 mm (mean, 14.9 mm). There were no statistically significant differences between patients with abnormal compared with normal speech for measurements of tongue protrusion and interincisal distance.

Fifteen children completed both preoperative and postoperative speech evaluations. Of these, 4 had normal speech preoperatively and had no change in speech postoperatively. In the 11 patients who had abnormal articulation preoperatively, 9 (82%) were judged to have improved articulation postoperatively. In the remaining 2 patients, persistent articulation difficulties were noted postoperatively, despite objective improvement in tongue mobility (Table 2). One of these children was very young, and thus it was difficult

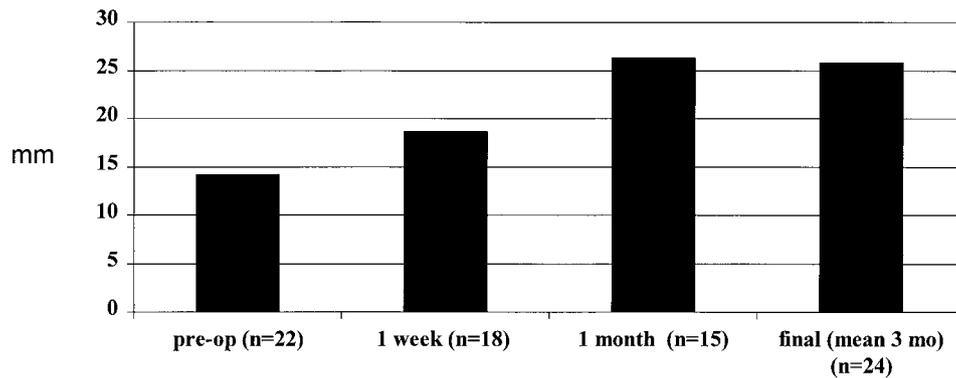


Fig 4. Protrusion past the lower teeth.

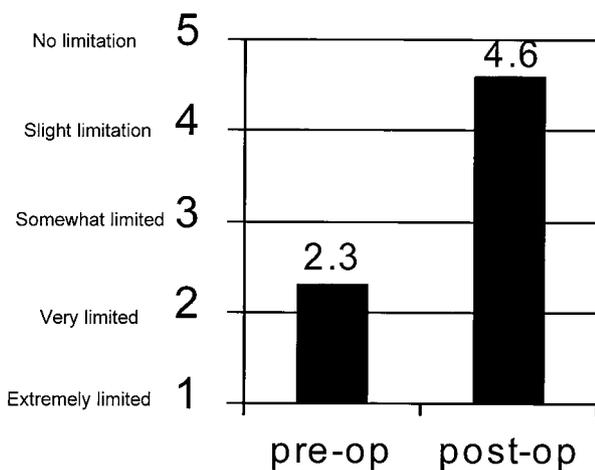


Fig 5. Parent perception of tongue mobility.

to evaluate the effect of surgery, and the other had a significant ongoing articulation disorder after frenulum release. Speech intelligibility as assessed by parents also improved significantly after frenulum release, from a mean score of 3.4 preoperatively to 4.2 postoperatively on a scale of 1 to 5 ( $P < 0.01$ ) (Fig 6).

Overall parental satisfaction with frenotomy/frenuloplasty was high (Fig 7). Two parents were less than completely satisfied with the procedure. One of these was lost to follow-up after the first postoperative visit, before the full benefit of the surgery may have been apparent. In the other case, the child underwent tympanostomy tube placement at the time of frenuloplasty. At the postoperative visit, the tubes were extruded, which may have contributed to the parent's relative dissatisfaction with the frenuloplasty as well.

## DISCUSSION

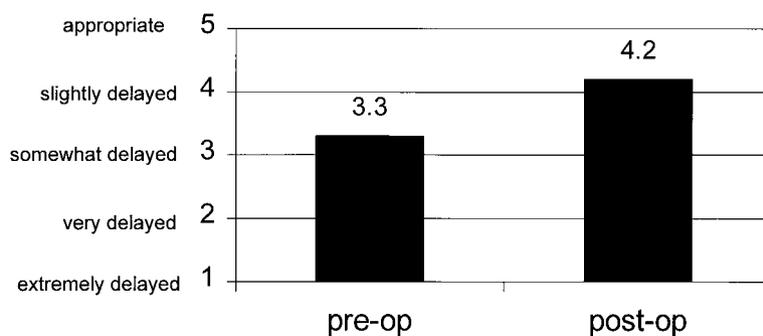
In the words of one prominent pediatrician, "Much of the information needed for making rational treatment decisions in cases of tongue-tie is lacking."<sup>2</sup> Possible adverse effects of ankyloglossia include difficulty with breastfeeding, speech problems, and mechanical/social issues such as difficulty licking an ice cream cone, difficulty playing a wind instrument, cuts beneath the tongue, and diastasis of the lower incisors related to the short frenulum.

With respect to breastfeeding, there does appear to be an association between ankyloglossia and feeding difficulties for some, but not all, affected infants. Although 4 of the 24 parents/patients in the current study who attempted to breastfeed were unsuccessful, the majority reported no problems. Similarly, another recent study has demonstrated that while most babies with ankyloglossia can breastfeed without difficulty, approximately 25% will have difficulty latching onto the breast or the mother will have prolonged nipple pain.<sup>4</sup>

Several parents in this study reported mechanical/social issues related to their child's tongue-tie, such as difficulty licking the lips and licking an ice cream cone, although speech concerns were a more common complaint. The young age of the study group as a whole may account in part for a low incidence of mechanical/social complaints. Our personal experience would suggest that problems such as social embarrassment, cuts under the tongue, and difficulty with "French" kissing, for example, are more likely to manifest in the older child and adult.

**Table 2.** Results of preoperative and postoperative speech evaluations

Patient	Age (y)	Articulation disorder	Age at surgery (y)	Age at speech follow-up (y)	Speech result
1	3 $\frac{8}{12}$	Yes	3 $\frac{8}{12}$	4 $\frac{2}{12}$	Improved
2	2 $\frac{5}{12}$	Yes	2 $\frac{5}{12}$	2 $\frac{10}{12}$	Improved
3	4 $\frac{5}{12}$	Yes	3 $\frac{5}{12}$	4 $\frac{8}{12}$	Improved
4	4 $\frac{10}{12}$	Yes	5	5 $\frac{3}{12}$	Improved
5	3 $\frac{9}{12}$	Yes	4 $\frac{1}{12}$	4 $\frac{5}{12}$	Improved
6	4 $\frac{6}{12}$	Yes	4 $\frac{6}{12}$	5	Improved
7	3 $\frac{10}{12}$	Yes	3 $\frac{10}{12}$	4 $\frac{3}{12}$	Improved
8	3 $\frac{2}{12}$	Yes	3 $\frac{3}{12}$	3 $\frac{6}{12}$	Improved
9	3 $\frac{9}{12}$	Yes	3 $\frac{9}{12}$	4 $\frac{2}{12}$	Improved
10	4 $\frac{6}{12}$	No	4 $\frac{6}{12}$	4 $\frac{9}{12}$	Normal
11	5 $\frac{10}{12}$	No	6	6 $\frac{4}{12}$	Normal
12	6 $\frac{4}{12}$	No	6 $\frac{6}{12}$	6 $\frac{10}{12}$	Normal
13	3 $\frac{5}{12}$	No	3 $\frac{6}{12}$	4 $\frac{4}{12}$	Normal
14	3 $\frac{11}{12}$	Yes	4	4 $\frac{4}{12}$	Articulation disorder
15	2 $\frac{2}{12}$	Yes	2 $\frac{5}{12}$	2 $\frac{8}{12}$	Mild articulation disorder



**Fig 6.** Parent perception of speech.

Opinion is divided with respect to speech manifestations of ankyloglossia. Anecdotal evidence suggests that some children with tongue-tie are able to develop normal speech, compensating for limited tongue tip mobility without treatment. However, in at least certain individuals, tongue-tie is believed to be clinically symptomatic, causing articulation errors or difficulty with the rate and range of articulation.<sup>7,9,10</sup> Speech sounds that may be affected by impaired tongue tip mobility include lingual sounds and sibilants, such as T, D, Z, S, TH, N, and L. The percentage of patients with

tongue-tie who will manifest a speech disorder related to their condition has been uncertain, and there has been no method for predicting at a young age which patients will require treatment.

This study demonstrates that a number of children with ankyloglossia may have normal speech despite restricted tongue mobility. However, a significant percentage of young children with ankyloglossia (71% in this study) will have articulation difficulties related to ankyloglossia as measured by formal speech pathology assessment. Those with speech difficulties had a mean preoperative

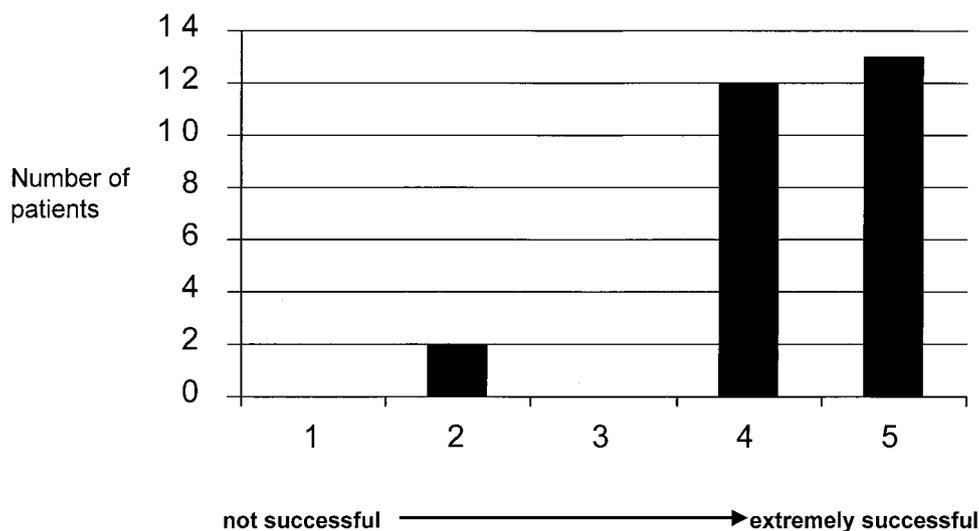


Fig 7. Parent perception of success of surgery.

tongue protrusion measurement of 14.9 mm. Previously, the ability to protrude the tongue past the lower dentition has been used as a rule of thumb for predicting which patients with ankyloglossia will not require surgery. The current study suggests that tongue protrusion may not be the best criteria upon which to base surgical decision-making.

At present, when evaluating the young child with ankyloglossia, it is difficult to predict based on exam findings or any other criteria which children will likely develop speech or social/mechanical problems related to their condition. Moreover, the natural history of uncorrected ankyloglossia as it relates to speech is unknown (ie, whether some percentage of patients will spontaneously improve over time or improve with speech therapy alone). However, it is clear from the current study that frenotomy/frenuloplasty results in significant gains in tongue mobility with minimal surgical morbidity. Moreover, speech articulation was noted to improve after frenulum release in the great majority of patients who were documented to have a preoperative articulation problem.

Ankyloglossia is not associated with failure to develop or delay in developing speech. Some parents erroneously believe that their child's lack of speech, or speech delay, is due to ankyloglossia. These parents may present to the pediatrician or otolaryngologist demanding surgical intervention in the hope that normal speech development will

promptly ensue. The astute clinician must be aware that ankyloglossia does not cause a lack of speech but rather, at most, articulation problems with otherwise normal language development. Such a patient should be directed for further evaluation, which may include audiologic, speech/language, and neurodevelopmental assessments. The ankyloglossia may be reevaluated, and surgical correction considered, after the true etiology of the speech delay becomes clear.

When evaluating tongue mobility, we have found the interincisal distance measurement to be an excellent assessment tool.<sup>11</sup> It is more accurate, in our opinion, than measuring tongue protrusion past the lower teeth. Many patients with ankyloglossia have interincisal distances of 0 mm (or only a few millimeters due to the width of the tongue) preoperatively. Improvements in tongue elevation and protrusion are typically not fully apparent until 1 to 3 months postoperatively, perhaps because improvement in tongue muscle function lags behind the frenulum release.

One of the possible complications of frenuloplasty/frenotomy is scarring at the incision site, leading to recurrent ankyloglossia. In an effort to avoid this complication, we requested that our patients perform tongue exercises postoperatively. Theoretically, tongue exercises may also help the patient to increase his or her tongue range of motion. We observed no significant complications

after frenuloplasty/frenotomy—specifically, no bleeding or worsening of the speech problem.

Limitations of this study include a relatively small and disparate study group. Some of our patients presented with symptomatic ankyloglossia, whereas for others, ankyloglossia was an incidental finding. Another possible limitation of the study relates to the method of speech assessment. A standardized speech sample was not used, and evaluations were performed by multiple speech pathologists. Speech pathologists were not blinded as to diagnosis or preoperative or postoperative status, and normative data were used for comparison rather than using control subjects. Because of the young age of most of the subjects and their limited ability to cooperate, obtaining recorded samples for blinded assessment was not thought to be feasible or practical. Therefore, in an effort to avoid bias by any single speech pathologist, patients were intentionally referred to several speech pathologists. Last, as previously noted, the natural history of ankyloglossia in young children is not clear. It may be that some children might have resolved their articulation and social/mechanical difficulties over the course of time or could have been treated with speech therapy rather than with surgery. Although a control group of children with ankyloglossia, to be managed without surgery, was initially planned for this study, parents universally strongly preferred the surgical approach to nonsurgical management.

Based on the present study, our current practice with respect to the treatment of ankyloglossia in young children is as follows. Frenotomy is offered when and if breastfeeding difficulties occur (and examination documents tongue-tie). Frenotomy/frenuloplasty may be considered for infants aged 2 years or younger with significant ankyloglossia, although parents are advised that a wait-and-see approach is also valid, as speech and social/mechanical problems may or may not develop. Fre-

notomy/frenuloplasty is recommended for children of speech age with articulation difficulties. In children with age-appropriate speech, social/mechanical manifestations of tongue-tie are discussed, and frenotomy/frenuloplasty may be considered at the discretion of the parents.

## CONCLUSION

Although some young children with ankyloglossia will have normal speech production, a significant percentage may experience feeding, speech, and/or social/mechanical difficulties related to reduced tongue mobility. Surgical release of the frenulum is a safe and efficacious procedure, typically resulting in improvement in tongue mobility, and often speech articulation as well.

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