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Oral functional improvements in lingual hypomobility: a systematic review of surgical, myofunctional, and combined therapies

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Abstract

Background: Ankyloglossia is a congenital condition characterized by restricted tongue mobility, which may influence oral functions such as speech, swallowing, and oral motor coordination. This systematic review aimed to evaluate oral functional outcomes following surgical and/or myofunctional interventions in individuals with lingual hypomobility. A secondary aim was to assess variability and consistency of functional improvements across different therapeutic approaches.

Methods: This systematic review was conducted in accordance with PRISMA guidelines. PubMed, Scopus, and Web of Science were searched between 15 June 2025 and 10 August 2025. Eligible clinical studies (randomized controlled trials, cohort studies, and case series/reports) evaluated lingual frenotomy, frenulectomy, or frenuloplasty, alone or combined with orofacial myofunctional therapy, and reported oral functional outcomes, including tongue mobility, oral posture, swallowing-related tasks, neuromuscular measures, and patient-reported function. Risk of bias was assessed using validated tools (ROBINS-I and RoB 2). Due to heterogeneity in study design and outcome measures, a narrative synthesis was performed.

Results: Ten studies involving more than 1,300 participants across pediatric, adolescent, and adult populations were included. The evidence comprised randomized controlled trials, observational studies, and case series. Surgical intervention alone was primarily associated with immediate anatomical and mobility-related improvements. In contrast, combined surgical and myofunctional approaches were more consistently associated with improvements in functional outcomes, including tongue mobility, resting posture, and swallowing-related functions. However, the consistency of these improvements varied across age groups, intervention protocols, and outcome assessment methods. Risk of bias was variable and frequently influenced by heterogeneous diagnostic criteria, nonstandardized interventions, and nonuniform outcome measures.

Discussion: Combined surgical and myofunctional interventions appear to be associated with improvements in oral functional outcomes compared with stand-alone approaches. However, due to substantial methodological heterogeneity and limited high-quality evidence, these findings should be interpreted with caution and are primarily applicable to the specific functional domains evaluated.

Keywords

lingual hypomobility, ankyloglossia, frenectomy, myofunctional therapy, orofacial function, tongue mobility

Introduction

Clinical background and current debate

Ankyloglossia is a congenital condition characterized by a structural restriction of the lingual frenulum, which may limit tongue mobility to varying degrees (Figure 1). In clinical practice, reduced lingual mobility is frequently discussed in relation to oral motor functions, including tongue posture at rest, swallowing-related tasks, and other oral functional behaviors [1–5]. However, the topic remains controversial due to heterogeneous symptom presentations and because the association between reduced lingual mobility and functional complaints does not, by itself, establish causation [6–8].

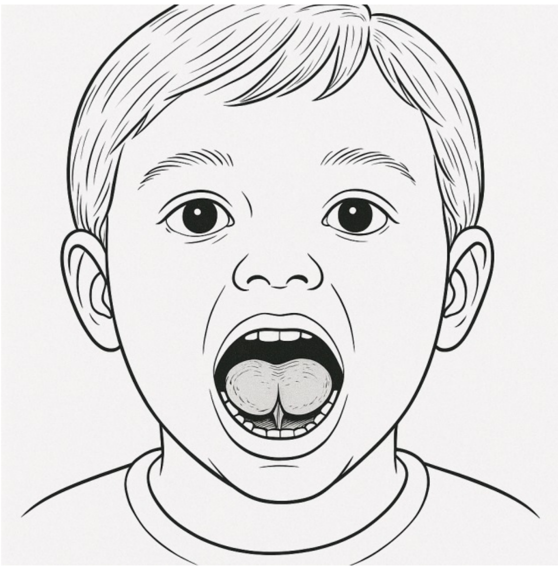

Figure 1. Ankyloglossia.

Terminology and conceptual clarification: "reduced lingual mobility" is not a single diagnosis

A key source of inconsistency in the literature is that "lingual hypomobility" is often used as an umbrella term encompassing distinct etiologies. Ankyloglossia represents a structural restriction, whereas reduced mobility may also arise from neuromotor impairment (e.g., hypotonia or neurological conditions), pain-related guarding, adaptive movement patterns, or learned compensations [9–13]. Conflating these mechanisms may lead to misleading conclusions, particularly when diagnostic criteria are not standardized and functional outcomes are assessed using noncomparable methods [14–18].

Interventions commonly proposed: surgery and oral motor rehabilitation

The two most frequently proposed clinical approaches are surgical release of the lingual frenulum (frenotomy, frenulectomy/frenectomy, or frenuloplasty) (Figure 2) and myofunctional rehabilitation, often labeled as orofacial myofunctional therapy (OMT) [19–21]. The terms frenotomy, frenectomy, and frenuloplasty are used according to the terminology adopted in the original studies.

Figure 2. Frenectomy.

Surgical procedures aim to reduce mechanical restriction and potentially enable a greater range of tongue movement, while myofunctional interventions generally target oral motor control and functional integration (e.g., tongue posture, coordinated swallowing tasks, and breathing-related oral behaviors). Importantly, terminology varies among studies; where appropriate, this manuscript prioritizes the term "oral motor" to reflect the primary functional domain evaluated, while retaining "OMT" when it corresponds to the intervention label used in the original studies [22–26].

Why functional outcomes matter and why overinterpretation should be avoided

Although a wide range of clinical effects have been attributed to tongue-tie in some narratives, the strength of evidence supporting broad claims, such as direct effects on complex craniofacial growth patterns, temporomandibular disorders, posture, or sleep-disordered breathing, is inconsistent [27–31]. For this reason, it is essential to distinguish between reported functional changes after intervention and etiologic claims about what ankyloglossia "causes." The present review focuses on reported oral functional outcomes rather than causal relationships between ankyloglossia and broader systemic conditions [32–36].

The role of myofunctional therapy and the speech therapy distinction

OMT is frequently discussed in relation to tongue posture and swallowing patterns; however, it should not be conflated with articulation-based speech therapy delivered by speech-language pathologists [37–39]. Speech outcomes reported after frenulum release are mixed across studies and can be confounded by concurrent speech therapy, developmental maturation, and nonstandard outcome measures [40–44]. Therefore, when speech-related outcomes are reported, they should be interpreted as reported associations within specific study contexts rather than predictable consequences of surgical release or OMT [45–49].

Methodological limitations in the existing evidence base

Across published clinical studies, substantial heterogeneity exists in diagnostic criteria, intervention protocols, outcome measures, and followup duration [50–54]. These limitations reduce comparability and often preclude quantitative pooling, while emphasizing the need for careful narrative synthesis and transparent risk-of-bias assessment by study design [55–59].

Research gap and rationale for the present review

Existing reviews have sometimes addressed specific domains (e.g., infant feeding or selected speech outcomes) or have blended functional and structural endpoints without a consistent operational definition of "reduced mobility" [60–65]. A focused synthesis on reported oral functional outcomes after lingual frenulum release, with explicit consideration of adjunctive myofunctional therapy and study-level limitations, is therefore warranted [66–70]. Clarifying what outcomes are reported under what circumstances may help clinicians counsel patients more accurately, refine intervention pathways, and identify priorities for future controlled research [71, 72].

Objective

This systematic review aims to synthesize the available clinical evidence on reported oral functional outcomes following lingual frenectomy, with or without adjunctive myofunctional therapy, in individuals with ankyloglossia or reduced lingual mobility. It also aims to evaluate the variability and consistency of functional outcomes across different therapeutic approaches.

Materials and methods

Protocol and registration

This systematic review was performed in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines. The protocol was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the CRD420251107552. The study design included predefined inclusion criteria, systematic data extraction, and risk-of-bias assessment to enhance transparency and reproducibility.

Search strategy

A comprehensive literature search was conducted in PubMed, Scopus, and Web of Science to identify clinical studies evaluating lingual frenectomy, with or without myofunctional therapy, in individuals diagnosed with ankyloglossia or reduced lingual mobility.

The time restriction (years 2015–2025) was applied to capture the most recent and methodologically consistent evidence, reflecting advancements in diagnostic criteria, surgical techniques, and the increasing use of standardized and validated outcome assessment tools in clinical research.

Only English-language studies were included to ensure methodological consistency and accurate interpretation of outcome measures, particularly in studies involving functional and patient-reported assessments, where translation variability may introduce bias.

The following Boolean search terms and keywords were used in various combinations to capture relevant literature: ("ankyloglossia" OR "lingual frenulum" OR "tongue-tie") AND ("frenotomy" OR "frenectomy" OR "frenuloplasty") AND ("myofunctional therapy" OR "orofacial myofunctional therapy" OR "oral motor therapy"). Search strategies were adapted to the indexing terms of each database. Reference lists of selected papers were also screened manually to identify additional relevant studies. A meta-analysis was not performed due to substantial heterogeneity in study design, intervention protocols, and outcome measures, which precluded meaningful quantitative synthesis.

Inclusion and exclusion criteria

To ensure relevance, clinical applicability, and scientific quality, predefined inclusion and exclusion criteria were established (Table 1). Eligible studies were randomized controlled trials (RCTs), controlled clinical trials (CCTs), and high-quality observational studies that investigated either: the effects of lingual frenectomy (laser or traditional techniques), the outcomes of OMT, or the combined approach of both treatments in individuals with ankyloglossia or reduced lingual mobility presenting with oral functional alterations (e.g., impaired tongue mobility, altered posture, or swallowing dysfunction).

Table 1. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Studies published in peer-reviewed journals between years 2015 and 2025	Articles not published in English
RCTs, CCTs, cohort studies, case series, and case reports	Narrative reviews, editorials, letters, conference abstracts
Studies involving children, adolescents, or adults diagnosed with ankyloglossia or reduced lingual mobility	Studies involving syndromic patients, craniofacial syndromes, or cleft lip/palate
Evaluation of lingual frenotomy/frenuloplasty, oral or OMT, or combined interventions	Studies not involving surgical or myofunctional interventions
Reported oral functional outcomes, including tongue mobility, tongue strength, resting tongue posture, swallowing-related tasks, oral motor coordination, or muscle activity (e.g., sEMG)	Animal studies, in vitro studies, or purely biomechanical modeling

RCTs: randomized controlled trials; CCTs: controlled clinical trials; OMT: orofacial myofunctional therapy; sEMG: surface electromyography.

Case series and case reports were included due to the limited availability of high-quality RCTs in this field, and were clearly identified as lower-level evidence in the qualitative synthesis.

The review was conducted using the population, intervention, comparison, outcome (PICO) criteria to synthesize reported oral functional outcomes and does not aim to establish causal relationships between ankyloglossia or reduced lingual mobility and broader respiratory, skeletal, or postural disorders (Table 2).

Table 2. PICO framework.

PICO element	Description
Population (P)	Children, adolescents, and adults diagnosed with ankyloglossia or reduced lingual mobility, with or without associated oral functional complaints (e.g., altered tongue posture, swallowing difficulties, and oral motor dysfunction).
Intervention (I)	Lingual frenectomy (performed with scalpel, laser, or plasma devices), or orofacial/OMT, alone or in combination.
Comparison (C)	Pre- and postintervention assessments within the same participants; comparisons between surgical intervention alone versus combined surgical and myofunctional approaches when available.
Outcome (O)	Reported oral functional outcomes, including tongue mobility, tongue strength, resting tongue posture, swallowing-related tasks, oral motor coordination, muscle activity (sEMG), and patient- or caregiver-reported functional measures.

PICO: population, intervention, comparison, outcome; OMT: orofacial myofunctional therapy; sEMG: surface electromyography.

Results

A total of 10 studies were included in the qualitative synthesis, encompassing heterogeneous study designs, populations, and intervention protocols. Overall, improvements in tongue mobility and oral function were frequently reported, although outcome measures were heterogeneous. Outcome reporting varied substantially across studies, particularly in terms of assessment tools, followup duration, and intervention protocols, limiting direct comparability and precluding quantitative synthesis.

Three main databases (PubMed, Scopus, and Web of Science) were consulted, yielding a total of 389 articles: PubMed (104), Web of Science (256), and Scopus (29). After removing 81 duplicates, 308 articles remained for screening. Following title and abstract evaluation, 27 articles were excluded due to lack of relevance to the inclusion criteria. Of the 281 articles selected for full-text review, 271 were excluded because they did not meet at least one of the predefined criteria (e.g., lack of followup, inappropriate study population, and absence of relevant clinical outcomes). Ultimately, 10 studies met the inclusion criteria and were included in the qualitative synthesis (Table 3). The selection process is illustrated in the PRISMA flow diagram (Figure 3).

Table 3. Analysis of the included studies in the discussion section.

Authors	Type of study	Aim	Materials and methods	Outcomes
Zaghi et al. (2019) [73]	Clinical study	To evaluate the safety and efficacy of lingual frenuloplasty combined with myofunctional therapy in a large sample.	Retrospective study on 348 patients (mean age 24.5 years) treated with lingual frenuloplasty and OMT. Evaluations included sleep quality (PSQI), postural assessments, pain (VAS scale), and speech function at 1, 3, and 6 months postoperation.	96% reported improved breathing; 87% improved resting tongue posture; 68% improved sleep quality. AHI improved > 30% in mild OSAS cases. No major complications were recorded.
Lichnowska et al. (2024) [74]	Prospective RCT	To assess the effectiveness of lingual frenuloplasty combined with myofunctional therapy in patients with maxillofacial deformities.	Prospective RCT on 155 patients aged 7 to 50 years with ankyloglossia and class II/III malocclusions. Participants were randomly assigned to receive either myofunctional therapy alone or in combination with lingual frenuloplasty. Clinical evaluations were performed at 6 and 12 months postoperation.	Patients who received both frenuloplasty and myofunctional therapy showed significantly greater improvements in tongue mobility, swallowing function, nasal breathing, and resting tongue posture compared to controls.
Carminatti et al. (2022) [75]	RCT	To compare frenectomy with and without myofunctional therapy in children.	The study included 40 children aged 6 to 12 years with ankyloglossia, all of whom underwent a lingual frenectomy. After 15 days, participants were randomized into two groups: one group performed isotonic tongue exercises for 15 days, while the control group received no additional therapy.	Children who received myofunctional exercises showed significantly better results in tongue mobility and mouth opening compared to the control group.
Ferrés-Amat et al. (2016) [76]	Descriptive cohort study	To describe a multidisciplinary treatment protocol for children with ankyloglossia and evaluate its clinical effectiveness.	101 children aged 4 to 14 years were treated with a combined approach that included one week of preoperative myofunctional therapy, surgical frenectomy with lingual plasty, and postoperative rehabilitation. Followups were conducted at 3, 15, and 45 days postoperatively.	Surgery alone led to improvement in 28% of cases, while the full protocol, including myofunctional therapy, resulted in complete resolution in 96% of patients.
Zhao et al. (2024) [77]	RCT	To determine the optimal timing and effectiveness of frenotomy (infant tongue-tie release) on speech articulation and intelligibility in young children with ankyloglossia.	The study involved 341 children aged 2 to 5 years with speech difficulties due to tongue-tie. They were randomly assigned to either undergo frenotomy or receive no surgical treatment. Children were further grouped by age (2 to 3, 3 to 4, and 4 to 5 years) and assessed at 2, 6, and 12 months postintervention using clinical and speech-language evaluation tools.	In the youngest group (under 3 years), no significant difference in speech articulation or tongue mobility was observed between those treated and untreated. However, in children aged 3 to 5 years, those who underwent frenotomy showed clear improvements in speech production and intelligibility compared to controls.
Fioravanti et al. (2021) [78]	Randomized, double-blind, CCT	To determine if performing a diode laser lingual frenectomy in children with a short tongue-tie can help reduce the severity of OSAS.	The study involved 32 children aged 4 to 13 years, all diagnosed with OSAS and restricted tongue mobility. Participants were randomly assigned to two groups: one received a lingual frenectomy using a diode laser along with myofunctional and speech therapy, while the control group received only the therapy without surgery. Sleep quality was assessed with polysomnography before and three months after treatment. Pain perception was also recorded.	At 3-month followup: in the laser group, 93.8% had mild OSAS and 6.2% moderate; in the control group, only 18.8% had mild OSAS, 62.5% moderate, and 18.8% remained severe.
Gouvêa et al. (2025) [79]	RCT	To examine the immediate effect of photobiomodulation on tongue strength.	30 randomized patients (mean age 16.2 years). Laser group received 810 nm, 100 mW, 60 s photobiomodulation; control group received placebo. Tongue pressure assessed using IOPI before and 10 minutes after intervention.	Laser group had a 21.4% increase in tongue pressure (28.5–34.6 kPa; *p* = 0.03). No adverse effects. Placebo group showed no significant change.

Table 3. Analysis of the included studies in the discussion section. (*continued*)

Authors	Type of study	Aim	Materials and methods	Outcomes
Scarano et al. (2023) [80]	Prospective cohort study	To evaluate the effects of postural myofunctional therapy (Mézières method with postural bench) after lingual frenectomy in children with tongue-tie.	130 children with severe ankyloglossia underwent frenectomy followed by a structured postural and myofunctional program. Outcomes were assessed at 1 week and 2 months using parent-reported scales.	Tongue mobility improved in 96% at 2 months; speech: 58%→72%; feeding: 58%→75%; sleep: 61% → 74%. PSS score increased from 8.0 to 8.5 ($p < 0.0001$). Combined therapy led to significant functional improvements over 2 months.
Tecco et al. (2015) [81]	Prospective cohort study	To evaluate the effect of lingual frenulectomy and myofunctional exercises on the sEMG activity of masticatory and perioral muscles in children.	24 children (~7 years old) were enrolled: 13 underwent frenulectomy with rehabilitation, 11 were untreated controls. sEMG recordings were taken at baseline, 1 month, and 6 months during tasks like clenching, swallowing, and protrusion.	After 6 months, treated children showed increased masseter (+ 13.5 μV) and submental (+ 14.2 μV) activity ($p < 0.01$), with normalized muscle patterns during function. No changes were observed in controls.
Scarano et al. (2023) [82]	Case series	To evaluate the effectiveness of atmospheric plasma frenectomy followed by tongue exercises in children with Kotlow class III/IV ankyloglossia.	30 children (6 to 11 years) with Kotlow class III or IV ankyloglossia underwent frenectomy using atmospheric plasma. Tongue mobility was measured using Kotlow's free-tongue length, MIO, and MOTTIP at five time points: preoperation, immediately postoperation, and at 1 week, 1 month, and 2 months.	All three measures (Kotlow, MIO, MOTTIP) showed statistically significant improvement immediately after surgery and maintained stable values at followup ($p < 0.05$). No bleeding, edema, fibrosis, or recurrence was observed during the study period.

OMT: orofacial myofunctional therapy; PSQI: Pittsburgh Sleep Quality Index; VAS: Visual Analog Scale; AHI: apnea-hypopnea index; OSAS: obstructive sleep apnea syndrome; RCT: randomized controlled trial; CCT: controlled clinical trial; IOPI: Iowa Oral Performance Instrument; PSS: Perceived Stress Scale; sEMG: surface electromyography; MIO: maximal intercisal mouth opening; MOTTIP: mouth opening with tongue tip to incisive papilla.

The main characteristics and outcomes of the included studies are summarized in Table 3 and described in the following sections.

Data extraction

Four independent reviewers (SS, AP, LPZ, ADI) conducted the screening of articles and assessed their methodological quality using Zotero software version 6.0.15. Discrepancies were resolved through discussion and mediation by a senior reviewer (FI). Extracted data included: year of publication, study design, sample size, type of intervention (laser or conventional frenulotomy, OMT, or combined approach), followup duration, and clinical outcomes (tongue mobility, muscle strength, occlusal improvement, cephalometric changes, respiratory parameters, masticatory and articulatory function).

Quality assessment

Non-randomized clinical studies were evaluated using the ROBINS-I tool (Table 4). Randomized controlled trials (RCTs) were assessed using the revised Cochrane Risk of Bias tool (RoB 2) (Table 5). Due to their descriptive nature, case series and case reports were not subjected to formal risk-of-bias assessment and were included for descriptive purposes only.

Table 4. Bias assessment by ROBINS-I tool.

Authors	D1	D2	D3	D4	D5	D6	D7	Overall
Zaghi et al. (2019) [73]	X	-	+	+	-	X	-	X
Ferrés-Amat et al. (2016) [76]	X	-	+	+	-	-	-	X
Scarano et al. (2023) [80]	X	-	+	+	-	-	-	-
Tecco et al. (2015) [81]	-	-	+	+	+	-	+	X
Scarano et al. (2023) [82]	X	-	+	-	+	-	-	X

Domains: D1: Bias due to confounding; D2: Bias arising from measurement of the exposure; D3: Bias in selection of participants into the study (or into the analysis); D4: Bias due to post-exposure intervention; D5: Bias due to missing data; D6: Bias arising from measurement of the outcome; D7: Bias in selection of the reported result. ×: high; -: some concerns; +: low.

Table 5. Cochrane risk of bias tool (RoB 2).

Authors	D1	D2	D3	D4	D5	Overall
Lichnowska et al. (2024) [74]	+	+	+	+	+	+
Carminatti et al. (2022) [75]	+	+	-	-	+	-
Zhao et al. (2024) [77]	+	+	+	-	+	+
Fioravanti et al. (2021) [78]	+	+	+	+	+	-
Gouvêa et al. (2025) [79]	+	+	+	+	+	+

Domains: D1: Bias arising from the randomization process; D2: Bias due to the deviations from intended interventions; D3: Bias due to missing outcome data; D4: Bias arising from measurement of the outcome; D5: Bias in selection of the reported result. -: some concerns; +: low.

These findings should be interpreted with caution, particularly when considering outcomes influenced by multiple factors beyond oral function.

Discussion

This systematic review synthesizes the available clinical evidence on oral functional outcomes following lingual frenectomy, myofunctional therapy, or combined approaches in individuals with ankyloglossia or reduced lingual mobility. Overall, the included studies suggest that surgical release alone is primarily associated with anatomical or immediate mobility-related changes, whereas combined surgical and myofunctional approaches appear to be more frequently associated with reported improvements in oral functional domains, such as tongue mobility, resting posture, swallowing-related tasks, and oral motor coordination.

From a methodological perspective, the overall quality of the included studies was variable. RCTs provided higher levels of evidence but were limited by small sample sizes and heterogeneous outcome measures. Observational studies and case series contributed descriptive insights but presented an increased risk of bias, particularly in terms of patient selection, lack of control groups, and reliance on subjective outcome reporting. These methodological limitations reduce the strength and generalizability of the reported findings.

Several studies suggested that combining surgical intervention with myofunctional therapy may enhance functional outcomes compared with stand-alone approaches. RCTs and prospective studies reported improvements in tongue mobility, swallowing function, and oral motor coordination when structured rehabilitation protocols were implemented alongside surgical release. These findings suggest a potential interaction between anatomical release and functional reeducation, although this relationship remains inconsistent across studies.

In pediatric populations, the integration of myofunctional therapy appears particularly relevant. Studies involving children reported that post-operative exercises and structured rehabilitation programs were associated with greater improvements in tongue mobility and oral function compared with surgery alone. These findings may reflect the role of neuromotor development and functional adaptability during growth, as well as patient engagement in therapy.

Age-related differences were also observed. Some studies reported limited effects of surgical intervention on speech outcomes in very young children, whereas older children showed more consistent improvements. This suggests that functional maturation and neuromuscular coordination may influence treatment outcomes rather than supporting a uniform benefit of early surgical intervention.

Some investigations explored functional domains beyond oral motor performance, including sleep-related parameters and breathing patterns. While improvements were reported in certain studies, these outcomes should be interpreted cautiously due to the multifactorial nature of such conditions and the

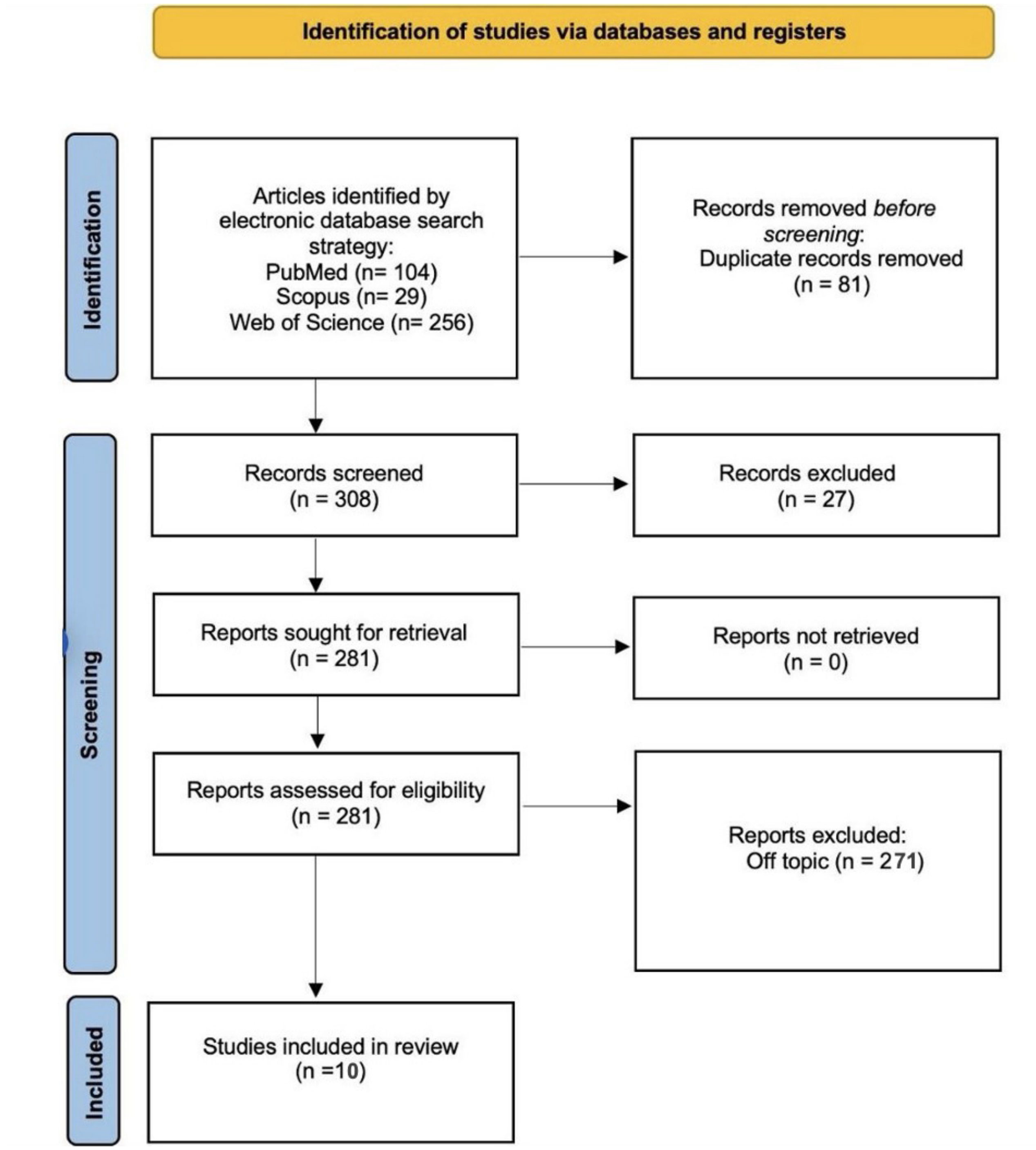

Figure 3. Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow diagram—article selection process. Adapted from "PRISMA" (http://www.prisma-statement.org/). Accessed January 14, 2026. © 2024–2026 the PRISMA Executive. Distributed under a Creative Commons CC BY 4.0 license.

frequent use of subjective or non-standardized assessment tools. Therefore, these findings should not be interpreted as evidence of direct causal relationships between ankyloglossia and broader systemic conditions.

Emerging adjunctive approaches, such as photobiomodulation and postural rehabilitation protocols, have shown potential short-term benefits in improving tongue strength and functional integration. However, these findings are based on limited data and require further validation through well-designed controlled studies with standardized methodologies and long-term followup.

Overall, the evidence included in this review is characterized by substantial heterogeneity in study design, diagnostic criteria, intervention protocols, outcome measures, and followup duration. This heterogeneity substantially limited direct comparability between studies and precluded meaningful quantitative synthesis. Moreover, many studies relied on subjective or nonvalidated outcome measures, and long-term functional stability remains insufficiently investigated.

Within these limitations, the available data suggest that combined surgical and myofunctional interventions are more frequently associated with reported improvements in oral functional outcomes than stand-alone approaches, particularly in cooperative children and adolescents. Importantly, this apparent advantage should not be interpreted as definitive evidence of efficacy but rather as a recurring trend observed across heterogeneous study designs. These findings do not support causal claims regarding broader systemic or structural outcomes, including craniofacial development, airway disorders, or orthodontic correction.

A key strength of this review lies in its focused evaluation of clearly defined oral functional outcomes, with explicit separation between functional findings and broader systemic interpretations, thereby improving the clinical interpretability of the results. In addition, the application of a structured methodological framework and risk-of-bias assessment contributes to the transparency and reproducibility of the analysis.

However, several limitations must be acknowledged. The included studies were highly heterogeneous and often affected by methodological constraints, including small sample sizes, lack of standardized outcome measures, and variable followup periods. Furthermore, the frequent reliance on subjective assessments reduces the robustness of the conclusions. These limitations highlight the need for well-designed studies using standardized diagnostic criteria, validated outcome measures, and adequately powered controlled designs.

This systematic review suggests that interventions targeting lingual hypomobility are associated with reported improvements in oral functional outcomes, particularly when surgical release is combined with myofunctional therapy.

However, due to methodological heterogeneity and variability in outcome assessment, these findings are primarily applicable to the specific functional domains evaluated and should not be interpreted as evidence of consistent or generalizable effects across populations and study designs.

Abbreviations

CCTs: controlled clinical trials

OMT: orofacial myofunctional therapy

OSAS: obstructive sleep apnea syndrome

PICO: population, intervention, comparison, outcome

RCTs: randomized controlled trials

sEMG: surface electromyography

Declarations

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During the preparation of this work, the authors used AI-assisted technologies for language editing and improvement of text clarity. After using these tools, the authors carefully reviewed and edited the content as needed and take full responsibility for the accuracy, originality, and integrity of the final manuscript.

Author contributions

AMI: Conceptualization, Methodology, Validation, Formal analysis, Resources, Data curation, Writing—original draft, Writing—review & editing, Visualization, Project administration. GM: Methodology, Formal analysis, Visualization, Supervision, Project administration. LPZ: Conceptualization, Validation, Formal analysis, Data curation, Writing—original draft, Supervision. SS: Conceptualization, Methodology, Validation, Formal analysis, Resources, Writing—original draft, Writing—review & editing, Visualization, Supervision. FI: Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing—original draft, Writing—review & editing, Visualization, Supervision, Project administration. DVD: Methodology, Validation, Visualization, Supervision. GI: Methodology, Formal analysis, Supervision, Project administration. AP: Conceptualization, Methodology, Validation, Resources, Data curation, Writing—original draft, Writing—review & editing, Visualization, Supervision. GD: Conceptualization, Methodology, Software, Validation, Formal analysis, Resources, Data curation, Writing—original draft, Writing—review & editing, Visualization, Project administration. ADI: Conceptualization, Methodology, Software, Formal analysis, Writing—original draft, Writing—review & editing. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest

Gaetano Isola, who is the Associate Editor of Exploration of Medicine, had no involvement in the decision-making or the review process of this manuscript. The other authors declare no conflicts of interest.

Ethical approval

Not applicable.

Consent to participate

Not applicable.

Consent to publication

Not applicable.

Availability of data and materials

The primary data for this systematic review were sourced online from databases listed in the methods. Referenced articles are accessible on PubMed, Scopus, and Web of Science. Additional supporting data are available from the corresponding author upon request.

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