Discussion

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An evaluation of infant tongue-tie assessment, management and outcomes in a multidisciplinary clinic in Western Australia: A retrospective audit

Eloise Wiffen, Jillian Wiffen and Leon Levitt

ABSTRACT

There is a lack of professional consensus regarding the assessment, diagnosis and treatment of what is referred to as 'tongue-tie', with both parental anxiety and practitioner motivation driving increasing rates of tongue-tie release (frenotomy). The aim of this audit was to review the current multidisciplinary protocol for assessment and management of tongue-tie at Baby Steps Health Centre, a private healthcare centre in Perth, Western Australia, and evaluate its role in objectively identifying infants who may benefit from frenotomy. A retrospective audit of electronic records of consultations for tongue-tie assessment performed between July 2020 and June 2023 was conducted. Extracted data included infant and maternal demographics, referral source, presenting concerns, infant oral characteristics, management approach and parents' perceived improvement in their presenting concerns 1 week following their appointment. A total of 217 infant–mother dyads presented for tongue-tie assessment. Lingual frenula attached to the anterior tongue were significantly more likely to require release compared to those attached to the mid- to posterior tongue (40/45 (89%) vs. 39/148 (23%), $p<0.001$). For the latter group, tongue mobility was a useful predictor of the need for frenotomy. Of the 108 families (50%) who provided follow-up, 80% reported a subjective improvement in their presenting concerns regardless of clinical management. This audit demonstrated the value of a standardised multidisciplinary approach to tongue-tie assessment and management in preventing unnecessary frenotomy and improving outcomes for infants and their families. The need for formalised education on tongue-tie for healthcare professionals was identified.

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Keywords: *tongue-tie; ankyloglossia; breastfeeding; frenotomy*

***Breastfeeding Review* 2025; 33(3), 34-44**

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INTRODUCTION

Ankyloglossia, commonly known as tongue-tie, is a congenital condition characterised by the presence of a restrictive lingual frenulum that limits tongue mobility and subsequent function (LeFort et al., 2021). The reported prevalence of tongue-tie in infants ranges from 0.02 to 10.7% (Power & Murphy, 2015). This variation is attributable to a lack of standardised diagnostic criteria for the condition. While the term 'tongue-tie' is often used by parents and health professionals to describe the presence of any lingual frenulum that is visible, the Academy of Breastfeeding Medicine asserts that tongue-tie is a functional diagnosis, and management decisions should be based on infant oral examination in conjunction with a skilled clinical breastfeeding assessment (LeFort et al., 2021). It should be noted that the success of the breastfeeding dyad is dependent not only on infant oral anatomy, but also maternal anatomy and breastfeeding experience (Walker et al., 2018). Many breastfeeding issues can be effectively managed with skilled lactation support, however in cases where a tongue-tie is assessed to be significantly restricting the infant's tongue function, surgical division of the lingual frenulum (frenotomy) can be offered (LeFort et al., 2021). Between 2006 and 2016, there was a marked increase in frenotomy rates in newborns to 4-year-olds reported in all states of Australia except Tasmania (Kapoor et al., 2018). Despite this, there still exists a lack of consensus regarding the diagnosis and treatment of tongue-tie (LeFort et al., 2021).

Literature review

The literature highlights the growing emphasis of a multidisciplinary approach to the assessment and management of tongue-tie in infants. Thomas et al. (2024) have documented the benefits of a thorough breastfeeding assessment for dyads presenting with suboptimal breastfeeding before any treatment is offered. Several assessment tools for diagnosing and assessing the impact of tongue-tie on breastfeeding

Table 1. *Tongue-tie assessment tools*

Tool	Anatomic vs. Functional	Scoring System
Hazelbaker Assessment Tool for Lingual Frenulum Function (ATLFF) (Hazelbaker, 1994)	Both	Anatomic factors: appearance of tongue when lifted, length and elasticity of frenulum, attachment of lingual frenulum to tongue and inferior alveolar ridge Functional factors: lateralisation, elevation, extension, cupping, peristalsis, snap-back of the tongue
Bristol Tongue Assessment Tool (BTAT) (Ingram et al., 2015)	Both	Tongue-tip appearance, location of frenulum attachment to gum/ridge or floor of mouth, lift of tongue, protrusion of tongue
Tongue-tie and Breastfed Baby (TABBY) assessment tool (Ingram et al., 2019)	Both	Pictorial version of BTAT consisting of 12 images demonstrating appearance of the infant tongue, its attachment to the gum and the limits of tongue mobility
Coryllos classification (Coryllos et al., 2004)	Anatomic	Four categories of tongue-tie severity based on distance of insertion of lingual frenulum from the tip of the tongue
Kotlow classification (Kotlow, 2011)	Anatomic	Four categories of tongue-tie severity based on distance of insertion of lingual frenulum from the tip of the tongue
Lingual Frenulum Protocol for Infants Neonatal Tongue Screening Tool (short version – NTST) (Martinelli et al., 2012)	Anatomic	Tongue and lip appearance at rest and crying, lingual frenulum thickness, lingual frenulum attachment to tongue and attachment to floor of mouth

have been published in the literature, none of which have been validated (Thomas et al., 2024) (Table 1).

Dixon et al. (2018) investigated the impact of a multifactorial program for diagnosis and treatment of tongue-tie in New Zealand, incorporating an expert breastfeeding review and assessment of lingual function using the Bristol Tongue Assessment Tool (BTAT). The BTAT screening tool proved to be reliable for evaluating frenulum function with good inter-user reliability. The establishment of consistent multidisciplinary assessment of tongue-tie in infants led to a marked reduction in frenotomy intervention rate without negatively impacting feeding patterns and sustained breastfeeding outcomes (Dixon et al., 2018). Ingram and colleagues (2019) produced the Tongue-tie and Breastfed Baby (TABBY) tool, a pictorial version of the BTAT, and found it to be useful when combined with a structured breastfeeding assessment in informing selection of infants for frenotomy.

Using a multidisciplinary approach in 2020, practitioners at the Massachusetts Eye and Ear Infirmary performed frenotomies on 30.1% of patients referred for feeding difficulties (Diercks et al., 2020). Infant–mother dyad observations associated with having a procedure included lower BTAT scores, specifically attachment, sucking and swallowing at the breast. Unkel et al. (2021) identified the appearance of the tongue when lifted, tongue protrusion, frenulum length and frenulum type as the anatomical features most commonly used in determining if a frenotomy was indicated.

Duursma et al. (2023) compared referral and frenotomy rates in 2014 and 2018 at an Australian tertiary hospital in Canberra. The tongue-tie assessment included a thorough breastfeeding assessment, the use of the Hazelbaker Assessment Tool for Lingual Frenulum Function (ATLFF) and Coryllos classification, and the position of attachment of the lingual frenulum to the inferior alveolar ridge (Duursma et al., 2023). They reported an increase in referral rates but no significant increase in the tongue-tie releases between the two periods (95% released in 2014, 94% released in 2018). They commented that there were now more 'mid-to posterior tongue-ties' and fewer 'anterior tongue-ties' seen at the clinic (Duursma et al., 2023).

These studies support the integration of a structured breastfeeding assessment alongside anatomical and functional evaluations to guide treatment decisions. Evidence suggests that such comprehensive approaches may reduce unnecessary frenotomies while maintaining or improving breastfeeding outcomes.

Background

The audit was conducted at Baby Steps Health Centre, a multidisciplinary private clinic in Perth, Western Australia, which specialises in infant, child and parent healthcare. Tongue-tie assessments included a skilled feeding assessment by an International Board Certified Lactation Consultant (IBCLC) and a review by an appropriately trained general practitioner (GP). The feeding assessment consisted of maternal and infant history and examination and direct observation of bottle- or breastfeeding, including pre- and post-feed infant weights, as recommended by the Academy of Breastfeeding Medicine (LeFort et al., 2021).

A detailed infant oral examination, performed by both the IBCLC and the GP, assessed a combination of structural and functional characteristics of the tongue, oral frenula, palate and lips. Characterisation of the appearance of the lingual and labial frenula is based on the anatomical work by Mills et al. (2019), describing the frenula as thick or thin, and elastic or inelastic. The position of the superior (where the frenulum attaches to the undersurface of the tongue) and inferior (where the frenulum attaches to the base of the mouth) attachments of the lingual frenula were also documented in a similar manner to the study by Duursma et al. (2023). Specifically, the superior attachment of the lingual frenulum to the tongue was reported as either anterior (within approximately 0.5 cm of the tongue tip) or to the mid-to-posterior area of the tongue. The inferior attachment was either to the floor of the mouth or to the inferior alveolar ridge (i.e. gum line). The presence or absence of pseudoleukoplakia (a white patch or plaque on the tongue that cannot be characterised clinically as any other disease) was also noted, as there is speculation in the general community that this may be associated with tongue-tie.

Functional observations included extension (ability to protrude tongue past the gum line), lateralisation (ability of tongue tip to follow examiners finger to corners of the mouth) and elevation (ability to raise tongue to upper palate with wide open mouth) as described in the Hazelbaker Assessment Tool for Lingual Frenulum Function (ATLFF), the importance of these features being highlighted by Unkel and colleagues (2021).

These observations, in combination with the feeding assessment, guided decisions regarding the necessity of surgical intervention and the appropriateness of scissor versus laser frenotomy. The protocol used to guide management decisions for infants presenting to Baby Steps for tongue-tie assessment is depicted in Figure 1. This protocol drew on elements from various pre-existing tongue-tie assessment tools to identify frenula which may be interfering with tongue function

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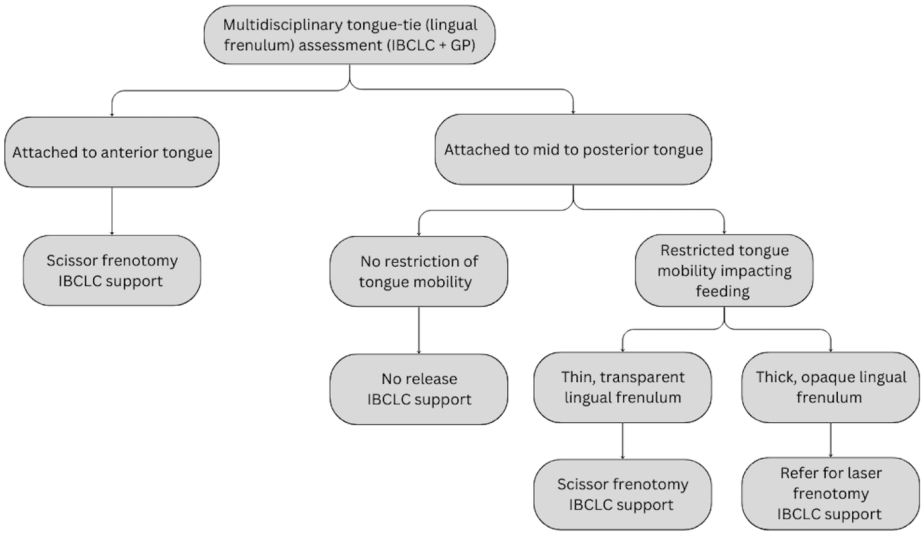
Figure 1. ***Baby Steps tongue-tie management protocol***



and would therefore benefit from frenotomy. Unlike many other approaches to tongue-tie assessment, the protocol employed at Baby Steps did not involve the classification of tongue-tie into categories based on severity, nor did it rely on a numerical scoring system to guide management decisions.

The ultimate decision regarding management was dependent on fully informed parental consent following a multidisciplinary discussion between the GP, IBCLC and the family. When the audit was conducted, the consultation fee for the combined IBCLC and GP tongue-tie assessment at Baby Steps resulted in an out-of-pocket cost of $120, whether or not a frenotomy was performed. This ensured that cost did not factor into the decision-making. Parents were followed up by the IBCLC with a phone call 1 week after their initial appointment to assess their concerns and offer further feeding support. Reconsideration of frenotomy was available if feeding assistance alone had not resolved the initial presenting concerns.

Aims

The aim of this audit was to review the assessment, management and outcomes of all families who presented to Baby Steps Health Centre between July 2020 and June 2023 for concerns related to infant tongue-tie. Specific objectives included evaluating the role of the practice's current protocol for the assessment and management of tongue-tie in objectively identifying infants who might benefit from a frenotomy and identifying the components of tongue-tie assessment which were most valuable in predicting the need for frenotomy. The authors hoped that findings from this audit might be used to inform future education of the health professionals managing newborn infants.

METHODS

A retrospective audit of electronic records of all tongue-tie assessments performed at Baby Steps Health Centre between July 2020 and June 2023 was conducted. Ethical approval was sought from St John of God Health Care Human Research Ethics Committee as Baby Steps Health Centre is a private entity. The Ethics Committee provided a Waiver of Consent as the review of records was deemed a quality-improvement evaluation. Baby Steps Health Centre uses Best Practice Software's Bp Premier for documentation of consultations. Data extracted from electronic patient health records for review in this audit included:

- infant and maternal demographic information
- source of referral (i.e. self or specified clinician) presenting concern(s) (more than one may be reported)
- infant oral characteristics – anatomical (appearance of tongue tip, position of superior and inferior attachment of lingual frenulum, appearance of lingual and labial frenula, presence of pseudoleukoplakia) and functional (elevation, extension and lateralisation of tongue)
- approach to management – IBCLC feeding support alone, or in combination with scissor frenotomy or referral for laser frenotomy
- parents' perceived improvement in their presenting concern(s) 1 week post-review.

Data analysis

Data extraction and descriptive analysis was undertaken using IBM SPSS Statistics Version 27 and Microsoft Excel Version 15.30 was utilised for data visualisation.

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RESULTS

A total of 217 infants presented to Baby Steps Health Centre for initial consultation for tongue-tie assessment between July 2020 and June 2023. Of these, 57% (124/217) were male and 43% (93/217) were female (Table 2). Overall, 6.9% (15/217) of infants were born pre-term, 5.1% (11/217) were low birth weight, and 45% (98/217) of mothers were primiparous (Table 2). Age at presentation for tongue-tie assessment ranged from 2 days to 10 months, with an average age of 6.6 weeks (Table 2). Fifty per cent (109/217) of families brought their infant to Baby Steps for an oral assessment at age 4 weeks or less.

The most frequent source of referral to Baby Steps Health Centre for tongue-tie assessments was parents themselves (64/217 [29%]), followed by child health nurses (46/217 [21%]), who provided scheduled universal appointments at 2 weeks, 8 weeks, 4 months, 12 months and 2 years of age in Western Australia. Of those who self-referred, 41% (26/64) were managed surgically. Referrals from hospital medical officers, IBCLCs and midwives were more likely to result in a frenotomy compared to those referred by child health nurses and GPs (Table 3).

The reasons for presentation to Baby Steps Health Centre for tongue-tie assessment are depicted in Figure 2. The majority of families had more than one presenting concern. Overall, the most frequently reported reasons for presentation were concerns about latch difficulties (125/217 [58%]), inadequate milk transfer (113/217 [52%]), maternal nipple pain (108/217 [50%]) or damage (67/217 [31%]) and low milk supply (66/217 [31%]). Infants with a lingual frenulum attached to the anterior tongue were slightly more likely to have difficulties with latch (29/45 [64%]) and milk transfer (27/45 [60%]) compared to those attached more posteriorly (96/172 [56%] and 86/172 [50%] respectively). The two groups reported similar concerns about maternal nipple pain (22/45 [49%] anterior vs. 86/172 [50%] mid-to-posterior attachments), however nipple damage was reported more commonly in the mid-to-posterior attachments (57/172 [33%] vs. 10/45 [22%]). Infants with a family history of tongue-tie were slightly more likely to have frenula attached anteriorly (14/45 [31%] vs. 32/172 [19%]). A total of 21 of the 217 infants (10%) presented with concerns related to exclusive bottle-feeding with commercial milk formula (CMF).

Overall, 63% of infants (136/217) were managed non-surgically with IBCLC feeding advice and support alone, compared to 36% (79/217) who underwent scissor frenotomy. Only two cases across the 3 years of data collection were referred for laser frenotomy. The proportion of infants managed with scissor frenotomy decreased from roughly one half (26/55 [47%]) in 2020–21 to one third (32/104 [31%]) in 2022–23 while referral rates almost doubled over these years (Table 4).

Overall, 89% (40/45) of lingual frenula with an anterior attachment underwent frenotomy, compared to 23% (39/148) of those attached to the mid-to-posterior tongue ($p<0.001$). A greater percentage of lingual frenula with anterior attachments attached inferiorly to the alveolar ridge (31/45 [69%]) compared to those attached to the mid-to-posterior tongue (37/172 [22%]) ($p<0.001$). Anterior attachments were also significantly more likely to be associated with restrictions in tongue extension (34/45 [76%] vs. 37/172 [22%], $p<0.001$), elevation (30/45 [67%] vs. 28/172 [16%], $p<0.001$) and lateralisation (24/45 [53%] vs. 25/172 [15%], $p<0.001$), as well as a notched tongue tip appearance (30/45 [67%] vs. 26/172 [15%], $p<0.001$). Pseudoleukoplakia was observed at similar rates in both anterior (10/45 [22%]) and mid-to-posterior (33/172 [19%]) groups. Frenula attached to the mid-to-posterior tongue were significantly more likely to be thick in appearance (47/172 [27%] vs. 0/45 [0%], $p<0.001$), whereas those attached anteriorly were more frequently inelastic (28/45 [62%] vs. 25/172 [15%], $p<0.001$).

Chi-square tests of independence were performed to evaluate the relationship between each of the functional (Table 6) and structural (Table 7) components of the oral assessment and the approach to management (i.e. scissor frenotomy or IBCLC support to assess their relevance in the Tongue-Tie Assessment protocol. With the exception of the presence of pseudoleukoplakia and the appearance of the labial frenulum, there was a statistically significant association ($p<0.001$) between each of the functional and structural oral characteristics and the decision to release the frenulum (Table 6 and Table 7).

When controlling for lingual frenulum superior attachment (anterior vs. mid-to-posterior), the relationship between each of the other structural and functional oral characteristics and the approach to management was no longer statistically significant for those attached anteriorly. However, for lingual frenula attached to the mid-to-posterior tongue, significant associations remained between frenotomy and restrictions in tongue elevation, extension and lateralisation, as well as notching of the tongue tip, attachment of the lingual frenulum inferiorly to the alveolar ridge, and a thick and inelastic lingual frenulum. See Table 8 in Appendix A for a detailed breakdown of these results comparing lingual frenula based on the position of superior attachment to the tongue.

One week after their initial tongue-tie review appointment, 27.6% (60/217) of all the participants

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Table 2. ***Participant demographics***

Demographic	
Male	124/217 (57%)
Pre-term (<37 weeks)	15/217 (6.9%)
Low birth weight (<2500g)	11/217 (5.1%)
Primiparous	98/217 (45%)
Age at presentation (weeks)	6.6 ± 6.2[1]

1. Mean ± SD

Table 3. ***Source of referral for tongue-tie assessment by approach to management***

Source of referral	Total	Managed with scissor frenotomy
Hospital medical officer	10/217 (5.0%)	6/10 (60%)
Midwife	30/217 (14%)	16/30 (53%)
IBCLC	32/217 (15%)	16/32 (49%)
Self	64/217 (29%)	26/64 (41%)
Child health nurse	46/217 (21%)	11/46 (24%)
General practitioner	25/217 (12%)	4/25 (16%)
Friend	3/217 (1.4%)	0/3 (0%)
Chiropractor	2/217 (1.0%)	0/2 (0%)
Physiotherapist	1/217 (0.5%)	0/1 (0%)
Speech pathologist	1/217 (0.5%)	0/1 (0%)
Sleep specialist	1/217 (0.5%)	0/1 (0%)
Obstetrician	1/217 (0.5%)	0/1 (0%)

Figure 2. ***Reasons for presentation for tongue-tie assessment***

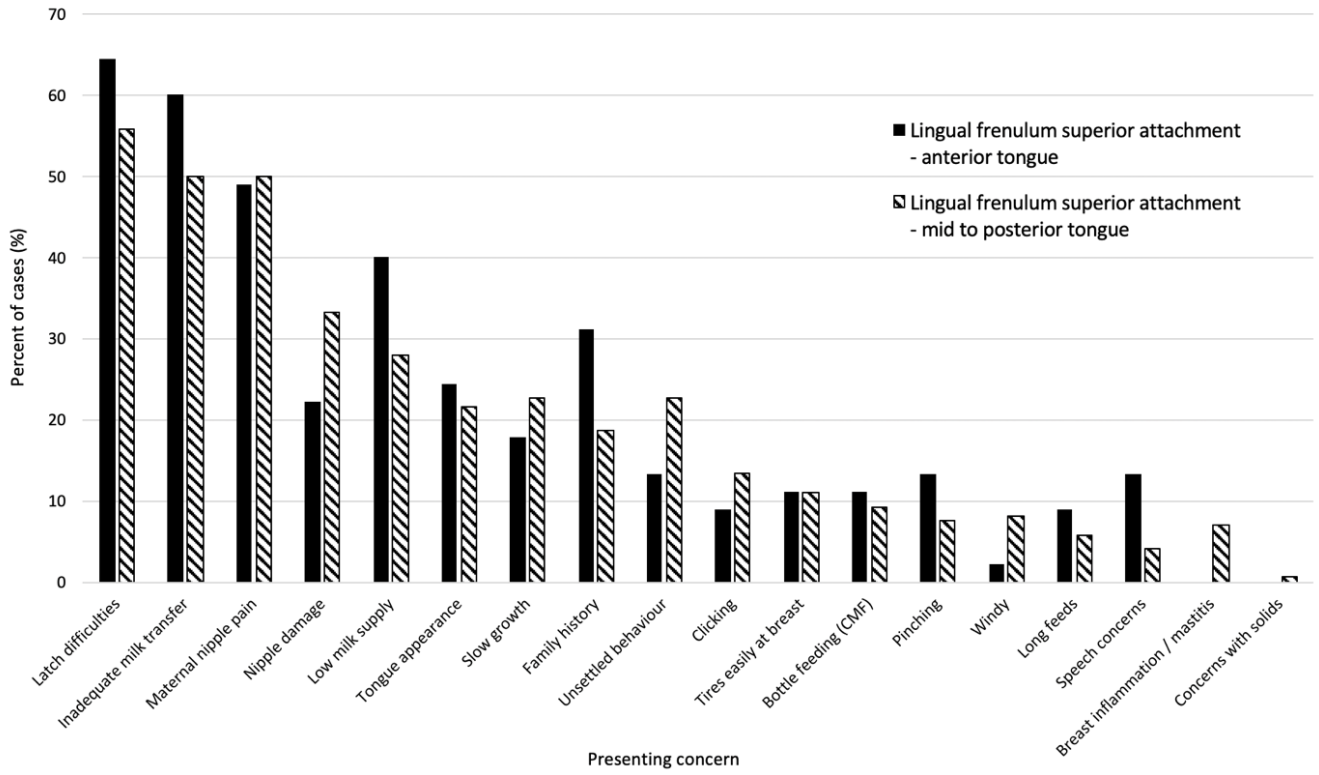

Table 4. ***Approach to management of tongue-tie by year***

		2020-21	2021-22	2022-23	Total
Approach to management	Scissor frenotomy	26/55 (47%)	21/58 (36%)	32/104 (31%)	79/217 (36%)
	Referral for laser frenotomy	1/55 (2%)	0/58 (0%)	1/104 (1%)	2/217 (1%)
	IBCLC support	28/55 (51%)	37/58 (64%)	71/104 (68%)	136/217 (63%)

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Table 5. ***Association between components of oral assessment and superior attachment of lingual frenulum to tongue***

	Lingual frenulum attachment to tongue		*p value (df)*
	Anterior	Mid to posterior	
Restricted extension	34/45 (76%)	37/172 (22%)	*<0.001 (1)*
Restricted elevation	30/45 (67%)	28/172 (16%)	*<0.001 (1)*
Restricted lateralisation	24/45 (53%)	25/172 (15%)	*<0.001 (1)*
Notched tongue tip	30/45 (67%)	26/172 (15%)	*<0.001 (1)*
Pseudoleukoplakia	10/45 (22%)	33/172 (19%)	*0.649 (1)*
Attached to alveolar ridge	31/45 (69%)	37/172 (22%)	*<0.001 (1)*
Thick frenulum	0/45 (0%)	47/172 (27%)	*<0.001 (1)*
Inelastic frenulum	28/45 (62%)	25/172 (15%)	*<0.001 (1)*

Table 6. ***Association between functional components of oral assessment and approach to management***

		Approach to management		x^2 (df)	*p*
		Scissor frenotomy	IBCLC support		
Tongue extension	**Restricted**	53/70 (76%)	17/70 (24%)	67.8 (1)	<0.001
	Non-restricted	26/145 (18%)	119/145 (82%)		
Tongue elevation	**Restricted**	45/56 (80%)	11/56 (20%)	62.0 (1)	<0.001
	Non-restricted	34/159 (21%)	125/159 (79%)		
Tongue lateralisation	**Restricted**	36/47 (77%)	11/47 (23%)	41.1 (1)	<0.001
	Non-restricted	43/168 (26%)	125/168 (74%)		
NB: The two cases referred for laser frenotomy were excluded from this analysis					

Table 7. ***Association between structural components of oral assessment and approach to management***

		Approach to management		x^2 (df)	*p*
		Scissor frenotomy	IBCLC support		
Tongue tip appearance	**Notched**	39/55 (71%)	16/55 (29%)	37.1 (1)	<0.001
	Rounded	40/160 (25%)	120/160 (75%)		
Lingual frenulum superior attachment	**Anterior tongue**	40/45 (89%)	5/45 (11%)	66.6 (1)	<0.001
	Mid to posterior tongue	39/170 (23%)	131/170 (77%)		
Lingual frenulum inferior attachment	**Alveolar ridge**	44/67 (66%)	23/67 (34%)	35.0 (1)	<0.001
	Floor of mouth	35/148 (24%)	113/148 (76%)		
Lingual frenulum appearance	**Thick and inelastic**	3/7 (43%)	4/7 (57%)	71.1 (3)	<0.001
	Thick and elastic	0 (0.0%)	38/38 (100%)		
	Thin and inelastic	38/44 (86%)	6/44 (14%)		
	Thin and elastic	38/126 (30%)	88/126 (70%)		
Labial frenulum appearance	**Thick and inelastic**	1/1 (100%)	0/1 (0.0%)	4.16 (3)	0.244
	Thick and elastic	15/35 (43%)	20/35 (57%)		
	Thin and inelastic	0/3 (0.0%)	3/3 (100%)		
	Thin and elastic	62/175 (35%)	113/175 (65%)		
Pseudoleukoplakia	**Present**	17/43 (40%)	26/43 (60%)	0.180 (1)	0.671
	Absent	62/172 (36%)	110/172 (64%)		
NB: The two cases referred for laser frenotomy were excluded from this analysis					

Table 9. ***Perceived improvement in presenting concerns at 1-week follow-up by management approach***

		Approach to management			
		Scissor frenotomy	Referral for laser frenotomy	IBCLC support	Total
Perceived improvement in presenting concerns one week post-review	No	8/50 (16%)	0/0 (0%)	14/58 (24%)	22/108 (20%)
	Yes	42/50 (84%)	0/0 (0%)	44/58 (76%)	86/108 (80%)
NB: The cases for which follow up was not required (N = 49) or was unable to be obtained (N = 60) are not included in this table.					

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were unable to be contacted for follow-up and a further 22.6% (49/217) did not require follow-up as the tongue was considered normal and there were no ongoing concerns. Of the 50% (108/217) of participants who did provide follow-up, 84% (42/50) in the scissor frenotomy group and 76% (44/58) in the IBCLC support group reported a perceived improvement in their initial presenting concerns (Table 9).

DISCUSSION

The majority of families presented to Baby Steps Health Centre for tongue-tie assessment due to concerns related to suboptimal breastfeeding. Half of these infants were assessed under the age of 4 weeks, at which time feeding difficulties are commonly experienced and often able to be addressed conservatively, in the first instance, with correct positioning and attachment (Kent et al., 2015).

The presence of a visible lingual frenulum is frequently reported as a 'tongue-tie', often without any formal assessment of tongue function or feeding. Worried parents are increasingly relying on the internet and social media as sources of further information regarding this condition. In fact, Google search interest in the term 'tongue-tie' has roughly quadrupled in Australia over the past decade (Google Trends, n.d.). A 2024 study in the United States demonstrated a significant relationship between online search interest and both the diagnosis and surgical treatment of tongue-tie (Naseem et al., 2024). However, the accuracy and reliability of online information is highly variable, and parents may have trouble discerning reliable sources from those conveying misleading or inappropriate advice and opinions.

The lack of consensus within the medical community around the diagnosis and appropriate management of tongue-tie only exacerbates controversy in this area (Unger et al., 2020). Only 35% (53/150) of referrals for tongue-tie assessment at Baby Steps Health Centre from healthcare providers resulted in frenotomy, however some clinicians may have been responding to parental anxiety and referring for specialist reassurance that the infant's oral anatomy was within normal limits. Formalised professional education around the significance of a lingual frenulum, its association with health issues and whether or when to release it, would be of great benefit to clinicians and parents. Currently, no training courses exist that allow any member of a health profession to register as a specialist in the treatment of tongue-tie (Australian Dental Association, 2020).

This audit supports the value of a multidisciplinary approach to the assessment of tongue-tie, and of the centrality of the role of the lactation consultant in the breastfeeding assessment at Baby Steps Health Centre. The history-taking and clinical assessment performed by the IBCLC, together with the medical expertise of the GP and their joint discussion with parents, resulted in a collaborative and holistic approach to management when compared to any given practitioner working in isolation. This approach is supported by the 2024 clinical report on ankyloglossia published by the American Academy of Pediatrics (Thomas et al., 2024).

Our findings suggest the majority of lingual frenula attached to the mid-to posterior tongue do not cause functional limitations which impact infant feeding and do not require surgical release. These findings are somewhat inconsistent with the Australian study by Duursma and colleagues (2023), who reported an increase in the proportion of tongue-tie attached to the posterior tongue across their 4-year study period, yet no change in the overall frenotomy rate. We found that useful predictors of the need for frenotomy in cases where the frenulum is attached more posteriorly are primarily restrictions in tongue elevation, extension and lateralisation, as well as notching of the tongue tip, attachment of the lingual frenulum inferiorly to the alveolar ridge, and a thick and inelastic lingual frenulum. These features are clear when examining the tongue and reproducible if proper examination is taught.

Our results reinforce the practice's alignment with the opinion of the American Academy of Pediatrics that the term 'posterior ankyloglossia' is poorly defined and lacking expert consensus and should not be used as a reason to perform surgical intervention on an infant (Thomas et al., 2024). The authors acknowledge the Modified Coryllos classification referred to by Duursma et al. (2023), that includes a Type 5 sub-mucosal tongue-tie attached greater than 15 mm from the tongue-tip. These frenula are characteristically thick at the base and would therefore be identified as unsuitable for scissor frenotomy at Baby Steps Health Centre. Referral for laser frenotomy may be considered if deemed clinically appropriate based on multidisciplinary assessment. It should be noted that five of the 45 infants with a lingual frenulum attached to the anterior tongue did not undergo frenotomy despite the practice's protocol stating that all of these should be released regardless of how the baby is feeding. Four of these infants were under 10 weeks of age. Two were referred by a child health nurse, two by GPs and one was self-referred. These five cases were managed non-surgically due to parental preference despite practitioner recommendation.

The appearance of the labial frenulum is documented as part of the oral examination at Baby Steps Health Centre, however our results demonstrated that an

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abnormally thick or inelastic labial frenulum is not significantly associated with the outcome of lingual frenotomy. Additionally, no infants were referred due to concerns for a restricted labial frenulum in the audit period. Revision of the labial frenulum is not offered at Baby Steps Health Centre as there is insufficient evidence to support the surgical release of the labial frenulum to assist with breastfeeding difficulties (LeFort et al., 2021), speech outcomes or orthodontic issues (Australian Dental Association, 2020).

The Baby Steps Health Centre's Tongue-Tie Assessment protocol was designed to be simple, reproducible and easily taught. With decision-making options based on a standardised examination of tongue appearance and mobility, it makes a good basis for education of clinicians in this field and may lead to some consistency in approach. Our findings suggest that the protocol is an effective decision-making tool for the management of tongue-tie, with 80% (86/108) of those families who were contacted for follow-up reporting an improvement in their presenting concerns.

Other benefits of this simple clinical approach to assessment and decision-making for frenotomy might be in reducing the procedural risks to the infant and reducing financial costs to parents and the community of unnecessary frenotomies. This audit suggests the need for laser frenotomy is very limited.

It should be noted that the decision-making process can be complex, as it often requires consideration of additional variables, such as parental anxiety, limited access to follow-up care and age of the infant. This was especially important in cases where the degree of restriction of tongue mobility was moderate and the association with the feeding issue possible rather than probable. The multidisciplinary discussion between families and the GP and IBCLC provided an opportunity for individual factors to be identified and considered.

Limitations

Setting the audit within a service-oriented clinic, where there is a need to manage individual parent and clinician personalities and other situational variations within each family, introduced multiple variables which would not necessarily be seen in a purely experimental environment. Moreover, all data having been obtained from a single private practice limits the generalisability of the results beyond this specific setting. However, the setting may increase its relevance for health professionals working in the real-world clinical environment. The Baby Steps Health Centre's Tongue-Tie Assessment protocol itself does have some limitations; specifically, it does not incorporate additional family-specific factors that contribute to management decisions.

In addition, the retrospective nature of this audit may account for some variance in observational data. Moreover, outcome data were based on a subjective opinion from mothers and limited to that extracted from notes recorded during routine unstructured 1-week follow-up phone calls. This is not a reliable measure of improvement in presenting concerns and would be more robust with a validated breastfeeding tool.

CONCLUSION

This audit demonstrated the value of a standardised multidisciplinary approach to tongue-tie assessment and management in preventing unnecessary frenotomy and improving outcomes for infants and their families. Formalised education on tongue-tie for healthcare professionals, with an emphasis on the importance of a structured assessment of oral anatomy and function, would be of great benefit.

CONFLICTS OF INTEREST

Two authors of this manuscript work in clinical practice at Baby Steps Health Centre. The authors have no conflicts of interest to disclose.

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APPENDIX A

Table 8. ***Association between components of oral assessment and approach to management of tongue-tie***

Lingual frenulum superior attachment			Management		x2 (df)	p
			Scissor frenotomy	IBCLC support		
Anterior tongue	Tongue extension	Restricted	30/45 (67%)	4/45 (9%)	0.06 (1)	0.806
		Unrestricted	10/45 (22%)	1/45 (2%)		
	Tongue elevation	Restricted	29/45 (64%)	1/45 (2%)	5.51 (1)	0.019
		Unrestricted	11/45 (24%)	4/45 (9%)		
	Tongue lateralisation	Restricted	23/45 (51%)	1/45 (2%)	2.51 (1)	0.113
		Unrestricted	17/45 (38%)	4/45 (9%)		
	Tongue tip appearance	Notched	28/45 (62%)	2/45 (4%)	1.80 (1)	0.180
		Rounded	12/45 (27%)	3/45 (7%)		
	Lingual frenulum inferior attachment	Alveolar ridge	27/45 (60%)	4/45 (9%)	0.324	0.569
		Floor of mouth	13/45 (29%)	1/45 (2%)		
	Pseudoleukoplakia	Present	9/45 (20%)	1/45 (2%)	0.16 (1)	0.899
		Absent	31/45 (69%)	4/45 (9%)		
	Lingual frenulum appearance	Thick and inelastic	0/45 (0%)	0/45 (0%)	0.01 (1)	0.913
		Thick and elastic	0/45 (0%)	0/45 (0%)		
		Thin and inelastic	25/45 (56%)	3/45 (7%)		
		Thin and elastic	15/45 (33%)	2/45 (4%)		
	Labial frenulum appearance	Thick and inelastic	0/45 (0%)	0/170 (0%)	0.01 (1)	0.979
		Thick and elastic	8/45 (18%)	1/170 (2%)		
		Thin and inelastic	0/45 (0%)	0/170 (0%)		
		Thin and elastic	31/45 (71%)	4/170 (9%)		
Mid to posterior tongue	Tongue extension	Restricted	23/170 (14%)	13/170 (8%)	43.3 (1)	<0.001
		Unrestricted	16/170 (9%)	118/170 (69%)		
	Tongue elevation	Restricted	16/170 (9%)	10/170 (6%)	25.9 (1)	<0.001
		Unrestricted	23/170 (14%)	121/170 (71%)		
	Tongue lateralisation	Restricted	13/170 (8%)	10/170 (6%)	17.0 (1)	<0.001
		Unrestricted	26/170 (15%)	121/170 (71%)		
	Tongue tip appearance	Notched	11/170 (7%)	14/170 (8%)	7.35 (1)	0.007
		Rounded	28/170 (17%)	117/170 (69%)		
	Lingual frenulum inferior attachment	Alveolar ridge	17/170 (10%)	19/170 (11%)	15.2 (1)	<0.001
		Floor of mouth	22/170 (13%)	112/170 (66%)		
	Pseudoleukoplakia	Present	8/170 (5%)	25/170 (15%)	0.04 (1)	0.843
		Absent	31/170 (18%)	106/170 (62%)		
	Lingual frenulum appearance	Thick and inelastic	3/170 (2%)	4/170 (2%)	43.9 (3)	<0.001
		Thick and elastic	0/170 (0%)	38/170 (22%)		
		Thin and inelastic	13/170 (8%)	3/170 (2%)		
		Thin and elastic	23/170 (14%)	86/170 (51%)		
	Labial frenulum appearance	Thick and inelastic	1/170 (1%)	0/170 (0%)	4.54 (3)	0.209
		Thick and elastic	7/170 (4%)	19/170 (11%)		
		Thin and inelastic	0/170 (0%)	3/170 (2%)		
		Thin and elastic	31/170 (18%)	109/170 (64%)		

NB: The two cases referred for laser frenotomy were excluded from this analysis

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