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RESEARCH ARTICLE

Feeding and Gastrointestinal Symptomatology: Comparing Infants Without Oral Restriction to Those With Treated and Untreated Tethered Oral Tissues

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Objectives: The aims of this study were to 1) evaluate if there were any significant differences in gastrointestinal (GI) and/or feeding symptoms for infants with tethered oral tissues (TOTs) pre-frenotomy compared to infants with untreated TOTs and infants without TOTs, and 2) evaluate if treatment via frenotomy led to improvements in symptoms that more closely align with GI and/or feeding symptoms in infants with untreated TOTs and/or infants without (TOTs).

Methods: This study utilized a pretest-only control group design. The Infant Eating Assessment Tool (InfantEAT) and Gastrointestinal and Gastroesophageal Reflux (GIGER) Scale were used to evaluate infant feeding and GI symptoms, respectively. Multiple linear regression was used to compare scores between the three groups at baseline, controlling for age and gestational age at birth. Treatment group's average score after intervention was compared to the mean baseline score of the other two groups. For the treatment group, paired t-test was used to evaluate changes in scores before and after the treatment.

Results: All subscales of both the InfantEAT and GIGER demonstrated statistically significant differences for infants with TOTs before intervention when compared with infants with TOTs who did not undergo treatment and infants without TOTs.

Conclusion: This study demonstrates the importance of considering structure along with function for infants with tongue- and/or lip-tie. Clinicians must evaluate maternal symptoms alongside infant factors. The decision to treat TOTs via frenotomy is multifactorial and is not necessary in every mother-infant dyad.

Keywords: ankyloglossia, digestive, infant, breastfeeding

INTRODUCTION

Ankyloglossia, also known as tongue-tie, is defined as a congenital abnormality leading to a short and/or thick lingual frenulum that can interfere with tongue movement (Smart et al., 2024). It has recently been best described through cadaver investigation by Mills and colleagues (2019), stating that the tongue-tie is not a band of tissue, but rather, a coming together of facia underneath the tongue that impairs tongue lift. Normally, the lingual frenulum attaches to the midline of the underside of the tongue to the floor of the mouth to help stabilize the base of the tongue (O'Shea et al., 2017). There are multiple causes believed to contribute to tongue-tie such as partial apoptosis of the frenulum during fetal development, immaturely developed anterior tongue length, over synthesis of the

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lateral lingual prominence, and/or genetic mutation of TBX22 (Walsh & Tunkel, 2017). Diagnosis of tongue-tie is dependent on tongue structure, free mobility of tongue, and functionality of the tongue (Kotlow, 2015), and should not be based solely on appearance. Tongue-tie has been linked to feeding problems because of latching difficulties onto the bottle and breast, maternal nipple pain, early cessation of breastfeeding, poor weight gain, and frustration for mother and infant (Becker & Mendez, 2022; CADTH, 2016; Hill & Pados, 2020; O'Shea et al., 2017; Walsh & Tunkel, 2017).

A restriction affecting the upper lip tissue known as the labial frenulum is a lip-tie, another type of congenital abnormality frequently diagnosed concurrently with tongue-tie. It has been suggested as another cause of poor feeding, with poor labial seal and chewing on the nipple directly associated with lip-tie (Hill et al., 2022). However, consensus on the role of lip-tie in feeding issues has not been established (Messner et al, 2020). In a small sample of infants with lip-tie, 100% of breastfeeding mothers reported improvement in breastfeeding following correction, regardless of it being an isolated lip-tie or occurring concurrently with tongue-tie (Pransky et al., 2015).

Freeman and colleagues (2022) demonstrated improved weight gain and breastfeeding in 7 infants with isolated lip-tie. There is no confirmed correlation between severity of restriction and breastfeeding symptoms (Shah et al, 2021). The incidence of the co-existence of tethered oral tissues (TOTs) has not been established (Shah et al., 2021), despite frequent intervention for both restrictions simultaneously. Treatment for both tongue-tie and lip-tie is completed via frenotomy, where the restricted tissue is released using either scissors or laser. Treatment via laser has shown to reduce pain and improve wound healing (Tancredi et al., 2022).

According to O'Connor and colleagues (2022), in the past two decades there has been an increase in tongue-tie diagnosis and treatment even though there are no standard diagnostic criteria for providers to use in making the decision to treat. In the same study, the authors concluded that while there are many assessment tools available to diagnose tongue-tie, none of them have been tested for validity on large samples nor do they have sound interrater reliability. In addition, not all infants that have tongue-tie have feeding difficulties necessitating surgical intervention (Brookes & Bowley, 2014). Infant feeding symptoms have been shown to improve in the immediate short-term post-frenotomy (Hill et al., 2023). Recent studies have demonstrated improvement in gastrointestinal (GI) symptoms for infants because of frenotomy intervention, but longitudinal data have been limited to the first month post-frenotomy (Hand et al., 2020; Hill & Pados, 2023; Slagter et al., 2021).

The aims of this study were to 1) evaluate if there were any significant differences in GI and/or feeding symptoms for infants with TOTs pre-frenotomy compared to infants with untreated TOTs and infants without TOTs, and 2) evaluate if treatment via frenotomy led to improvements in symptoms that more closely align with GI and/or feeding symptoms in infants with untreated TOTs and/or infants without TOTs.

METHODS

The Institutional Review Board at Boston College (IRB # 20.267.01) approved this study. Participants provided written consent prior to participating.

Design

This study utilized a pretest-only control group design. We wanted to establish that the treatment group significantly differed from the control groups at baseline to justify the treatment in the intervention group.

Settings

Data collection for infants with tongue and/or lip-tie undergoing frenotomy occurred at a pediatric dental office in the northeast region of the United States from July to November 2020. All assessments for oral restrictions and implementation of frenotomy procedures were completed by one pediatric dentist at the site. Parents of infants with tongue-tie without intervention and infants without tongue-tie completed an online survey to assess GI and feeding symptoms. Recruitment for these two groups took place via Facebook™ online support groups from June 2020 through April 2021.

Sample

To be included in this study, all infants were less than 4 months of age at the time of recruitment. Parents were required to be 18 years or older and proficient in English.

Infants were excluded from the study if they were born earlier than 37 weeks' gestation or had other anatomical anomalies of the head, face, and/or neck that could contribute to feeding symptoms (e.g., cleft palate) (Corvaglia & Martini, 2015; Talmor & Caloway, 2022). Convenience sampling was used, and all eligible parent-baby dyads were invited to participate during the recruitment periods. There were three distinct groups included in this study. The treatment group was comprised of infants diagnosed with TOTs and underwent revision of their tongue-tie, lip-tie, or both. The untreated group was comprised of infants that had received a diagnosis of tongue-tie but did not undergo revision. The comparison group was comprised of infants without TOTs.

Frenotomy Intervention

During the study interval, clinical care provided to the infants' undergoing frenotomy was unchanged. The pediatric dentist performed the assessment and need for frenotomy independent from the research study. Informed consent for the procedure was collected by the dentist. In a laser-safe room, the frenotomy was performed using a Solea CO2 laser, model 2, power setting of 40 without water or air, with a 1-mm spot size. The dentist did not use topical or injection numbing agents. During the procedure, the infant wore protective eyewear as a dental assistant swaddled and stabilized the infant's head.

Active wound management (lifting of the tongue and/or lip) instructions were provided to the parents. Instructions were to place a Tongue-Guide™ behind the opening of the surgical area, applying gentle

pressure, stretching the wound to appear as a diamond. The stretch should be completed three times, each held for 3 seconds, and repeated every 8 hours for 14 – 21 days, until the white appearance of the wound disappears. The pediatric dentist did not schedule routine follow-up appointments and encouraged patients to see their lactation consultant as needed post-intervention.

Data Collection

Data were collected and handled using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Boston College. REDCap allows researchers to collect data online and offline through a secured web-based software platform. It provides 1) user authentication and authorization; 2) audit trails for tracking data manipulation; 3) export procedures; and 4) a user-friendly interface (Harris et al., 2009; Harris et al., 2019).

For the treatment group, the lip and tongue-tie classification were extracted from the medical records with the written consent for participation. On the day of the frenotomy procedure, a pre-frenotomy survey was completed by the parent on a tablet provided by the research team. Infant data included sex, current age at time of frenotomy, gestational age at birth, current feeding mode (e.g., breast, bottle or both), medications used within the past week, and the presence of co-morbidities such as gastroesophageal reflux, or endocrine, cardiac, or respiratory disorders. A follow-up survey was sent to participants via email once their infant reached 4 months of age, asking about changes to infant medical history and re-assessment of GI and infant feeding symptoms.

For the untreated group and comparison group, parents were sent a one-time survey via email when the infant reached 4 months of age, calculated using the infant's date of birth provided on the initial contact survey.

Measures

For the treatment group, Kotlow's criteria for lip- and tongue-tie classification (Kotlow, 2015), a functional assessment of the lip and tongue, and an intake of maternal and infant symptoms using a checklist created by the dentist were used to reach a diagnosis of tongue and/or lip-tie (Appendix). Function, mobility, and appearance was used to evaluate tongue-tie with a Class I to Class IV ranking based on visual appearance. Evaluation for lip-tie was done using visual assessment of the inner lip's mucosal attachment with a Class I to Class IV ranking. While the assessment of the infant is important, Kotlow stresses that appearance, mobility, and symptoms

experienced by both the breastfeeding mother and infant are paramount when diagnosing and treating tethered oral tissues. Psychometric properties of these measurement tools have yet to be studied. Infants with untreated tongue-tie were diagnosed by various health care providers (e.g., pediatric dentist, lactation consultant, otolaryngologists, speech pathologist, family doctor).

The Infant Eating Assessment Tool (InfantEAT) evaluated symptoms of problematic feeding in the last 7 days via parental report (Pados & Hill, 2024). The questionnaire is answered using a 6-point Likert scale demonstrating frequency of the symptoms ranging from "Never" to "Always". There are nine subscales, each evaluating a different construct relating to problematic infant feeding. Five subscales were included in this study; we did not include the feeding mode subscales that ask feeding questions specific for infants who are either breast or bottle feeding. Responses are tallied for total and subscale scores; scores range from 0 to 100 for the five subscales included in this study. The more symptoms of problematic feeding, the higher the score. Reference values have been developed for infants up to 7 months of age (Pados & Hill, 2024).

Gastrointestinal symptoms were ascertained by parental report using the Gastrointestinal and Gastroesophageal Reflux (GIGER) Scale for infants and toddlers (Pados et al, 2021). This 36-item measure determines common and/or compelling GI and gastroesophageal reflux (GER) symptoms using a 6-point Likert scale for the last week. Scores range from 0 to 180, with higher scores indicating more symptoms. The GIGER Scale has been validated for use up to 2 years of age (Pados & Hill, 2024). The GIGER Scale is to be used in concert with a history and physical examination if a diagnosis of GER or other GI disorders are being considered.

Analysis

The baseline survey, which was administered online, was completed by parents of infants younger than 4 months of age (1) whose infant was diagnosed with tongue-tie but was not treated (*no-treatment group*); (2) whose infant was diagnosed with tongue-tie and was scheduled to be treated (in the frenotomy group; *treatment group*); and (3) whose infant did not have a diagnosis of tongue-tie (*control group*). Parents in the treatment group completed the survey pre-frenotomy and again when their infant reached 4 months of age post-intervention.

Multiple linear regression was used to compare scores between the three groups at baseline, controlling for

age and gestational age at birth. Similarly, treatment group's average score after the frenotomy was compared to the mean baseline score of the other two groups (controlling for age and gestational age at birth). Finally, for the treated group, paired t-test was used to evaluate changes in scores before and after the treatment. The level of significance was set at $\alpha = .05$.

Results

Mean infant age for the no-treatment and control groups as well as the post-frenotomy assessment for the treatment group was 18 weeks (SD = 2.3). Mean parent age was 31 yr (SD = 4.34). The mean infant age of the treatment group pre-frenotomy (N = 30) was 6 weeks, 6 days (SD = 4.56). Full demographics for the infants and parents are provided in Table 1. There were clear differences between the qualitative responses of

participants when asked about making the decision to treat their infant's tongue-tie. Parents who shared that their infant had feeding challenges, excess gas, or maternal pain during breastfeeding elected for frenotomy (Table 2). Parents who did not pursue intervention indicated adequate growth for their infant, no issues with breastfeeding, and not enough information to correct the anomaly (Table 3).

Reliability of the InfantEAT and GIGER scales were evaluated using Cronbach's alpha and were acceptable ($\alpha = 0.94$ and 0.86, respectively). Controlling for age and gestational age at birth and adjusting for multiple comparisons, there were statistically significant differences with large effect sizes in InfantEAT and GIGER total scores between infants with tongue-tie prior to frenotomy (n=27) compared with infants with

Table 1. Demographics of the sample according to group. (Continued on next page.)

Demographic Data	Treatment Group, post-frenotomy (N=30) N (%)	Untreated Group (N=21) N (%)	Comparison Group (N=32) N (%)
Infant Group			
Age, M (SD)	18 weeks (1.5)	20 weeks (3)	18 weeks (1.8)
Sex			
Female	12 (40)	10 (47.6)	16 (50)
Male	13 (43.3)	11 (52.4)	16 (50)
No Response	5 (16.7)	0	0
Race			
Asian	0	1 (4.8)	1 (3.1)
White	23 (76.7)	17 (81)	29 (90.6)
More than one race	1 (3.3)	3 (14.3)	2 (6.3)
Other	1 (3.3)	0	0
No Response	5 (16.7)	0	0
Ethnicity			
Hispanic/Latino	1 (3.3)	3 (14.3)	1 (3.1)
Not Hispanic/Latino	21 (70)	14 (66.7)	29 (90.6)
Other	3 (10)	3 (14.3)	1 (3.1)
Unknown	0	0	1 (3.1)
No Response	5 (16.7)	0	0
Medical Conditions			
GERD	5 (16.7)	4 (19)	7 (21.9)
Developmental delay	0	0	1 (3.1)
Genetic disorder	0	0	1 (3.1)
Hearing impairment	1 (3.3)	0	0
Heart murmur	0	1 (4.8)	0
Laryngomalacia	0	1 (4.8)	0
Umbilical hernia	1 (3.3)	1 (4.8)	1 (3.1)
Undescended testes	0	1 (4.8)	1 (3.1)
Other	2 (6.7)	0	2 (6.3)
Current Feeding Mode			
Breastfeeding	10 (33.3)	14 (66.7)	13 (40.6)
Bottle feeding	3 (10)	4 (19)	6 (18.8)
Both breast and bottle-feeding	17 (56.7)	3 (14.3)	13 (40.6)

Demographic Data	Treatment Group, post-frenotomy (N=30) N (%)	Untreated Group (N=21) N (%)	Comparison Group (N=32) N (%)
Parent Group			
Age (SD)	30 (4.4)	33 (4.9)	32 (3.7)
Sex			
Female	25 (100%)	20 (95.2)	31 (96.9)
Male	0	1 (4.8)	1 (3.1)
No Response	5	0	0
Race			
Asian	0	1 (4.8)	1 (3.1)
White	22 (73.3)	17 (81)	31 (96.9)
More than 1 race	0	2 (9.5)	0
Other	3 (10)	0	0
Unknown	0	1 (4.8)	0
No Response	5 (16.7)	0	0
Ethnicity			
Not Hispanic/Latino	22 (73.3)	15 (71.4)	29 (90.6)
Other	3 (10)	3 (14.3)	1 (3.1)
No response	5 (16.7)	3 (14.3)	1 (3.1)
Other			1 (3.1)
Marital Status			
Never married	4 (13.3)	1 (4.8)	1 (3.1)
Married	20 (66.7)	18 (85.7)	30 (93.8)
Domestic partnership	1 (3.3)	2 (9.5)	1 (3.1)
No response	5 (16.7)	0	0
Level of education			
Did not complete HS	0	2 (9.5)	1 (3.1)
High School / GED	5 (16.7)	0	1 (3.1)
Associate / Technical Degree	4 (13.3)	2 (9.5)	2 (6.3)
Bachelor's Degree	11 (36.7)	10 (47.6)	8 (25)
Master's Degree	4 (13.3)	7 (33.3)	6 (18.8)
Doctoral Degree	1 (3.3)	0	14 (43.8)
No Response	5 (16.7)	0	0
Household income			
< 15,000 1	1 (3.3)	1 (4.8)	1 (3.1)
15,000-24,999	1 (3.3)	0	1 (3.1)
25,000-34,999	1 (3.3)	2 (9.5)	1 (3.1)
35,000-49,999	3 (10)	2 (9.5)	1 (3.1)
50,000-74,999	4 (13.3)	2 (9.5)	6 (18.8)
75,000-99,999	(20)	2 (9.5)	6 (18.8)
>100,000	9 (30)	12 (57.1)	16 (50)
No Response	5 (16.7)	0	0

tongue-tie without intervention (n=21) and infants without tongue-tie (n=31). After frenotomy, the intervention group's scores were not significantly different from the comparison groups. Table 4 lists and Figure 1 depicts the scores for all groups.

The decreases in the scores from pre- to post-frenotomy for the treated group in InfantEAT and GIGER were estimated at 18.44 and 18.92 points, which were statistically significant (p < 0.001). The effect sizes for both changes were large, with Cohen's

d estimated at 1.45 and 1.26 for InfantEAT and GIGER, respectively. All subscales of both the InfantEAT and GIGER demonstrated statistically significant differences for infants with tongue-tie before intervention when compared with infants with tongue-tie who did not undergo treatment and infants without tongue-tie. Individual items on the InfantEAT with the highest gains from pre- to post-intervention were those relating to the work of eating and fatigue at mealtimes (e.g., "My baby breathes faster or harder when eating"; "My baby gets exhausted during eating

Table 2. Number (and percentage) of parents (N = 30) reporting reason(s) for intervention.

Reason for intervention	Intervention N (%)
Gas	2 (6.7)
Breast pain during feeding	4 (13.3)
Reflux	1 (3.3)
Feeding difficulties*	6 (20)
Tongue tie/lip tie	7 (23.3)
Slow weight gain	1 (3.3)
Past experiences	2 (6.7)
Recommendation	2 (6.7)
Other**	5 (16.7)

*Feeding difficulties include poor latch, struggling to eat, breastfeeding difficulties.
**Parents mentioned more than one reason

Table 3. Number (and percentage) of parents (N = 21) reporting reason(s) for not intervening.

| Reason for no intervention*	No Intervention N(%)
No feeding difficulties	15 (71.4)
No growth issues	8 (38.0)
Not enough information available	6 (28.6)
Child in pain	3 (14.3)
Not recommended	5 (23.8)
Cost/service not available	3 (14.3)
Mother not in pain when breastfeeding	5 (23.8)
Breastmilk production issue	1 (4.8)

*All respondents had more than one reason as to why they opted out of surgery

Table 4. Mean InfantEAT and GIGER Total and Subscale Scores by Group

Measures	TOTS Pre-Treatment N (SD)	TOTs Post-Treatment N (SD)	Untreated TOTS Group N (SD)	Infants without TOTs N (SD)
InfantEAT Total*+	48.8 (16.9)	30.3 (6.2)	31.4 (8.3)	28.0 (6.7)
Infant Dysregulation*+	8.9 (3.2)	12.5 (1.9)	11.4 (2.7)	11.9 (2.7)
Infant Energy*+	9.4 (4.9)	3.0 (2.3)	4.4 (3.2)	2.9 (1.9)
Infant Swallowing*+	12.6 (5.9)	5.9 (3.5)	6.7 (3.6)	5.3 (2.9)
GE Dysfunction*+	7.6 (5.3)	3.7 (1.9)	4.5 (3.6)	3.5 (2.3)
GI Dysfunction*+	10.3 (5)	5.3 (3.1)	4.5 (3.7)	4.6 (3.3)
GIGER Total*+	72.9 (19.2)	54.0 (8.8)	53.2 (12.8)	51.6 (11.8)
GIGER Self-Regulation	26.9 (6.3)	29.9 (3.2)	28.1 (3.9)	29.0 (6.2)
GI Common Symptoms*+	37.5 (17.8)	19.9 (8.3)	19.9 (11)	18.9 (10.2)
GI Compelling Symptoms*+	8.9 (6.8)	4.1 (3.2)	5.1 (4.5)	3.7 (3)

*Significant difference between groups pre-treatment
+Significant difference in scores pre- to post- intervention for the treatment group
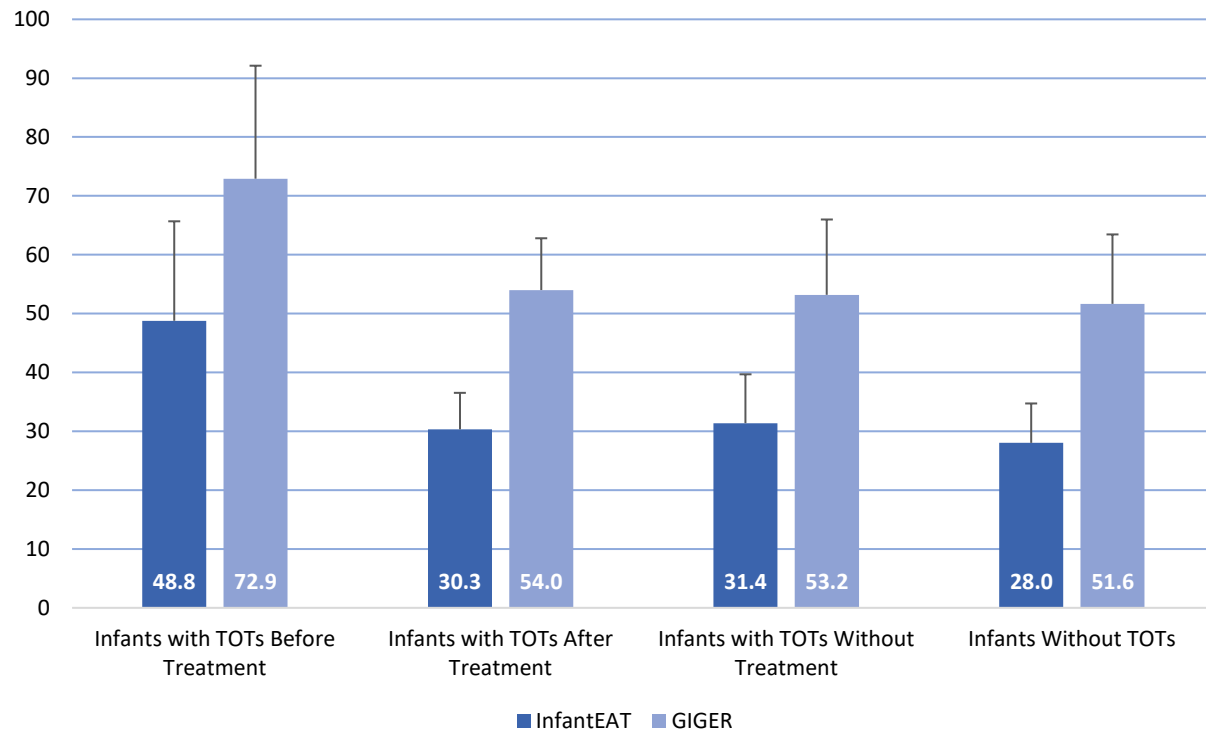
Figure 1. Mean InfantEAT and GIGER scores by group. Error bars = 1 SD.

and is not able to finish"). For the GIGER scale, the items that demonstrated the most valuable information were related to symptoms of GI dysfunction (e.g., "My baby seems uncomfortable after eating"; "My baby gets a bloated tummy after eating").

There were items on both the InfantEat and GIGER scales that demonstrated the highest gains (from pre to post intervention). On the InfantEAT, parents reported the most significant changes in symptoms of problematic feeding relating to the work of eating. For example, "My baby breathes faster or harder when eating", "My baby can only suck a few times before needing to take a break", and "My baby gets exhausted during eating and is not able to finish" were more problematic before intervention for the infants with tongue-tie referred for frenotomy. After treatment, the odds of improvement on the item "My baby breathes faster or harder..." increased by a factor of 14 (OR = 14.44, CI = [4.54, 45.94], $p<0.001$). In other words, infants treated for tongue-tie had 14 times higher odds of having this symptom before treatment compared to the untreated and control groups of infants. The odds of improvement in the other two items increased by a factor of 10 and 9 (OR = 10.38, CI = [3.57, 30.22, $p<0.001$ and OR = 9.03, CI = [2.97, 27.52, $p<0.001$, respectively).

On the GIGER scale, GI symptoms identified pre-intervention included statements "My baby seems uncomfortable after feeding" and "My baby gets a bloated tummy after eating". After treatment, the odds of improvement on these two items both increased by a factor of 7 (OR = 7.72, CI = [2.73, 21.79, $p<0.001$ and OR = 7.00, CI = [2.53, 19.35, $p<0.001$, respectively).

The total and subscale mean scores for both the InfantEAT and GIGER tools all demonstrated significantly higher scores (greater problems), in the treatment group pre-frenotomy and significant improvement in scores post-intervention except for the *Self-Regulation Abilities* subscale of the GIGER (Table 2). This scale ascertains information about the infant's ability to initiate and terminate feeding in response to internal cues (e.g. "My baby eats enough to grow the way he/she should").

DISCUSSION

While there has been an increase in the diagnosis of tongue and lip-ties, (O'Connor et al., 2022), surgical intervention is not necessary for every child. Some reasons parents decided surgical intervention was necessary included difficulty feeding, pain felt by the mother during breastfeeding, symptoms of gas or

reflux, and recommendation during evaluation by a dentist (Table 1). The top three reasons parents opted out of treatment included adequate growth seen in the child, no problems or difficulties with breastfeeding, and not enough research available suggesting surgical treatment was necessary (Table 3). The self-selection of parents choosing to undergo treatment based on symptoms is consistent with the treatment algorithm proposed by Shekher et al (2020).

Using the GIGER and InfantEAT scales, we were able to identify specific assessment questions that provide the most useful information to determine need for intervention. Consistent with prior research (Hill et al, 2021), the energy required to eat for some infants with tongue-tie creates short feedings, increased work of breathing, and more frequent feedings as the infant cannot sustain the energy needed to complete a full feeding. Concurrently, those infants also display signs of GI discomfort, which may be attributed to aerophagia or reflux commonly associated with tongue-tie (Siegel, 2016). Clinicians should observe a feeding session, focusing specifically on the work of feeding and subsequent discomfort after eating when making the decision to treat tongue-tie. It is evident that some infants with tongue-tie do not require treatment, as they do not develop GI sequelae and are able to complete full feedings for age-appropriate satiety.

This study has several limitations. The data gathered were self-reported by parents, and the information could not be verified by physical exam or observation of a breastfeeding session. We are unable to determine the credibility of the providers who diagnosed the infants in the untreated group, the classification system used for diagnosis (if any), or the type and severity of their oral restriction(s) (i.e., tongue-tie, lip-tie, and/or buccal tie). In the treatment group, most infants (N = 26, 87%) were diagnosed with Class III tongue-tie, considered a severe restriction. We cannot compare the severity of the restriction between the treated and untreated groups. It may be that infants that did not undergo treatment had less severe restrictions, which in turn did not produce symptoms warranting frenotomy. However, prior research has demonstrated that symptoms are not congruent with restriction severity using the Kotlow or Stanford classification systems (Shah et al., 2020).

Some of the untreated families who participated in this study live outside of the United States. Medical cost, practices, and ideology can differ based on geographic location. With this study being conducted entirely online, there was no way to confirm that infants with untreated tongue-tie and those in the group without

oral restrictions truly belong in those categories. The infants in the tongue-tie groups were homogenous, representing mainly white infants, with married, well-educated parents (Table 1). All infants in the intervention group were treated for both tongue-tie and lip-tie; we cannot state whether it was the tongue-tie, lip-tie or a combination of both as the cause of the feeding difficulties.

Future studies should focus on larger and more diverse samples and include those with and without co-existing lip-tie. Future research is necessary to evaluate the psychometric properties of the existing assessment tools or develop a psychometrically sound measure that can provide clear guidance on making the decision to treat. Nonetheless, this study identified symptoms that prompted evaluation and treatment, and some evidence that there are infants with tongue-tie without feeding challenges who do not need intervention.

CONCLUSION

This study demonstrates the importance of considering structure along with function of the tongue for infants with TOTs. It is important for clinicians to evaluate maternal symptoms frequently associated with TOTs (e.g., nipple pain, poor latch) alongside infant factors including, but not limited to tongue mobility, feeding efficiency, and GI distress. The decision to treat tongue- and/or lip-tie via frenotomy is multifactorial and is not necessary in every mother-infant dyad.

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APPENDIX

Symptom Checklists used by Dentist (present or absent)

Infant Symptoms
Apnea
Reflux
Short sleep episodes
Slow or poor weight gain
Difficulty achieving a firm latch
Unable to keep pacifier in mouth
Only sleeping in an upright position
Falls to sleep while attempting to nurse
Slides off the breast when attempting to latch
Waking up congested in the morning or after nap
Gagging when attempting to introduce solid foods
Notch in the upper gum / gap between top front teeth

Maternal Symptoms
Mastitis
Over supply
Under supply
Nipple thrush
Plugged ducts
Abraded nipples
Feelings of depression
Infection of nipples or breasts
Bleeding, cracked or cut nipples
Poor/incomplete breast drainage
Gumming or chewing of the nipples
Creased, cracked or blanching nipples
Painful latching of infant onto the breast