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ORIGINAL RESEARCH

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Prevalence and clinical decision-making in pediatric ankyloglossia: the role of functional assessment

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Abstract

Background: Ankyloglossia is a congenital condition that may restrict tongue mobility and affect oral functions such as speech and feeding. Variability in diagnostic criteria and the lack of functional assessment tools have led to inconsistent prevalence data and potential overtreatment. This study aimed to determine the prevalence of ankyloglossia in a pediatric population and evaluate its relationship with functional findings and clinical decision-making. **Methods**: This study included 982 pediatric patients (484 females, 498 males; mean age: 9.57 $\pm$ 2.70 years) attending a university pediatric dentistry clinic. Ankyloglossia was assessed using the Coryllos classification alongside functional parameters. Speech disorders and other functional limitations were recorded. Statistical analyses included the chi-square test, Mann-Whitney U test, and logistic regression analysis (Jamovi v2.6). Intra-observer reliability was assessed using weighted kappa (κ = 0.71). **Results**: Ankyloglossia was identified in 257 of 982 patients (26.2%). No significant association was found between gender and ankyloglossia (p = 0.175). Posterior types (Types 3–4) accounted for 61.5% of cases. Speech disorders were significantly more frequent in patients with ankyloglossia (53/257; 20.6%) than in those without (7/725; 1.0%) ($p < 0.001$). Logistic regression analysis demonstrated that ankyloglossia was associated with speech disorders (adjusted odds ratio (OR) = 29.1, 95% confidence interval (CI): 12.9–65.7, $p < 0.001$). Age showed a protective effect (adjusted OR = 0.83 per year, 95% CI: 0.74–0.93, p = 0.001). Other functional limitations were infrequent. Clinical management differed significantly across Coryllos groups ($p < 0.001$), with conservative approaches predominating. **Conclusions**: Ankyloglossia was prevalent in this clinical pediatric population and was associated with speech disorders. Functional assessment plays a critical role in guiding clinical decision-making, and not all anatomical types require surgical intervention. Standardized diagnostic criteria and evidence-based management strategies are needed to optimize patient care.

Keywords

Ankyloglossia; Child; Prevalence; Speech disorders

1. Introduction

Ankyloglossia (derived from the Greek words “ankylos” (bound) and “glossa” (tongue)) is a congenital tongue anomaly characterized by a short lingual frenulum. This condition may lead to restricted tongue mobility (partial ankyloglossia) or complete tongue attachment to the floor of the mouth (total ankyloglossia) [1]. Ankyloglossia may occur sporadically or exhibit genetic transmission and can be associated with certain rare syndromes, including Moebius syndrome, Beckwith-Wiedemann syndrome, orofacial-digital syndrome, and X-linked cleft palate [2].

The most frequently observed complication in infants with ankyloglossia is difficulty with breastfeeding. This manifestation may present as inadequate breast latch, infant distress during feeding, and failure to thrive. Maternal complications include pain during breastfeeding, insufficient milk ejection, nipple ulceration, infection, and bleeding [2]. In older children and adults, restricted tongue mobility may be associated with articulation difficulties involving certain phonemes [3]. However, the impact of ankyloglossia on mandibular development, malocclusion, and gingival recession remains unclear [2].

The reported prevalence of ankyloglossia in the literature demonstrates considerable variability. A meta-analysis indicated that prevalence in the general population ranges from 2% to 20%, with an average prevalence of 5%, while in newborns, the prevalence approaches approximately 7% [4]. This variation has been largely attributed to the absence of a universally accepted diagnostic classification system for evaluating anatomical structures, alongside differences in examination

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methods and the specific age groups evaluated across studies [5]. Furthermore, spontaneous resolution of mild forms of ankyloglossia over time may explain the higher prevalence rates reported in studies exclusively examining newborns. In recent years, a marked increase in ankyloglossia diagnoses has been observed, which is believed to result from divergent diagnostic approaches and increased clinical awareness rather than a true increase in incidence. This finding warrants careful consideration, as it may lead to unnecessary surgical interventions in certain cases [6, 7].

Various grading systems have been proposed for the evaluation of ankyloglossia. Kotlow [8] suggested a simple anatomical classification based on measuring "free tongue" length (the distance from the frenulum to the tongue tip). The Coryllos classification [9] categorizes ankyloglossia into four main types (Type 1–4) according to the location of the lingual frenulum attachment on the tongue. Although these classification systems facilitate rapid anatomical assessment in clinical practice, they do not encompass functional tongue mobility [1, 10].

Evaluation of the literature reveals that the wide variation in ankyloglossia prevalence data, the absence of standardized diagnostic criteria, and diagnostic uncertainties that may lead to unnecessary interventions highlight the importance of well-characterized clinical data. The present study aimed primarily to determine the prevalence of ankyloglossia in a university-based pediatric population comprising routine clinical attendees using a combined anatomical and functional assessment approach and, secondarily, to evaluate its association with speech disorders and clinical management patterns.

2. Materials and methods

2.1 Study design and ethical approval

This study was designed as a descriptive, prospective clinical investigation to determine the prevalence and clinical variations of ankyloglossia in pediatric patients presenting to a pediatric dentistry clinic. This study was approved by the Istanbul University Clinical Research Ethics Committee (Approval No: 2025/52). Written informed consent was obtained from the parents or legal guardians of all participants included in the study.

2.2 Sample selection

The study was conducted on 1002 patients who attended the Istanbul University Faculty of Dentistry, Department of Pediatric Dentistry, for an initial examination between 03 November 2025, and 01 April 2026.

• Inclusion Criteria: Age range 0–15 years, attendance at the pediatric dentistry clinic for an examination, and absence of any systemic emergency condition.

• Exclusion Criteria: Previous history of frenotomy or similar tongue-tie surgery, a documented history of developmental speech or language delays/disorders unrelated to ankyloglossia, and active or past enrollment in speech-language therapy.

2.3 Data collection and clinical examination

A preliminary calibration study was conducted to ensure standardization of the assessments. All clinical examinations were performed by a single investigator to enhance intra-observer consistency. To assess diagnostic consistency, a sample of 30 patients was randomly re-evaluated by the same investigator after a two-week interval. Data analysis employed the quadratic weighted kappa coefficient to determine the graded level of agreement between extreme values (Type 1 and Type 4) and intermediate values (Type 2 and Type 3). The resulting weighted kappa value ($\kappa w = 0.71$) was interpreted as indicating "substantial agreement". The collected data were transferred to standardized recording forms prepared using a digital platform (Google Forms).

The following parameters were evaluated during examination:

• Demographic Data: Patient age, gender, and anonymized identifying information were recorded.

• Anatomical and Functional Assessment: Tongue tip appearance (normal or heart-shaped), tongue elevation capacity toward the palate (adequate/restricted), frenulum structure (thin/thick), and the presence of a submucosal band were evaluated. The Coryllos Classification [9] was used as the basis for determining ankyloglossia types because it comprehensively encompasses both anterior and posterior anatomical variations, thereby allowing for a more nuanced evaluation of posterior subtypes that are frequently underdiagnosed by rigid linear measurements.

- Type 1: Fine and elastic frenulum; the tongue is anchored from the tip to the alveolar ridge and demonstrates a heart-shaped appearance.

- Type 2: Fine and elastic frenulum; the tongue is anchored 2–4 mm from the tip and lies close to the alveolar ridge.

- Type 3: Thick, fibrous, non-elastic frenulum; the tongue is anchored from the middle of the tongue to the floor of the mouth.

- Type 4: The frenulum is not visibly apparent but palpated; it presents as a fibrous and/or thick, shiny submucous anchoring extending from the base of the tongue to the floor of the mouth.

• Parental Survey: Interviews with parents documented potential ankyloglossia-related complications, including sucking/feeding difficulties, articulation disorders, swallowing/choking problems, oral hygiene difficulties, and the degree to which the child was socially affected by the condition.

Speech and articulation assessments were performed using a targeted subset of the Turkish Articulation and Phonology Test. Based on established literature validating their specific sensitivity to restricted tongue mobility, the assessment focused on the lingual phonemes most frequently implicated in ankyloglossia-related articulation disorders, including /r/, /l/, /s/, /n/, /t/, and /d/.

2.4 Clinical decision-making mechanism

Following evaluation of examination and survey data, one or more appropriate clinical approaches (follow-up, functional exercise counseling, consultation, or frenotomy) were planned

for each patient based on the clinical presentation.

Treatment decisions were made jointly by the attending pedodontist and the child's family, based on a combined assessment of anatomical classification (Coryllos type) and functional complaints reported by the parent or guardian, including feeding difficulties, speech problems, and social impact. No universally standardized decision-making criteria were applied; rather, clinical judgment was exercised on a case-by-case basis by integrating both anatomical and functional findings. Children for whom surgical intervention was deemed necessary were referred to an appropriate surgical specialist for frenectomy. These clinical management decisions were not mutually exclusive; a single patient could receive multiple recommendations simultaneously (*e.g.*, both frenotomy and functional intervention), depending on their specific functional needs.

2.5 Statistical analysis

Sample size calculation was performed using G*Power 3.1.9.4 software (Franz Faul, University of Kiel, Kiel, SH, Germany). Power analysis determined an effect size of 18% for comparing ankyloglossia grades between genders. With 80% power and a 5% significance level, the minimum sample size was calculated as 200 participants, comprising 100 females and 100 males.

Numerical variables were summarized as mean ± standard deviation and median (minimum–maximum), while categorical variables were presented as frequencies and percentages. Statistical analyses were performed using Jamovi software (version 2.6). During data cleaning, 20 cases with missing or unverifiable data were excluded from the analysis. Analyses were conducted on individuals with complete datasets (complete-case analysis), and no additional imputation methods were applied on a variable basis. The chi-square test was used to compare qualitative data. For comparison of numerical data between two independent groups, the Mann-Whitney U test was applied for non-normally distributed parameters. To assess the impact of ankyloglossia on speech disorders, univariate analysis was followed by multivariable logistic regression adjusted for age and gender. Age was analyzed as a continuous variable (exact age in years, calculated from date of birth). Associations between Coryllos type and each management category were evaluated using the Fisher–Freeman–Halton exact test. Statistical significance was set at $p < 0.05$.

3. Results

3.1 Demographic analysis and ankyloglossia prevalence

A total of 1002 patient records were screened for eligibility. Twenty patients were excluded for not meeting the inclusion criteria (age >15 years, n = 5; previous frenotomy, n = 6; incomplete baseline data, n = 6; unclear age information, n = 3) (Fig. 1). Consequently, the final study population consisted of 982 pediatric patients with complete datasets. The sample comprised 484 females (49.3%) and 498 males (50.7%). The mean age was 9.57 ± 2.70 years (median: 9.64; range: 0–15 years).

Ankyloglossia was identified in 257 (26.2%) of the examined patients, while 725 (73.8%) were classified as non-ankyloglossia cases. Among females, ankyloglossia prevalence was 28.1% (n = 136), whereas among males it was 24.3% (n = 121). The association between gender and the presence of ankyloglossia was analyzed using the chi-square test, and no statistically significant difference was identified ($p = 0.175$) (Table 1). Age distributions according to the presence of ankyloglossia were compared using the Mann-Whitney U test. The median age was 9.72 years in the non-ankyloglossia group and 9.36 years in the ankyloglossia group (Mann-Whitney U, $p = 0.730$).

3.2 Distribution according to Coryllos classification

Among patients diagnosed with ankyloglossia (n = 257), the distribution according to the Coryllos classification was as follows (Table 2):

- Type 1 (anterior ankyloglossia): 5 patients (0.5% of total population, 1.9% of ankyloglossia cases).
- Type 2 (anterior ankyloglossia): 94 patients (9.6% of total population, 36.6% of ankyloglossia cases).
- Type 3 (posterior ankyloglossia): 145 patients (14.8% of total population, 56.4% of ankyloglossia cases).
- Type 4 (posterior ankyloglossia): 13 patients (1.3% of total population, 5.1% of ankyloglossia cases).

3.3 Relationship between ankyloglossia and speech disorders

Speech disorders, identified solely through the study's clinical assessment protocols rather than formal diagnosis by a speech-language specialist, were present in 60 patients (6.1%). Among patients with ankyloglossia, 53 (20.6%) exhibited speech problems, whereas only 7 patients (1.0%) without ankyloglossia presented with speech difficulties. This difference was statistically significant ($p < 0.001$) (Table 3). Among children with ankyloglossia-related speech disorders, lingual phonemes, particularly /r/, /l/, and /s/, were most affected.

Univariate logistic regression analysis revealed that the presence of ankyloglossia significantly increased the risk of speech disorders (odds ratio (OR) = 26.6, 95% confidence interval (CI): 11.9–59.5, $p < 0.001$) (Table 4). After adjusting for age and gender in the multivariable analysis, ankyloglossia remained a significant predictor of speech disorders (adjusted OR = 29.1, 95% CI: 12.9–65.7, $p < 0.001$). Age demonstrated a protective effect (adjusted OR = 0.83 per year, 95% CI: 0.74–0.93, $p = 0.001$), indicating that older children were less likely to experience speech problems. Gender showed no significant association with speech disorders (adjusted OR = 1.07, 95% CI: 0.61–1.90, $p = 0.806$) (Table 5).

Collinearity diagnostics were performed to assess potential multicollinearity in the multivariable model. olerance values ranged from 0.997 to 0.999, and VIF values from 1.001 to 1.003. These findings confirmed the absence of multicollinearity issues among the predictors.

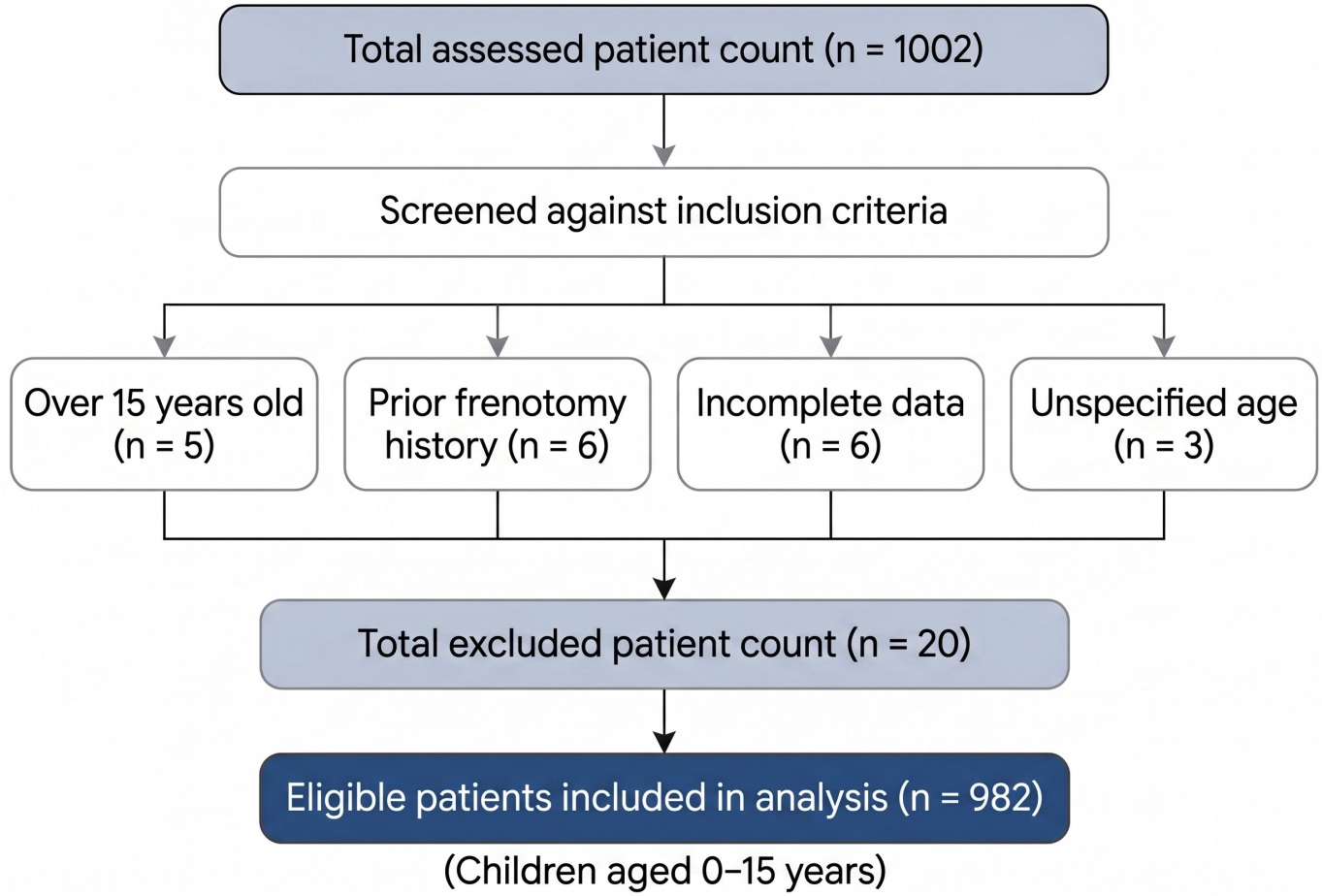


FIGURE 1. Patient selection flowchart for the study.

TABLE 1. Ankyloglossia prevalence according to gender distribution of participants.

Gender	Ankyloglossia Present	Ankyloglossia Absent	Total	*p*-value
Female	136 (28.1%)	348 (71.9%)	484 (49.3%)	
Male	121 (24.3%)	377 (75.7%)	498 (50.7%)	0.175*
Total	257 (26.2%)	725 (73.8%)	982 (100.0%)	

**Chi-square test.*

TABLE 2. Distribution and types of ankyloglossia according to Coryllos classification.

Coryllos Classification	Ankyloglossia Type	Total Population n (%)	% Within Ankyloglossia Cases
Healthy	None	725 (73.8%)	-
Type 1	Anterior ankyloglossia	5 (0.5%)	1.9%
Type 2	Anterior ankyloglossia	94 (9.6%)	36.6%
Type 3	Posterior ankyloglossia	145 (14.8%)	56.4%
Type 4	Posterior ankyloglossia	13 (1.3%)	5.1%
Total		982 (100.0%)	100.0%

TABLE 3. Distribution of speech disorders according to ankyloglossia status.

	Speech Problems Present n (%)	Speech Problems Absent n (%)	Total n (%)
Ankyloglossia present	53 (20.6%)	204 (79.4%)	257 (100%)
Ankyloglossia absent	7 (1.0%)	718 (99.0%)	725 (100%)
Total	60 (6.1%)	922 (93.9%)	982 (100%)

TABLE 4. Effect of ankyloglossia presence on speech disorders.

Variable	N (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	*p*-value
Ankyloglossia absent	725 (73.8%)	1 (Reference)	-	-
Ankyloglossia present	257 (26.2%)	26.6	11.9–59.5	<0.001*

**Logistic Regression Analysis: OR = 26.6 (95% CI: 11.9–59.5).*

TABLE 5. Independent predictors of speech disorders.

Variable	adj. OR	95% CI	*p*-value	Significance
Ankyloglossia present	29.1	12.9–65.7	<0.001*	Significant
Age	0.83	0.74–0.93	0.001*	Significant (protective)
Gender (Female)	1.07	0.61–1.90	0.806	Not significant

**Multivariable logistic regression analysis (reference: No ankyloglossia, Male); Dependent variable: Speech disorder. adj. OR: Odds Ratio adjusted for age and gender; CI: Confidence Interval. Model Fit Measures: McFadden's R^2 = 0.271, Nagelkerke's R^2 = 0.318, Overall Model Test $\chi^2(3) = 122.3$, $p < 0.001$.*

3.4 Other functional limitations

Sucking/feeding problems were observed at a very low frequency, occurring in 0.1% (n = 1) of the non-ankyloglossia group and 1.2% (n = 3) of the ankyloglossia group. Due to low cell counts, Fisher's exact test was applied, and the difference between groups did not approach statistical significance (Fisher's exact test; $p = 0.057$).

Swallowing problems were observed only in patients with ankyloglossia (0.8%; n = 2) and were not detected in the non-ankyloglossia group. Owing to zero cell counts, Fisher's exact test was used, and the difference did not approach statistical significance (Fisher's exact test; $p = 0.068$).

Difficulty maintaining oral hygiene was identified exclusively in the ankyloglossia group (3.9%; n = 10) and was not observed in the non-ankyloglossia group (Fisher's exact test; $p < 0.001$). Social impact was also reported exclusively among patients with ankyloglossia (1.6%; n = 4) and was found to be statistically significant (Fisher's exact test; $p = 0.005$).

3.5 Clinical decision-making

Clinical management decisions varied according to ankyloglossia type, and since patients could receive multiple simultaneous recommendations, cumulative percentages exceed 100%. For Type 1 cases (n = 5), follow-up was planned for 60.0% of patients, frenotomy for 80.0%, consultation for 40.0%, and functional intervention for 40.0%. Type 2 patients (n = 94) received follow-up recommendations in 89.4% of cases, frenotomy in 3.2%, consultation in 28.7%, and functional intervention in 28.7% of cases. Type 3 cases (n = 145) were managed with follow-up (82.8%), consultation (2.1%), and functional intervention (9.0%), with no frenotomy recommendations. Type 4 patients (n = 13) received follow-up (69.2%), frenotomy (7.7%), consultation (7.7%), and functional intervention (23.1%) recommendations. Among patients without ankyloglossia (n = 725), only 5 patients (0.7%) required follow-up, with no other interventions planned. Across all groups, management differed significantly by Coryllos type for follow-up, frenotomy, consultation, and functional intervention (all $p < 0.001$). Among patients with ankyloglossia (Types 1–4), frenotomy, consultation, and functional intervention differed by type (all $p < 0.001$), whereas follow-up did not ($p = 0.062$). (Table 6, Fig. 2). While parental concerns were acknowledged and informed consent was strictly obtained for surgical procedures such as frenotomy, the ultimate clinical management decisions were predominantly driven by the attending clinician's judgment.

Percentages do not total 100% because the treatment categories were not mutually exclusive. A single patient may have received more than one clinical recommendation simultaneously. Therefore, overlapping recommendations were statistically handled by treating each treatment category as an independent binary outcome.

Within this framework, consultation involved multidisciplinary referrals to speech-language pathologists (SLPs) for advanced phonetic intervention, or to Ear, Nose and Throat (ENT) specialists and oral surgeons for definitive surgical assessments. Follow-up was defined as scheduled periodic clinical evaluations conducted at six-month intervals to monitor ongoing speech development, oral hygiene compliance, and spontaneous functional compensation. Additionally, functional intervention specifically referred to targeted myofunctional tongue exercises prescribed to patients and their parents for regular home practice to improve tongue mobility and function.

4. Discussion

This prospective clinical study evaluated the prevalence of ankyloglossia and its clinical implications in a pediatric population presenting to a university-based pediatric dentistry clinic.

The prevalence of ankyloglossia in the present study was 26.2%, which is markedly higher than the 4.2–10.7% range reported in systematic reviews limited to infant populations [5, 11]. This discrepancy should be interpreted with caution, as our study included children across a broader age range (0–15 years), whereas previous reviews were restricted exclusively to infants evaluated using both specific and non-specific diagnostic tools. Such differences in study design may substan-

TABLE 6. Distribution of clinical decisions according to Coryllos classification.

Coryllos Type	n (total)	Follow-up n (%)	Frenotomy n (%)	Consultation n (%)	Functional Intervention n (%)
Normal	725	5 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Type 1	5	3 (60.0%)	4 (80.0%)	2 (40.0%)	2 (40.0%)
Type 2	94	84 (89.4%)	3 (3.2%)	27 (28.7%)	27 (28.7%)
Type 3	145	120 (82.8%)	0 (0.0%)	3 (2.1%)	13 (9.0%)
Type 4	13	9 (69.2%)	1 (7.7%)	1 (7.7%)	3 (23.1%)

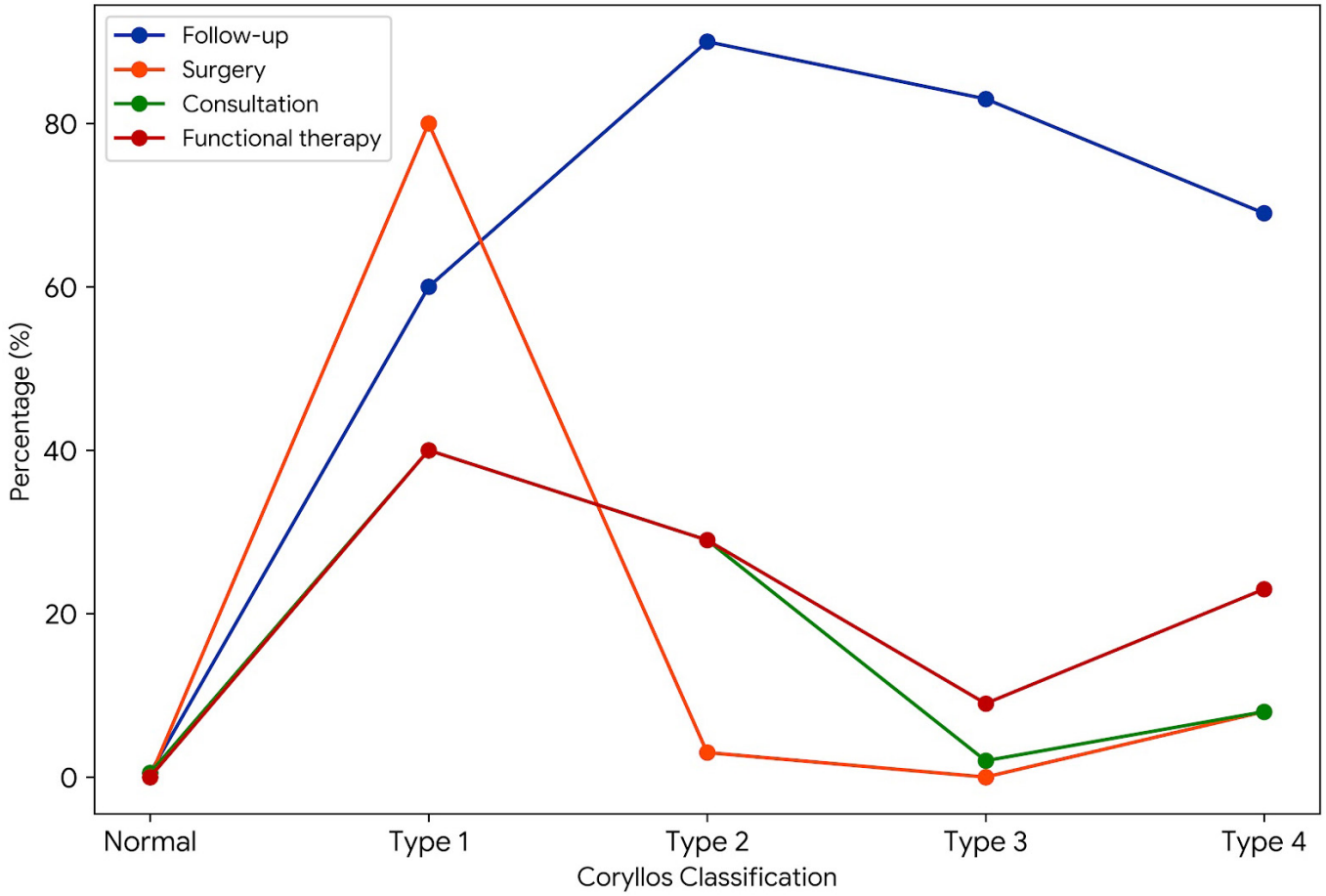


FIGURE 2. Distribution of clinical decisions according to the Coryllos classification.

tially affect prevalence estimates. Another systematic review highlighted that studies utilizing non-specific diagnostic tools reported considerably lower prevalence rates than those using specific criteria. Notably, the same review reported that studies utilizing the Coryllos classification yielded a pooled prevalence of approximately 20%, with individual rates ranging from 9.0% to 35.0%. The prevalence of 26.2% observed in the present study falls well within this range, supporting the comparability of our findings with those of Coryllos-based assessments in the literature [4].

Several factors may explain the high prevalence observed in our cohort. First, the clinical setting likely introduced referral bias. As a university-based pediatric dentistry clinic serving as a tertiary-care center, our sample may have been enriched with symptomatic individuals presenting with oral or functional concerns. Consequently, this influx of specialized referrals artificially expands prevalence estimates in contrast to the unselected samples typically evaluated in community-based or population-level studies. In addition, previous systematic reviews are limited by their exclusive focus on infants and a relatively small number of included studies, which may restrict the generalizability of their findings.

The distribution of ankyloglossia types in our sample revealed a predominance of posterior forms (Types 3 and 4: 61.5% of ankyloglossia cases), consistent with emerging recognition that posterior ankyloglossia may represent the most common variant. This finding has important clinical implications, as posterior ankyloglossia can be more challenging to diagnose and may be underreported in studies relying solely on visual inspection without functional assessment. However, the inclusion of these posterior subtypes may have simultaneously contributed to the elevated prevalence observed in our cohort. Recent literature highlights that the concept of “posterior tongue-tie” remains

highly controversial. Many experts argue that what is often diagnosed as a posterior tie through palpation may instead represent normal anatomical variation or submucosal tissue, rather than a true tethered oral tissue requiring intervention [12, 13]. Consequently, this diagnostic ambiguity leads to wide prevalence variability reported across studies and complicates clinical decision-making, forcing practitioners to carefully distinguish true functional impairments from normal anatomical variations. When only anterior forms (Types 1 and 2) were considered, the prevalence decreased to approximately 10.1%, aligning more closely with general population estimates. This discrepancy underscores an ongoing debate regarding the potential for overdiagnosis, particularly in the absence of universally accepted diagnostic criteria [1]. Although the Coryllos classification provides a useful anatomical framework, it does not fully address the distinction between normal anatomical variation and clinically significant restriction. This limitation is especially relevant for posterior subtypes, which may lack consistent functional correlates [14]. Supporting this interpretation, no patients with Type 3 ankyloglossia in our cohort required surgical intervention, and most were managed conservatively, suggesting that anatomical classification alone may be insufficient to guide clinical decision-making.

Our finding of no statistically significant gender difference in ankyloglossia prevalence (females 28.1% *vs.* males 24.3%, $p = 0.175$) contrasts with some previous reports suggesting a male predominance in this condition [15, 16]. However, this discordance may reflect differences in study populations and diagnostic methodologies. Furthermore, systematic reviews emphasize that the evidence regarding gender differences remains inconclusive [4].

A particularly significant finding of this study was the strong association between ankyloglossia and speech disorders. The 20.6% prevalence of speech problems among children with ankyloglossia, compared with 1.0% among those without the condition, yielded a substantial odds ratio (OR = 26.6), which remained robust after adjustment for age and gender (adjusted OR = 29.1). These findings suggest that ankyloglossia is independently associated with speech difficulties. This finding aligns with previous research indicating that restricted tongue mobility can impair articulation of specific phonemes, particularly lingual sounds such as /r/, /l/, and /s/ [17–19]. However, the magnitude of these effect sizes warrants cautious interpretation, as exceptionally large odds ratios can sometimes represent statistical artifacts rather than precise reflections of true clinical magnitude, particularly in multifactorial developmental conditions. The observed association may partly reflect referral bias inherent to a tertiary care setting, the inclusion of posterior subtypes with variable functional correlates, the notably low baseline prevalence of speech difficulties in the control group, and potential classification bias arising from subjective diagnostic criteria. These considerations suggest that, although the association is clinically plausible, the true effect size in an unselected population is likely more modest.

The protective effect of age observed in our analysis (adjusted OR = 0.83, $p = 0.001$) suggests that speech disorders associated with ankyloglossia may improve over time, potentially through compensatory mechanisms or natural anatomical changes during growth. This finding has important implications for clinical decision-making regarding the timing of surgical intervention and supports a more conservative, observation-based approach in certain cases.

The low frequency of sucking/feeding and swallowing problems, which did not reach statistical significance ($p = 0.057$ and $p = 0.068$, respectively), may be explained by the relatively older age distribution of the study population (mean age: 9.57 years). Feeding and swallowing difficulties associated with ankyloglossia are more prominent during the neonatal and early infancy periods, whereas in older children, these issues may diminish or be compensated for over time. These findings support the notion that the functional impact of ankyloglossia varies across age groups, with feeding difficulties being more prominent in early life and articulation problems becoming more relevant later. This heterogeneity highlights the need for age-specific assessment and follow-up protocols [20, 21].

Our clinical decision-making data indicate a nuanced approach to ankyloglossia management, with treatment recommendations tailored to severity and functional impact rather than anatomical classification alone. Management differed by Coryllos type (Table 6); frenotomy was recommended most often for Type 1 (80.0%) and rarely for other types, whereas follow-up did not differ significantly across Types 1–4 ($p = 0.062$). The high rate of frenotomy recommendations for Type 1 ankyloglossia (80.0%) reflects the typically severe functional impairment associated with this variant. Conversely, the absence of frenotomy recommendations for Type 3 cases, despite this being the most common type, suggests that many posterior ankyloglossias may not require surgical intervention and can be managed conservatively with functional exercises and monitoring. This conservative approach aligns closely with growing concerns regarding the risk of overtreatment. Despite stable or declining birth rates worldwide, the frequency of ankyloglossia diagnoses and subsequent frenotomies has increased exponentially in recent decades, raising concerns regarding potential overmedicalization [22]. While the American Academy of Otolaryngology–Head and Neck Surgery [6] has attempted to establish diagnostic and therapeutic standards, recent systematic reviews argue that treatment decisions reported in the literature are still frequently driven by anatomical appearance rather than universally validated functional necessity [23]. By emphasizing functional impairment over mere anatomical presence alone, our approach may reduce the risk of unnecessary surgical interventions and their associated complications.

Several limitations of this study should be acknowledged. First, the single-center design and academic setting may limit the generalizability of the findings to community-based practice settings. Second, the cross-sectional nature of the study precludes assessment of long-term outcomes and the natural history of untreated ankyloglossia. Third, although the Turkish Articulation and Phonology Test was used to reduce subjective interpretation, the assessments were performed by a pedodontist rather than a speech-language pathologist, and severity levels were not recorded. This absence of severity grading limits the detailed interpretation of speech outcomes, as it prevents determining whether more restrictive anatomical types directly correlate with a greater clinical magnitude of speech impair-

ment. Tongue mobility was evaluated using the Coryllos classification, which provides an anatomical framework but does not quantitatively capture functional restriction; incorporation of a validated functional scoring system, such as the Bristol Tongue Assessment Tool (BTAT), would have strengthened this assessment. Implementing such quantitative functional tools establishes objective, measurable criteria that minimize subjective bias, thereby significantly enhancing diagnostic reproducibility across different clinicians compared with purely observational anatomical classifications alone. The absence of validated feeding and swallowing questionnaires represents an additional limitation, although no single instrument adequately captures these functions across the broad age range included in our sample (0–15 years). Finally, treatment decisions were based on clinical judgment integrating anatomical and functional findings rather than a standardized protocol, and formal multidisciplinary evaluation was not routinely performed. Patients requiring additional evaluation were referred through consultation pathways to SLPs, ENT specialists, or oral surgeons as appropriate. Objective instrumental phonetic analysis (*e.g.*, acoustic spectrography) was not used, as the study's primary focus was on clinical articulation screening within a dental setting rather than micro-acoustic parameters. Moreover, only intra-observer agreement was evaluated, while inter-observer reliability was not evaluated. Future studies would benefit from structured decision-making algorithms incorporating speech-language pathology assessment alongside surgical consultation.

Clinical populations often consist of more symptomatic individuals presenting with speech disorders, feeding difficulties, or parental concerns, which may result in higher prevalence estimates than those observed in the general population. Therefore, these findings should not be directly generalized to the broader population. Nevertheless, evaluating this population provides a significant advantage for clinical decision-making, as it reflects real-world patient profiles encountered in routine practice.

Despite these limitations, our study provides valuable data regarding ankyloglossia prevalence and its functional consequences in a well-characterized pediatric population. The strong association with speech disorders and the variability in clinical management approaches underscore the need for standardized diagnostic criteria and evidence-based treatment guidelines. Future research should focus on longitudinal studies examining the natural history of different ankyloglossia types, randomized controlled trials comparing treatment approaches, and the development of validated functional assessment tools to guide clinical decision-making. Additionally, studies investigating the impact of early versus delayed intervention on breastfeeding outcomes, speech development, and quality of life are needed to optimize management strategies.

5. Conclusions

This study identified a 26.2% prevalence of ankyloglossia in a pediatric dentistry setting, with posterior types predominating. Ankyloglossia was significantly associated with increased odds of speech disorders, underscoring the need for standardized diagnostic criteria and systematic screening in pediatric practice. These findings highlight the importance of integrating functional assessment into the evaluation of pediatric ankyloglossia, as anatomical classification alone may not adequately reflect clinical significance or treatment necessity; ultimately, a standardized approach will empower clinicians to make evidence-based decisions and avoid unnecessary surgical interventions.

AVAILABILITY OF DATA AND MATERIALS

The summarised study data generated and analyzed during the current study are included in this published article. The underlying raw datasets are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

MK and AK—designed the research study. MM—analyzed the data. MC, RD and MK—wrote the manuscript. All authors performed the research. All authors contributed to the revisions of the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Istanbul University Clinical Research Ethics Committee (Approval No: 2025/52). Written informed consent was obtained from the parents or legal guardians of all participants included in the study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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