

## Infant Tongue Tie: The Research

**1. Amir LH<sup>1</sup>, James JP, Beatty J. Review of tongue-tie release at a tertiary maternity hospital. J Paediatr Child Health. 2005 May-Jun;41(5-6):243-5.**

- Objective: To review the first 12 months of assessment and release of lingual frenulum (frenotomy) at a breast-feeding clinic in a tertiary maternity hospital (August 2002 to end of July 2003) and to report on the breast-feeding outcomes and parental satisfaction.
- Conclusion: Frenotomy is a safe and easy procedure. Infants with a significant tongue-tie that is interfering with breast-feeding have shown an improvement with breast-feeding following frenotomy.

**2. Anna H. Messner, MD; M. Lauren Lalakea, MD; Janelle Aby, MD; et al.**

- Objectives: To determine the incidence of ankyloglossia (tongue-tie) in the well-baby population, and to determine whether patients with ankyloglossia experience breastfeeding difficulties.
- Conclusion: Ankyloglossia can adversely affect breastfeeding in a minority of cases, making it difficult for the baby to latch onto the breast and/or prolonged maternal nipple pain.

**3. Ballard JL, Auer CE, Khoury JC. Ankyloglossia: assessment, incidence, and effect of frenuloplasty on the breastfeeding dyad. Pediatrics. 2002 Nov;110(5):e63.**

- Objective: Ankyloglossia in breastfeeding infants can cause ineffective latch, inadequate milk transfer, and maternal nipple pain, resulting in untimely weaning. The question of whether the performance of a frenuloplasty benefits the breastfeeding dyad in such a situation remains controversial. We wished to 1) define significant ankyloglossia, 2) determine the incidence in breastfeeding infants, and 3) measure the effectiveness of the frenuloplasty procedure with respect to solving specific breastfeeding problems in mother-infant dyads who served as their own controls.
- Conclusion: Ankyloglossia is a relatively common finding in the newborn population and represents a significant proportion of breastfeeding problems. Poor infant latch and maternal nipple pain are frequently associated with this finding. Careful assessment of the lingual function, followed by frenuloplasty when indicated, seems to be a successful approach to the facilitation of breastfeeding in the presence of significant ankyloglossia.

**4. Berry J, Griffiths M, Westcott C. A double-blind, randomized, controlled trial of tongue-tie division and its immediate effect on breastfeeding. Breastfeed Med. 2012 Jun;7(3):189-93. doi: 10.1089/bfm.2011.0030. Epub 2011 Oct 14**

- Aim: This study investigated if a maternally reported, immediate improvement in breastfeeding following division of tongue-tie is due to a placebo effect.
- Results: Seventy-eight percent (21 of 27) of mothers in Group A reported an immediate improvement in feeding following the intervention, compared with 47% (14 of 30) in Group B (two-tailed  $\chi^2$   $p < 0.02$ ; 95% confidence interval, 6-51%). At 1-day follow-up, 90% (54 of 60) reported improved feeding following division. At 3-month follow-up, 92% (54 of 59) still reported improved feeding, with 51% (30 of 59) continuing to breastfeed.
- Conclusion: There is a real, immediate improvement in breastfeeding, detectable by the mother, which is sustained and does not appear to be due to a placebo effect.

5. **Buryk M<sup>1</sup>, Bloom D, Shope T. Efficacy of neonatal release of ankyloglossia: a randomized trial. Pediatrics. 2011 Aug;128(2):280-8. doi: 10.1542/peds.2011-0077. Epub 2011 Jul 18.**
  - Objective: Our primary objective was to determine whether frenotomy for infants with ankyloglossia improved maternal nipple pain and ability to breastfeed. A secondary objective was to determine whether frenotomy improved the length of breastfeeding.
  - Conclusion: We demonstrated immediate improvement in nipple-pain and breastfeeding scores, despite a placebo effect on nipple pain. This should provide convincing evidence for those seeking a frenotomy for infants with significant ankyloglossia.
  
6. **Chele Marmet, MA, IBCLC, Ellen Shell, MA, IBCLC, Ruben Marmet, MD Neonatal Frenotomy May be Necessary to Correct Breastfeeding Problems. <https://doi.org/10.1177/089033449000600318>**
  - Abstract: A review of cases of short frenulum (tongue-tie) seen in a recent year at the Lactation Institute and Breastfeeding Clinic provides data about its relationship to sucking and breastfeeding problems such as insufficient infant weight gain and reduced milk supply, sore nipples and repeat bouts of mastitis in the mother. Frenotomy was recommended for ten of 13 babies who appeared to have a short frenulum. Three mothers chose not to have the frenulum clipped and either gave up breastfeeding or continued to experience problems. Breastfeeding was successfully established by the five healthy babies whose frenulum was clipped. The two babies for whom frenotomy did not completely correct breastfeeding problems had severe birth defects.
  
7. **Dollberg S, Botzer E, Grunis E, Mimouni FB. Immediate nipple pain relief after frenotomy in breast-fed infants with ankyloglossia: a randomized, prospective study.**
  - Purpose: Ankyloglossia ("tongue-tie") occurs in nearly 5% of neonates, but its clinical significance relating to breast-feeding difficulties is controversial. We tested the hypothesis that in infants with ankyloglossia referred because of breast-feeding difficulties, frenotomy alleviates the symptoms.
  - Conclusion: Frenotomy appears to alleviate nipple pain immediately after frenotomy. We speculate that ankyloglossia plays a significant role in early breast-feeding difficulties, and that frenotomy is an effective therapy for these difficulties.
  
8. **Edmunds J<sup>1</sup>, Miles SC, Fulbrook P. Tongue-tie and breastfeeding: a review of the literature. Breastfeed Rev. 2011 Mar;19(1):19-26.**
  - Abstract: In Australia, initial exclusive breastfeeding rates are 80%, reducing to 14% at 6 months. One factor that contributes to early breastfeeding cessation is infant tongue-tie, a congenital abnormality occurring in 2.8-10.7% of infants, in which a thickened, tightened or shortened frenulum is present. Tongue-tie is linked to breastfeeding difficulties, speech and dental problems. It may prevent the baby from taking enough breast tissue into its mouth to form a teat and the mother may experience painful, bleeding nipples and frequent feeding with poor infant weight gain; these problems may contribute to early breastfeeding cessation. This review of research literature analyses the evidence regarding tongue-tie to determine if appropriate intervention can reduce its impact on breastfeeding cessation, concluding that, for most infants, frenotomy offers the best chance of improved and continued breastfeeding. Furthermore, studies have demonstrated that the procedure does not lead to complications for the infant or mother.
  
9. **Elad D, Kozlovsky P, Blum O, Laine AF, Po MJ, Botzer E, Dollberg S, Zelicovich M, Ben Sira L. Biomechanics of milk extraction during breastfeeding. Proc Natl Acad Sci U S A 2014;111:5230–5235.**

- Abstract: How do infants extract milk during breast-feeding? We have resolved a century-long scientific controversy, whether it is sucking of the milk by subatmospheric pressure or mouthing of the nipple-areola complex to induce a peristaltic-like extraction mechanism. Breast-feeding is a dynamic process, which requires coupling between periodic motions of the infant's jaws, undulation of the tongue, and the breast milk ejection reflex. The physical mechanisms executed by the infant have been intriguing topics. We used an objective and dynamic analysis of ultrasound (US) movie clips acquired during breast-feeding to explore the tongue dynamic characteristics. Then, we developed a new 3D biophysical model of the breast and lactiferous tubes that enables the mimicking of dynamic characteristics observed in US imaging during breast-feeding, and thereby, exploration of the biomechanical aspects of breast-feeding. We have shown, for the first time to our knowledge, that latch-on to draw the nipple-areola complex into the infant mouth, as well as milk extraction during breast-feeding, require development of time-varying subatmospheric pressures within the infant's oral cavity. Analysis of the US movies clearly demonstrated that tongue motility during breast-feeding was fairly periodic. The anterior tongue, which is wedged between the nipple-areola complex and the lower lips, moves as a rigid body with the cycling motion of the mandible, while the posterior section of the tongue undulates in a pattern similar to a propagating peristaltic wave, which is essential for swallowing.

**10. Garbin CP, Sakalidis VS, Chadwick LM, Whan E, Hartmann PE, Geddes DT. Evidence of improved milk intake after frenotomy: a case report. *Pediatrics*. 2013 Nov;132(5):e1413-7. doi: 10.1542/peds.2012-2651. Epub 2013 Oct 7.**

- 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. Post-frenotomy, 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.

**11. Geddes DT, Langton DB, Gollow I, Jacobs LA, Hartmann PE, Simmer K. Frenulotomy for breastfeeding infants with ankyloglossia: effect on milk removal and sucking mechanism as imaged by ultrasound. *Pediatrics* 2008;122:e188–e194.**

- Objective: There is evidence that infants with ankyloglossia can experience breastfeeding difficulties including poor attachment to the breast, suboptimal weight gain, and maternal nipple pain, which may lead to early weaning of the infant. No studies have investigated the cause of these breastfeeding difficulties. The objective of this study was to determine the effectiveness of frenulotomy in infants experiencing persistent breastfeeding difficulties despite professional assistance by measuring changes in milk transfer and tongue movement during breastfeeding before and after frenulotomy.
- Conclusion: Infants with ankyloglossia experiencing persistent breastfeeding difficulties showed less compression of the nipple by the tongue postfrenulotomy, which was associated with improved breastfeeding defined as better attachment, increased milk transfer, and less maternal pain. In the assessment of breastfeeding difficulties, ankyloglossia should be considered as a potential cause.

**12. Ghaheri BA, Cole M, Fausel SC, Chuop M, Mace JC. Breastfeeding improvement following tongue-tie and lip-tie release: A prospective cohort study.**

- Objective: Numerous symptoms may arise that prevent mother-infant dyads from maintaining desired breastfeeding intervals. Investigations into treatments that positively influence breastfeeding outcomes allow for improved patient counseling for treatment decisions to optimize breastfeeding quality. This investigation aimed to determine the impact of surgical tongue-tie/lip-tie release on breastfeeding impairment.
- Conclusion: Surgical release of tongue-tie/lip-tie results in significant improvement in breastfeeding outcomes. Improvements occur early (1 week postoperatively) and continue to improve through 1 month postoperatively. Improvements were demonstrated in both infants with classic anterior tongue-tie and less obvious posterior tongue-tie. This study identifies a previously under-recognized patient population that may benefit from surgical intervention if abnormal breastfeeding symptoms exist.

**13. Gregory E. Notestine, DDS. The Importance of the Identification of Ankyloglossia (Short Lingual Frenulum) as a Cause of Breastfeeding Problems. <https://doi.org/10.1177/089033449000600316>.**

- Abstract: The short lingual frenulum can be a cause of breastfeeding problems, including sore and damaged nipples and inadequate feedings. This article describes two cases, discusses the difficulty in recognizing the condition, and describes the role of primary care providers in the recognition, diagnosis, and surgical treatment of the short lingual frenulum.

**14. Griffiths DM. Do tongue ties affect breastfeeding? J Hum Lact. 2004 Nov;20(4):409-14.**

- Abstract: This study assessed indications for and safety and outcome of simple division of tongue tie without an anesthetic. There were 215 infants younger than 3 months (mean 0-19 days) who had major problems breastfeeding, despite professional support. Symptoms, tongue tie details, safety of division, and complications were recorded. Feeding was assessed by the mothers immediately, at 24 hours, and 3 months after division. Prior to division, 88% had difficulty latching, 77% of mothers experienced nipple trauma, and 72% had a continuous feeding cycle. During division, 18% slept throughout; 60% cried more after division (mean 0-15 seconds). There were no significant complications. Within 24 hours, 80% were feeding better. Overall, 64% breastfed for at least 3 months (UK national average is 30%). Initial assessment, diagnosis, and help, followed by division and subsequent support by a qualified lactation consultant, might ensure that even more mothers and infants benefit from breastfeeding.

**15. Hogan M, Westcott C, Griffiths M. Randomized, controlled trial of division of tongue-tie in infants with feeding problems. J Paediatr Child Health. 2005 May-Jun;41(5-6):246-50.**

- Objective: To determine whether, in infants with a tongue-tie and a feeding problem, the current medical treatment (referral to a lactation consultant) or immediate division works best and enables the infants to feed normally.
- Conclusion: This randomized, controlled trial has clearly shown that tongue-ties can affect feeding and that division is safe, successful and improved feeding for mother and baby significantly better than the intensive skilled support of a lactation consultant.

**16. Hong SJ, Cha BG, Kim YS, Lee SK, Chi JG. Tongue Growth during Prenatal Development in Korean Fetuses and Embryos. J Pathol Transl Med. 2015 Nov;49(6):497-510. doi: 10.4132/jptm.2015.09.17. Epub 2015 Oct 16.**

- Background: Prenatal tongue development may affect oral-craniofacial structures, but this muscular organ has rarely been investigated.

- Conclusion: The early clockwise growth of the ACB to the maxillary plane became harmonious with the counter-clockwise growth of the PCB to the tongue axis during the early prenatal period. These observations suggest that human embryonic tongue growth affects ACB and PCB angulation, stimulates maxillary growth, and induces mandibular movement to achieve the essential functions of oral and maxillofacial structures.

**17. Ito Y. Does frenotomy improve breast-feeding difficulties in infants with ankyloglossia? *Pediatr Int.* 2014 Aug;56(4):497-505. doi: 10.1111/ped.12429.**

- Abstract: The aim of this systematic review was to critically examine the existing literature regarding the effectiveness of tongue-tie division in infants with ankyloglossia, using the new grades of recommendations, assessment, development, and evaluation (GRADE) rating system. A clinical question was structured according to patient, intervention, comparison, and outcome, as follows: in infants with poor breast-feeding and ankyloglossia (patient), does frenotomy (intervention), compared to lactation support alone (comparison), improve feeding (outcome)? An electronic literature search was systematically conducted from databases including PubMed, Japana Centra Revuo Medicina (Igaku Chuo Zasshi), CINAHL, and Cochrane Library using the key words "ankyloglossia," "tongue-tie," "frenotomy," and/or "breast-feeding" in English and equivalent terms in Japanese. The literature search yielded four randomized clinical trials, and 12 observational studies for analysis. The quality of the literature was rated in regard to the two most important outcomes (sucking/latching, and nipple pain) and five less important outcomes (milk supply/milk production, continuation of breast-feeding, weight gain, adverse events, and dyad distress) in accordance with the GRADE system. Evidence levels of the most important outcomes were rated either A (strong evidence) or B (moderate evidence), and less important outcomes were rated C (weak evidence); every outcome consistently showed a favorable effect of frenotomy on breast-feeding. The literature review supported an overall moderate quality of evidence for the effectiveness of frenotomy for the treatment of breast-feeding difficulties in infants with ankyloglossia. No major complications from frenotomy were reported.

**18. *J Hum Lact.* 2018 Aug;34(3):566-574. Revision Lingual Frenotomy Improves Patient-Reported Breastfeeding Outcomes: A Prospective Cohort Study. Ghaheri BA, Cole M, Mace JC.**

- Background: Lingual frenotomy improves patient-reported outcome measures, including infant reflux and maternal nipple pain, and prolongs the nursing relationship; however, many mother-infant dyads continue to experience breastfeeding difficulty despite having had a frenotomy. Research aim: The aim of this study was to determine how incomplete release of the tethered lingual frenulum may result in persistent breastfeeding difficulties.
- Conclusion: We demonstrated that besides nipple pain, measures of infant reflux symptoms and maternal breastfeeding self-confidence can improve following full release of the lingual frenulum. Additionally, a patient population was identified that could benefit from increased scrutiny of infant tongue function when initial frenotomy fails to improve breastfeeding symptoms.

**19. Junqueira MA, Cunha NN, Costa e Silva LL, Araújo LB, Moretti AB, Couto Filho CE, Sakai VT. Surgical techniques for the treatment of ankyloglossia in children: a case series. *J Appl Oral Sci.* 2014 Jun;22(3):241-8.**

- Abstract: This paper reports a series of clinical cases of ankyloglossia in children, which were approached by different techniques: frenotomy and frenectomy with the use of one hemostat, two hemostats, a groove director or laser. Information on the indications, contraindications, advantages and disadvantages of the techniques was also presented. Children diagnosed with ankyloglossia were subjected to different surgical procedures. The choice of the techniques was based on the age of the patient, length of the frenulum and availability of the instruments and equipment. All the techniques presented are successful for the treatment of ankyloglossia and require a skilled professional. Laser

may be considered a simple and safe alternative for children while reducing the amount of local anesthetics needed, the bleeding and the chances of infection, swelling and discomfort.

20. Karabulut R<sup>1</sup>, Sönmez K, Türkyilmaz Z, Demiroğullari B, Ozen IO, Bağbanci B, Kale N, Başaklar AC. **Ankyloglossia and effects on breast-feeding, speech problems and mechanical/social issues in children.** *B-ENT*. 2008;4(2):81-5.

- Background: This aim of this study was to define the characteristics of the patients who underwent surgery for ankyloglossia.
- Conclusion: The correction of ankyloglossia at an early age reduces the risk of latent complications. In addition, the early correction will mitigate the feeding- and speech-related concerns of parents and doctors alike.

21. Kumar M1, Kalke E. **Tongue-tie, breastfeeding difficulties and the role of Frenotomy.** *Acta Paediatr*. 2012 Jul;101(7):687-9. doi: 10.1111/j.1651-2227.2012.02661.x. Epub 2012 Apr 5.

- Abstract: A greater emphasis on exclusive breastfeeding in recent years has re-ignited the historical debate over the role of ankyloglossia (tongue-tie) in infants with breastfeeding difficulties. Several prospective cohort studies and randomized control trials have been published in this area in the last 10-15 years. We critically evaluated recent evidence and attempted to answer two important clinical queries in this area, that is, (i) whether ankyloglossia is associated with breastfeeding difficulties and (ii) whether frenotomy helps mother-baby dyad in such setting?
- Conclusion: Neonates with tongue-tie are at increased risk for breastfeeding difficulties. An early recognition of this association by primary care provider and prompt referral to a lactation consultant is important. In cases with clearly documented breastfeeding difficulties, frenotomy often results in rapid improvement in symptoms.

22. Lori A. Ricke, Nancy J. Baker, Diane J. Madlon-Kay and Terese A. DeFor. **Newborn Tongue-tie: Prevalence and Effect on Breast-Feeding.** *J Am Board Fam Pract* January 2005, 18 (1) 1-7; DOI: <https://doi.org/10.3122/jabfm.18.1.1>

- Objective: The purposes of this study were: (1) to determine whether breast-fed infants with tongue-tie have decreased rates of breast-feeding at 1 week and 1 month of age, (2) to determine the prevalence of tongue-tie, and (3) to test the usefulness of the Assessment Tool for Lingual Frenulum Function (ATLFF) in assessing the severity of tongue-tie in breast-feeding newborns.
- Conclusions: Tongue-tie is a relatively common condition in newborns. Affected infants are significantly more likely to be exclusively bottle-fed by 1 week of age. The ATLFF was not a useful tool to identify which tongue-tied infants are at risk for breast-feeding problems.

23. Martinelli RL, Marchesan IQ, Gusmão RJ, Honório HM, Berretin-Felix G. **The effects of frenotomy on breastfeeding.** *J Appl Oral Sci*. 2015 Mar-Apr;23(2):153-7. doi: 10.1590/1678-775720140339.

- Abstract: Although the interference of tongue-tie with breastfeeding is a controversial subject, The use of lingual frenotomy has been widely indicated by health professionals.
- Objective: To observe changes in breastfeeding patterns after lingual frenotomy concerning the number of sucks, pause length between groups of sucking and mother's complaints.
- Conclusions: After lingual frenotomy, changes were observed in the breastfeeding patterns of the the tongue-tied infants while the control group maintained the same patterns. Moreover, all symptoms reported by the mothers of the tongue-tied infants had improved after frenotomy.

24. Messner AH, Lalakea ML. The effect of ankyloglossia on speech in children. *Otolaryngol Head Neck Surg.* 2002 Dec;127(6):539-45.

- Objective: We wanted to determine whether ankyloglossia is associated with articulation problems and the effect of frenuloplasty on speech and tongue mobility.
- Conclusion: Tongue mobility and speech improve significantly after frenuloplasty in children with ankyloglossia who have articulation problems.

25. Miranda BH<sup>1</sup>, Milroy CJ. A quick snip - A study of the impact of outpatient tongue tie release on neonatal growth and breastfeeding. *J Plast Reconstr Aesthet Surg.* 2010 Sep;63(9):e683-5. doi: 10.1016/j.bjps.2010.04.003. Epub 2010 May 24.

- Abstract: A prospective study (62 neonates) of ankyloglossia and breastfeeding difficulty is presented. At 2 weeks post-frenulotomy, there were significant improvements in weight (15+/-1.2 centiles) and breastfeeding, including number of sessions/24h (19%) and bottle top-ups/24h (81%) ( $p < 0.0001$ ).

26. Post ED, Rupert AW, Schulpen TW. [Problematic breastfeeding due to a short frenulum]. *Ned Tijdschr Geneeskd.* 2010;154:A918.

- Abstract: Ankyloglossia (tongue tie) in the neonate can be a cause of breastfeeding problems. Frenotomy (cutting of the frenulum linguae) had fallen into disrepute, but has regained its place as a standard medical procedure in Anglo-Saxon countries, though not in the Netherlands. We present two neonates, both boys, presenting with breastfeeding problems caused by ankyloglossia. The first baby described did not drink enough and hence did not gain any weight. The mother of the second patient experienced a great deal of pain and had cracked nipples, caused by an abnormal suckling action. Both boys underwent frenotomy with good result. Recent ultrasound studies reveal that frenotomy immediately normalizes the suckling action in babies with ankyloglossia. Randomized controlled trials show that 95% of breastfeeding problems disappear. There is sufficient evidence to state that frenotomy is a very safe and useful procedure in neonates.

27. Richard Baxter, Lauren Hughes, Speech and Feeding Improvements in Children After Posterior Tongue-Tie Release: A Case Series. *Int J Clin Pediatr.* 2018;7(3):29-35doi: <https://doi.org/10.14740/ijcp295w>

- Abstract: Ankyloglossia, commonly referred to as “tongue-tie,” has recently seen a surge in cases and awareness with a corresponding increase in diagnosis and treatment. The evidence linking tongue-tie release and breastfeeding improvement has been published previously. However, due to a lack of published evidence for children, many medical professionals still believe that a restricted tongue does not contribute to feeding or speech issues in older children. The condition of tongue-tie exists on a continuum with variable visibility and symptoms. Some restrictions, mainly anterior or “classic” tongue-tie, are highly visible and easier to detect. However, “posterior” or submucosal tongue-ties are often more challenging to diagnose. Recently, an increase in awareness and education has led to improved detection of these posterior tongue-ties. The data presented in these case studies will demonstrate that even posterior ties restrict movement and affect oral structures that are required for speech and feeding. In this case series, five patients with posterior tongue restrictions underwent CO<sub>2</sub> laser frenectomy without any general anesthesia or sedation.
- Conclusion: After a quick in-office procedure, all five patients demonstrated increased lingual mobility evidenced by improved speech and feeding skills. Some improvements were observed immediately after the procedure by clinical staff and the child’s family. While these patients required continued intervention from a speech-language pathologist, their improved lingual mobility allowed for more significant and faster improvement in speech and feeding skills. These cases challenge the status

quo that speech and feeding are not affected by posterior tongue-tie. Continued research is warranted to determine the impact that all classes of lingual restrictions can have on speech and feeding development.

**28. Riskin A<sup>1</sup>, Mansovsky M, Coler-Botzer T, Kugelman A, Shaoul R, Hemo M, Wolff L, Harpaz S, Olchov Z, Bader D. Tongue-tie and breastfeeding in newborns-mothers' perspective.**

- Objective: This study explored clinical implications of tongue-tie (TT) on breastfeeding from the mothers' perspective and evaluated the assistance provided.
- Conclusion: TT infants had significantly more breastfeeding problems in the first month, but similar rates and durations of breastfeeding. Early diagnosis and lactation consultation may assist mother-infant dyads substantially. Mothers whose infants underwent frenotomies for breastfeeding more frequently found the procedure alleviated breastfeeding problems.

**29. Scott A, Siegel Aerophagia Induced Reflux in Breastfeeding Infants With Ankyloglossia and Shortened Maxillary Labial Frenula (Tongue and Lip Tie).**

- Background: Infants with tongue and possible lip tie often have a poor latch in which there is often an inadequate seal around the breast and disorganized swallowing. As a result, many of these infants swallow air during breastfeeding. Many of these infants suffer from symptoms of reflux.
- Conclusion: There appears to be a relationship between maxillary lip tie (ankyloglossia and shortened maxillary labial frenula) and AIR. Treatment of these infants with a relatively simple frenotomy procedure may reduce or eliminate reflux. As a result, many of these infants may be spared from invasive testing or medications that have been shown to have potentially significant side effects. This may change diagnostic and treatment algorithms.

**30. Srinivasan A, Dobrich C, Mitnick H, Feldman P. Ankyloglossia in breastfeeding infants: the effect of frenotomy on maternal nipple pain and latch.**

- Objective: The aim of this study was to measure the effectiveness of frenotomy in infants with ankyloglossia, by quantifying the changes in latch and maternal nipple pain using standardized tools.
- Conclusion: Timely frenotomy and breastfeeding counseling is an effective intervention, improving latch and decreasing nipple pain. All infants had an equal or higher latch score after frenotomy, with an improvement in mean latch score.

**31. Wakhanrittee J<sup>1</sup>, Khorana J<sup>2</sup>, Kiatipunsodsai S<sup>3</sup>. The outcomes of a frenulotomy on breastfeeding infants followed up for 3 months at Thammasat University Hospital. *Pediatr Surg Int.* 2016 Oct;32(10):945-52. doi: 10.1007/s00383-016-3952-8. Epub 2016 Aug 2.**

- Purpose: To study the effects of frenulotomy on nipple pain, latch and the success in exclusive breastfeeding (EBF) at 3-month follow-up.
- Conclusion: Frenulotomy could significantly reduce nipple pain and increase LATCH score in tongue-tied infants with breastfeeding difficulty. Several factors are positively associated with the success of EBF. Tongue-tie severity, LATCH score and nipple sensation were the factors that can be modified by frenulotomy.

**32. Veysiere A, Kun-Darbois JD, Paulus C, Chatellier A, Caillot A, Bénateau H. [Diagnosis and management of ankyloglossia in young children]. *Rev Stomatol Chir Maxillofac Chir Orale.* 2015 Sep;116(4):215-20. doi: 10.1016/j.revsto.2015.06.003. Epub 2015 Aug 18.**

- Abstract: Ankyloglossia is a common condition. Its prevalence is between 3.2% and 4.8% depending on the series and is largely underestimated given the fact of non-diagnosis when the symptoms are limited. It is defined as a short lingual frenulum resulting in a limitation of the lingual mobility. It is due to a defect in cellular apoptosis embryogenesis between the floor of the mouth and tongue. The result is a fibrous and short lingual frenulum. Several classifications were used to make the diagnosis. However, these are the clinical implications, particularly on food and primarily breastfeeding in the baby and phonation in older children that will motivate the management. This is surgical and different techniques are available: infants before the age of 6 months and when the lingual frenulum is still a fine cellular membrane, frenotomy is recommended. Frenectomy with or without frenuloplasty is indicated for the older child. The surgery is simple, the results are good and rapidly improving grievances. Complications are rare. Finally, speech therapy is important when there are implications for phonation.

**33. Walls A, Pierce M, Wang H, Steehler A, Steehler M, Harley EH Jr. Int J Pediatr Otorhinolaryngol. 2014 Jan;78(1):128-31. doi: 10.1016/j.ijporl.2013.11.006. Epub 2013 Nov 18.**

- Objectives: The goal of this study was to evaluate parental speech outcomes and tongue mobility in children with ankyloglossia who underwent frenotomy by an otolaryngologist during the neonatal period.
- Conclusions: There was a statistically significant improvement in speech outcomes and tongue mobility in children who underwent frenotomy compared to individuals who declined the operation. As a result of the data presented within this study, there appears to be a long-term benefit beyond feeding when frenotomy is performed in newborns with ankyloglossia.

**34. Yoon AJ, Zaghi S, Ha S, Law CS, Guilleminault C, Liu SY. Ankyloglossia as a risk factor for maxillary hypoplasia and soft palate elongation: A functional - morphological study. Orthod Craniofac Res. 2017 Nov;20(4):237-244. doi: 10.1111/ocr.12206. Epub 2017 Oct 10.**

- Objective: To characterize associations between restricted tongue mobility and maxillofacial development.
- Conclusions: Restricted tongue mobility was associated with narrowing of the maxillary arch and elongation of the soft palate in this study. These findings suggest that variations in tongue mobility may affect maxillofacial development.