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Myofunctional therapy in sleep disorders: a systematic review

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Abstract

Background: Obstructive sleep apnea (OSA) is a syndrome characterized by episodes of complete cessation of breathing (apnea) or inadequate breathing (hypopnea) during sleep.

Methods: A systematic search of PubMed, Cochrane Library, Embase, Scopus, Web of Science, and Lilacs databases was conducted following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We identified 1,532 records; after screening, 9 randomized controlled trials (RCTs), published between 2009 and 2020, met the inclusion criteria. These studies included 698 participants aged 5–75 years.

Results: Nine randomized trials (n = 698; 2009–2020) showed that myofunctional therapy (MFT), alone or as an adjunct, for example, continuous positive airway pressure (CPAP) and nasal washing, reduced apnea-hypopnea index (AHI) versus control in adults and children. Snoring intensity improved in trials that measured it; several studies reported gains in oxygen saturation and mouth-breathing reduction. Protocols targeted the soft palate, tongue, and facial muscles with daily home exercises.

Discussion: MFT appears to be a promising non-invasive treatment for reducing AHI, especially in pediatric patients. Its benefits extend beyond AHI reduction, supporting orofacial function and nasal breathing. However, its clinical integration remains limited due to a lack of standardized protocols and inconsistent reporting of patient adherence. Most studies also have short follow-up periods, which makes it difficult to assess long-term efficacy. To advance evidence-based use of MFT, future research should adopt standardized outcomes, monitor adherence systematically, and include long-term follow-up.

Keywords

myofunctional therapy, tongue exercise, breathing exercise, respiratory exercise, apnea, periodontitis, sleep-disordered breathing

Introduction

The obstructive sleep apnea syndrome (OSAS) is a sleep-related disorder in which the upper airway repeatedly collapses during sleep, resulting in either incomplete or total interruption of airflow [1]. Although it affects a significant portion of the population, it often goes unrecognized because its clinical presentation is nonspecific and sometimes misleading. OSAS is classified within the spectrum of sleep-related breathing disturbances, commonly referred to as sleep-disordered breathing (SDB) [2]. Typical features include loud snoring, witnessed apneas, nocturnal gasping, and non-restorative sleep, with daytime sleepiness and cognitive complaints; hypertension and autonomic dysregulation further increase cardiovascular risk [3].

A distinctive complication of OSA in children, not observed in adults, is its effect on growth. Children with OSA often experience weight gain and a catch-up growth period following adenotonsillectomy (AT) [4].

The treatment approach for OSAS varies depending on the severity of the disorder and the patient's age. In milder cases without complications, weight loss is recommended as it can significantly improve the apnea-hypopnea index (AHI). For more complex cases, treatment options may include continuous positive airway pressure (CPAP), mandibular advancement devices (MADs), positional therapies, and surgical interventions aimed at correcting anatomical abnormalities or obstructive defects. In children, the most common factor associated with pediatric OSA is the enlargement of tonsils and adenoids, making AT the primary treatment option. Although AT often results in the cure or improvement of OSA in most cases, residual OSA can still occur, particularly in obese children. The prevalence of postoperative residual OSA ranges from 13% to 29% in low-risk populations and can reach levels of up to 73% when obese children are considered. Furthermore, orofacial myofunctional disorders may persist even after successful surgery [5].

While PAP therapy is the mainstay treatment for OSA in adults, its role in pediatric OSA is limited to a subset of children who do not respond to AT or when upper airway obstruction is not primarily caused by adeno-tonsillar hypertrophy, such as in cases of obesity or craniofacial abnormalities [6]. CPAP treatment is well-tolerated and highly effective in infants and older children with OSA. However, practitioners may encounter challenges in finding appropriate equipment and interfaces, particularly for infants and young children [7].

According to another systematic review, rapid maxillary expansion (RME) devices have shown promise as an effective alternative treatment for pediatric OSAS [8]. These devices involve the RME and have been found to be beneficial [9, 10]. In addition to anatomical airway narrowing, neuro-muscular factors contribute to OSA, such as decreased function of the upper airway dilator muscles during sleep or poor muscle activation. Some researchers have explored the relationship between neuromuscular factors and OSA, specifically residual OSA after AT or orthodontic treatment in childhood, supporting the inclusion of orofacial myofunctional therapy (OMT) as an adjunctive approach in pediatric SDB/OSA, including residual OSA after AT [11–13]. The exercises involved in OMT target the soft palate, tongue, and facial muscles, as well as stomatognathic functions. Soft palate exercises include continuous or intermittent pronunciation of oral vocal sounds, while tongue exercises involve various movements along the palatal and buccal surfaces of the teeth. Facial exercises target the lips, buccinators, and jaw muscles. Stomatognathic functions are addressed through nasal inhalation, oral exhalation, blowing and inflating a balloon, as well as specific swallowing and chewing exercises.

The aim of this study was to evaluate the validity of myofunctional therapy (MFT) in the treatment of disordered breathing and OSAS in both children and adults. Globally, it is estimated that approximately 936 million adults aged 30–69 years suffer from mild to severe OSAS, with the majority remaining undiagnosed [14]. The socioeconomic burden of OSAS includes increased healthcare costs, reduced work productivity, and a higher incidence of workplace and traffic accidents, highlighting the need for effective, accessible treatment strategies such as MFT [15, 16].

Compared with prior reviews, this study restricts inclusion to randomized trials only, reports reproducible, exercise-level details of MFT (target muscles, frequency, session length), separates pediatric and adult outcomes, pre-specifies AHI and snoring as primary endpoints, and appraises bias with current RoB 2.0 criteria. This combination provides a tighter estimate of effectiveness and practical parameters for clinical translation.

Materials and methods

Guidelines

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was adhered to as much as possible. In the study section paragraph, there is the PRISMA flowchart.

Population, intervention, comparison, outcome (PICO) question

This review was designed following PICO guidelines to determine the:

1) population: children and adults diagnosed with OSAS;
2) intervention: MFT;
3) comparison: MFT versus another therapy;
4) outcomes: The primary outcome was to evaluate AHI and snoring.

The secondary outcome was to investigate the efficacy of MFT in the patients with OSAS children and adults.

Search strategy

We registered the protocol on international prospective register of systematic reviews (PROSPERO) (CRD42021237554) and followed PRISMA. Searches were run in PubMed, Scopus, Embase, Web of Science, Cochrane Library, and Lilacs from 1 Jan 2009 to 31 Dec 2020; English language; humans. The core string (adapted per database) was: (myofunctional therapy OR orofacial myotherapy OR oropharyngeal exercise OR tongue exercise OR swallowing exercise OR breathing exercise) AND (apnea OR OSA OR OSAS OR snoring OR sleep-disordered breathing). Two reviewers (SS and CV), independently, deduplicated (EndNote X9), screened titles/abstracts (Rayyan), and assessed full texts; disagreements were resolved by a third reviewer (MP). Pre-specified outcomes: primary AHI and snoring; secondary oxygen saturation, daytime symptoms/sleep quality, mouth breathing, and adherence. Risk of bias was assessed with Cochrane RoB 2.0. Owing to heterogeneity of protocols and populations, we performed a structured narrative synthesis and reported effect directions; no meta-analysis was attempted. Searches were conducted up to 31 Dec 2020 according to the original protocol; therefore, studies published after this date were not included.

Inclusion criteria

We included randomized controlled trials (RCTs) that focused on the efficacy of respiratory muscle therapy compared to control therapy or no treatment. Studies involving participants of any age group, ranging from 5 to 75 years old, were considered.

Exclusion criteria

We excluded articles published prior to 2009, abstracts, letters to the editor, pilot studies, commentaries, literature reviews, systematic reviews, case reports, case series, animal studies, and clinical guidelines.

However, literature reviews, systematic reviews, and clinical guidelines were screened to identify relevant RCTs.

Study selection 1

A. The selection process for this study was made in two phases. In the first stage, studies were considered according to the following inclusion (A): MFT and SDB.

B. Language restrictions: English.

C. Studies after 2009.

Study selection 2

The initial electronic search strategy yielded a total of 1,532 articles. After eliminating 1,305 duplicate records, 227 studies proceeded to title and abstract screening. At this stage, 203 papers were excluded (157 reviews and 46 unrelated to the topic). Consequently, 24 articles were retrieved for full-text assessment, of which 15 were further excluded for being off-topic. In the end, 9 studies fulfilled all the inclusion criteria and were incorporated into the systematic review. The selection process is visually presented in a PRISMA flowchart (Figure 1).

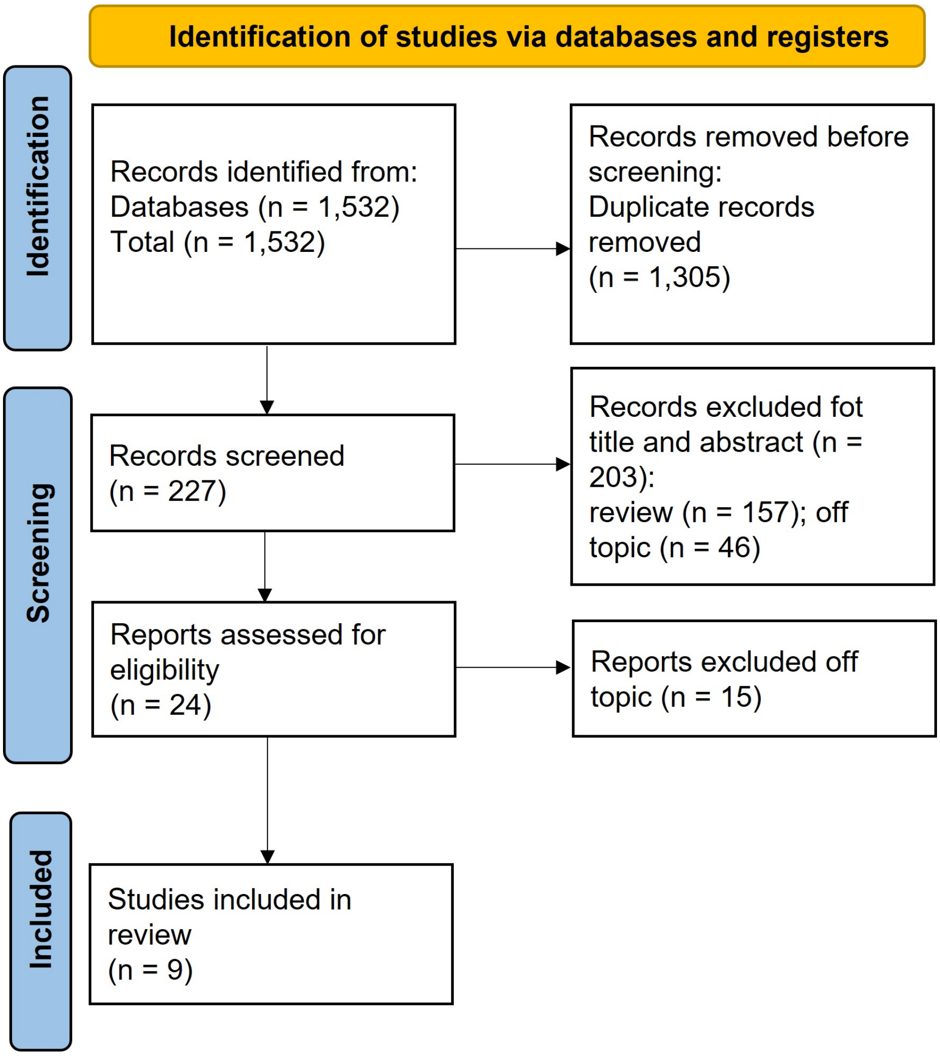

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. Adapted from [17]. Accessed Mar 1, 2026.

Data screening and extraction

Duplicate records were removed using EndNote X9 software. Two independent reviewers (SS and CV) then performed title and abstract screening in a blinded fashion using Rayyan QCRI. Discrepancies were resolved by consensus or by consulting a third reviewer (MP). Studies were selected based on methodological rigor, including clarity of outcome definitions, completeness of follow-up, and use of intention-to-treat analysis. All the authors separately did initial screenings. At this stage, the title and abstract, if available, were analyzed by all the authors. The articles were selected if considered interesting by all the reviewers. A detailed full-text analysis was carried out, and three reviewers (SS, CV, and MP) extracted data from each study. There was no dissent related to data screening and extraction.

Data analysis

This systematic review was carried out by using original studies, comparative studies, research journal articles and, once analyzed, we collected data regarding six areas (country- design- sample size, intervention, inclusion criteria, sex and age, time, outcomes) as summary in Table 1 and other five areas (intervention therapy, details, duration, frequency, control therapy) as summary in Table 2. We also extracted protocol fidelity/adherence (sessions/day, minutes/session, completion rate) when available, to contextualize AHI changes.

Table 1. Main characteristics of randomized controlled trials (RCTs) included in the systematic review, reporting study design, sample size, intervention type, inclusion criteria, demographics, follow-up time, and evaluated outcomes.

Study	Country/Disctrict, design, sample size	Intervention	Inclusion criteria	Sex and age	Time	Outcomes
Villa et al. (2015) [11]	Italy, single-blinded RCT, *n*: 27	OE + nasal washing, *n*: 14 Controls (nasal washing), *n*: 13	Children with AHI > 5 events/h Children with residual OSAS AHI > 1 event/h after AT persistence of respiratory symptoms	4.82 ± 1.36 years 24 males 3 females	2 months of treatment	AHI, oxygen saturation, SCR, IOPI measurements
Diaferia et al. (2013) [18]	Brazil, RCT, n.d.	MFT + CPAP vs. sham	OSAS patients (criteria not detailed)	n.d.	3 months	AHI, snoring, oxygen saturation
Diaféria et al. (2017) [19]	Brazil, RCT, n.d.	MFT + CPAP vs. sham	OSAS patients (criteria not detailed)	n.d.	3 months	AHI, PSG, functional outcomes
Erturk et al. (2020) [20]	Turkey, non-blinded RCT, *n*: 41	IMT, *n*:15 OE, *n*: 14 Control, *n*: 12	Patients with mild, moderate, or severe OSAS, were not using CPAP	Patients aged 19 to 75 years	3 months of treatment	AHI, PSG, MIP and MEP values, inspiratory muscle work and expiratory muscle work outcomes
Guimarães et al. (2009) [21]	Brazil, single-blinded RCT, *n*: 31	OE, *n*: 16 Controls (deep breathing), *n*: 15	Patients between 25 and 65 years of age with a recent diagnosis of moderate OSAS	Intervention group: 51.5 ± 6.8 years Controls: 47.7 ± 9.8 years 21 males 10 females	3 months of treatment	AHI, PSG, snoring outcomes Epworth daytime sleepiness scale, and Pittsburgh sleep quality index questionnaires
Villa et al. (2017) [22]	Italy, single-blinded RCT, n.d.	OE vs. nasal washing	Children with OSAS	n.d.	2 months	AHI, sleep quality
Ieto et al. (2015) [23]	Brazil, RCT, n.d.	OE + nasal washing vs. control	Adults with primary snoring or mild OSAS	n.d.	3 months	Snoring intensity, AHI

Table 1. Main characteristics of randomized controlled trials (RCTs) included in the systematic review, reporting study design, sample size, intervention type, inclusion criteria, demographics, follow-up time, and evaluated outcomes. (*continued*)

Study	Country/Disctrict, design, sample size	Intervention	Inclusion criteria	Sex and age	Time	Outcomes
Kim et al. (2020) [24]	Korea, RCT, n.d.	MFT vs. no treatment	Adults with OSAS	n.d.	12 weeks	AHI, sleep parameters
Lin et al. (2020) [25]	Taiwan, China, RCT, n.d.	Nasal washing + MFT + endurance training vs. control	Adults with OSAS	n.d.	12 weeks	AHI, oxygen saturation, functional outcomes

n.d.: no data. AHI: apnea-hypopnea index; AT: adenotonsillectomy; CPAP: continuous positive airway pressure; IMT: inspiratory muscle training; IOPI: Iowa Oral Performance Instrument; MEP: maximal expiratory pressure; MFT: myofunctional therapy; MIP: maximal inspiratory pressure; OE: oropharyngeal exercises; OSAS: obstructive sleep apnea syndrome; PSG: polysomnography; SCR: sleep clinical record.

Table 2. Summary of intervention protocols across the included studies, detailing the type of therapy, specific exercises, duration, frequency, and control conditions.

Study	Intervention therapy	Details	Duration	Frequency	Control therapy
Villa et al. (2015) [11]	OE	Isometric and isotonic exercises, nasal breathing rehabilitation, labial seal and lip tone exercises, and tongue posture exercises	2 months	Three times/day, 10–20 repetitions each time	Nasal washing
Diaferia et al. (2013) [18]	Myofunctional therapy + CPAP therapy	Soft palate, pharyngeal constrictor muscles, suprahyoid muscles, tip and root of the tongue, cheeks, and lips	3 months	20 min, 3 times/day	Head movements without any therapeutic function
Diaféria et al. (2017) [19]	Myofunctional therapy + CPAP therapy	1) Soft palate exercises 2) Tongue brushing 3) Tongue pushing and sucking 4) Tongue rotation 5) Facial exercises	3 months	1) 3 min, 3 times/day 2) 5 min, 3 times/day 3) 20 min, 3 times/day 4) 10 min on each side, 3 times/day	Head movements without any therapeutic function
Erturk et al. (2020) [20]	2 groups: 1) Passive myofunctional therapy with oral device 2) Active myofunctional therapy	1) IMT with a threshold IMT device 2) OE included soft palate, tongue, and facial muscle exercises	12 weeks	7 days/week 5 days/week	Control group not specified
Guimarães et al. (2009) [21]	OE	Exercises for the soft palate, tongue, and facial muscles	3 months	Repeated exercises for a total of about 20 min per day	Deep breathing and nasal washing
Villa et al. (2017) [22]	OE	1) Nasal breathing rehabilitation 2) Labial seal and lip tone exercises 3) Tongue posture exercises	2 months	Three times a day, 10–20 repetitions each time	Nasal washing
Ieto et al. (2015) [23]	Nasal washing and OE	Exercises for the soft palate, tongue, and stomatognathic functions	3 months	8 min set of exercises (20 times), 3 times/day	Deep breathing and nasal washing
Kim et al. (2020) [24]	Myofunctional therapy	Tongue and lips exercises	12 weeks	Perform 10 exercises with 10 repetitions each, and perform at least 10 sets every day	Control group that did not receive any treatment

Table 2. Summary of intervention protocols across the included studies, detailing the type of therapy, specific exercises, duration, frequency, and control conditions. (*continued*)

Study	Intervention therapy	Details	Duration	Frequency	Control therapy
Lin et al. (2020) [25]	Daily nasal washing + myofunctional therapy and general endurance training	Retropalatal, retroglossal, hypopharyngeal, facial, and TMJ exercises	12 weeks	24 sessions, daily nasal washing + upper airway muscle strengthening for 20 min, respiratory muscle strengthening for 15 min, and general endurance training for 45 min	Control group that did not receive any treatment

CPAP: continuous positive airway pressure; IMT: inspiratory muscle training; OE: oropharyngeal exercises; TMJ: temporomandibular joint.

Eligible interventions and comparators

We considered studies evaluating MFT delivered as a stand-alone program or in combination with other therapies (e.g., CPAP, adjunctive breathing/aerobic training, nasal washing), as well as trials comparing active vs. passive MFT approaches or sham protocols [11, 19–21, 24]. For each study, we extracted the MFT protocol (exercise set, frequency, duration), the comparator(s) (e.g., usual care, CPAP, sham), and follow-up. This information was prespecified in the extraction form and did not contribute to effect estimation beyond descriptive synthesis.

Quality assessment

Three reviewers (SS, CV, and MP) independently evaluated the risk of bias. This evaluation was carried out following the Cochrane-recommended approach for assessing the risk of bias in randomized controlled clinical studies, including four quality parameters: sequence generation, consideration of incomplete outcome data, freedom of selective outcome reporting, and other sources of bias.

Outcome measures

The primary outcome was to evaluate AHI and snoring.

The secondary outcome was to investigate the efficacy of MFT in patients with OSAS children and adults.

Level of evidence

Levels of evidence and grade of recommendation followed the grading recommendations of the GRADE Working Group [26].

Our 9 final studies, published between 2009 and 2020, in Table 3, were all level 2B since we excluded reviews and meta-analyses, which would have been level 1A.

Table 3. Summary of the risk of bias for each article included in the systematic review.

Study	Incomplete outcome data	Selective reporting	Other bias
Villa et al. (2015) [11]	+	+	?
Diaferia et al. (2013) [18]	+	+	?
Diaféria et al. (2017) [19]	+	–	?
Erturk et al. (2020) [20]	–	–	?
Guimarães et al. (2009) [21]	–	–	–
Villa et al. (2017) [22]	–	–	?
Ieto et al. (2015) [23]	–	–	?
Kim et al. (2020) [24]	–	+	?
Lin et al. (2020) [25]	?	?	+

+: low risk of bias; –: high risk of bias; ?: unclear risk of bias.

Results

Assessment of risk of bias

The studies were evaluated as having high, unclear, or low risk, based on selection bias, as can be observed in Table 3. The evaluation of the methodological quality of the included studies revealed variable levels of bias across different domains. Regarding incomplete outcome data, three studies [18, 19, 22] were judged at low risk, while the majority of the others presented a high or unclear risk. For selective reporting, consistent low risk was observed in the earlier trials by the other two studies [18, 22], whereas other studies showed either high or unclear risk, suggesting that outcome reporting was not always sufficiently transparent. With respect to other potential sources of bias, most trials were rated as unclear, reflecting insufficient information to permit a firm judgment, while a few were assessed as high risk. Overall, older and more methodologically rigorous studies tended to report lower risks of bias, while more recent investigations often suffered from limitations such as incomplete reporting, small sample sizes, or insufficient methodological details. This heterogeneity in study quality highlights the need for standardized protocols and more robust trial designs in future research on MFT for OSAS.

Characteristics of interventions across included studies

Across the included trials, MFT was delivered in several configurations:

1) stand-alone exercise programs targeting tongue, soft palate, and orofacial muscles;
2) randomized comparisons allocating patients to MFT, CPAP, combined MFT + CPAP, or sham/speech therapy;
3) head-to-head comparisons of active vs. passive MFT approaches;
4) adjunctive combinations, such as MFT with nasal washing or with aerobic training sessions.

This heterogeneity in delivery and co-interventions is summarized in Table 1 (study characteristics) and is considered in the interpretation of effects below.

Effects of interventions

The primary outcome was to evaluate AHI and snoring. The results of this systematic review indicate that with MFT, there is a reduction in the index, but the reduction in snoring is not evaluated in all articles, but Ieto et al. [23] demonstrated that oropharyngeal exercises are effective in reducing objectively measured snoring and are possible treatment of population suffering from snoring [27].

The secondary outcome was to investigate the efficacy of MFT in the patients with OSAS children and adults and the results demonstrated that use both alone and in combination with other therapies is useful in both adult and children's patients. While AHI reduction was consistently reported and remains the main outcome, other clinically relevant endpoints such as snoring intensity, sleep quality, daytime sleepiness, and patient-reported quality of life were not systematically assessed.

Notably, several studies reported a more pronounced reduction in AHI among pediatric patients compared to adults, possibly due to greater tissue plasticity and neuromuscular responsiveness in younger subjects. Additionally, improvements in peripheral oxygen saturation and reductions in mouth breathing were consistently reported, particularly in interventions combining MFT with nasal breathing exercises.

Across 9 RCTs, MFT reduced AHI versus control or usual care; snoring reduction was demonstrated in two trials that measured it; oxygen saturation and mouth breathing improved in several pediatric cohorts. These outcomes are highly consistent with emerging evidence that early functional rehabilitation can enhance upper airway tone, reduce obstruction, and improve overall sleep quality.

Discussion

Overall discussion

While the Results section objectively summarizes study outcomes, here we discuss mechanisms, patient adherence, and the clinical significance of these findings. OSAS is defined as a pathology that recognizes multiple risk factors for its development, often combined with each other [20].

The mechanism of action underlying this correlation could be based on structural or functional alterations. The therapeutic approach must also be aimed at acting on various factors. Even some craniofacial factors, such as a reduced size of the skull and jaw or the reduced width of the upper respiratory tract, or a short lingual frenulum, are currently considered risk factors in the development of OSAS, together with particular malocclusions [11, 18, 23]. In the diagnosis and therapeutic choice, we must pay attention to the age of the patient, particularly in adolescents and children; therefore, the treatment of malocclusions through orthodontic or functional therapy could represent a fundamentally important aid in the treatment of OSAS in pediatric individuals [28–30]. CPAP remains the standard treatment for the most severe forms of OSAS. MADs are also highly effective in patients with moderate or severe diseases who are unable to tolerate CPAP. However, their use can be more challenging in partially or completely edentulous patients, although in such cases, integrated osteo-implants may represent a possible solution [21].

The MFT approach: a set of exercises that involve the soft palate, tongue, and facial muscles closely involved in the apnea characteristic of the syndrome; this can, in fact, determine a notable improvement in the parameters commonly used to monitor obstructive apnea syndromes, up to reducing the AHI by 50%. The physiological rationale behind these improvements lies in the enhancement of upper airway muscle tone and coordination. By strengthening the tongue, soft palate, and oropharyngeal muscles, MFT reduces airway collapsibility during sleep and promotes more stable breathing patterns. Improved nasal breathing and swallowing function further contribute to maintaining airway patency and reducing mouth breathing, mechanisms that explain the observed clinical benefits [31].

However, regarding many of these cofactors and the effect of these therapies, considerable confusion remains in the scientific world, and it is of fundamental importance to clarify their action in order to intercept and promptly treat this pathology. The study characteristics of the selected articles demonstrate the rigorous approach taken to assess the effectiveness of MFT in the treatment of OSAS [20]. Among the 9 chosen studies, considered the gold standard in clinical research for evaluating treatment efficacy. The inclusion of a minimum sample size of 15 patients in all studies ensures that the results are based on a sufficiently representative group, enhancing the reliability and generalizability of the findings. Furthermore, the minimum follow-up period of 2 months in each study allows for the evaluation of the sustained impact of MFT on OSAS over a reasonable timeframe [25].

Qualitative characteristics

Regarding qualitative characteristics, the consistent reporting of primary outcome measurements across all studies, such as the AHI, Apnea Index, oxygen saturation levels, snoring intensity, and neck circumference, highlights the standardized and comprehensive approach taken in assessing the effectiveness of MFT. These outcome measures are crucial in capturing different aspects of OSAS severity and the treatment response, ensuring a comprehensive evaluation of the therapy's impact [22]. A major factor influencing the efficacy of MFT is patient compliance. Unlike CPAP, which offers a passive form of treatment, MFT requires active daily participation. Studies have shown that higher adherence to exercise frequency is directly associated with greater reductions in AHI and symptom severity. However, adherence metrics were rarely quantified in the included studies, making it difficult to assess dropout reasons or long-term feasibility. Strategies such as structured follow-up, caregiver involvement for pediatric patients, and the integration of digital tools (e.g., mobile applications, telemonitoring) could improve compliance and should be considered in future trials. However, variability in exercise protocols across studies poses a challenge to reproducibility [19]. There is currently no universally accepted standardized regimen, and this heterogeneity limits the ability to draw definitive conclusions on the most effective therapeutic approach [32, 33].

Adherence to MFT represents a critical factor for its effectiveness. Unlike CPAP, which provides a passive treatment modality, MFT requires active, daily patient engagement. Reported adherence rates varied across studies and were not always explicitly quantified, but several authors noted difficulties related to motivation, time commitment, and integration of exercises into daily routines. Potential barriers included a lack of supervision, limited awareness of the long-term benefits, and the repetitive nature of the exercises. Dropouts were often associated with poor motivation or perceived limited benefits. These findings underscore the importance of structured follow-up, patient education, and possibly the use of digital tools (e.g., mobile applications or telemonitoring) to enhance compliance. Future trials should systematically measure and report adherence data, since feasibility is essential for translating MFT into routine clinical practice.

In addition to behavioral interventions such as MFT, recent advances in neurotechnology have opened novel therapeutic perspectives. Temporal interference (TI) stimulation, a non-invasive technique using intersecting high-frequency electrical fields to selectively activate deep neural targets, has shown preliminary promise in modulating hypoglossal nerve activity and oropharyngeal muscles involved in OSA pathophysiology. Early studies suggest that TI stimulation may achieve functional benefits similar to MFT while overcoming the challenge of patient adherence, since it does not require daily active participation. Although still experimental, these innovations highlight the potential future integration of neuromodulation strategies with conventional therapies to broaden the management options for OSA.

Although a formal meta-analysis could not be conducted because of the high variability in study designs, populations, and intervention protocols, the findings highlight the urgent need for standardization. A preliminary framework for future MFT protocols could include:

1) clearly defined sets of oropharyngeal and tongue exercises;
2) standardized daily frequency and session duration;
3) minimum treatment length of 8–12 weeks;
4) objective outcome measures such as AHI reduction and polysomnography;
5) systematic assessment of secondary outcomes, including snoring, oxygen saturation, and quality of life.

Such a framework may guide future clinical trials and support the development of reproducible, evidence-based guidelines. To enhance clinical applicability, we also provide in Table 4 a preliminary summary of key elements that could form the basis for future standardized MFT protocols.

Table 4. Proposed framework for future MFT protocols.

Component	Recommendation
Exercise types	Oropharyngeal and tongue exercises
Frequency	2–3 sessions/day
Duration per session	15–20 min
Total treatment length	8–12 weeks minimum
Primary outcomes	AHI reduction, PSG
Secondary outcomes	Snoring, oxygen saturation, QOL

AHI: apnea-hypopnea index; MFT: myofunctional therapy; PSG: polysomnography, QOL: quality of life.

Population

The inclusion of a total population of 698 patients with OSAS, derived from the nine included studies, strengthens the reliability and relevance of the findings [13]. The large number of participants allows for a more comprehensive assessment of the effectiveness of various MFT interventions in managing OSAS. The confirmation of the OSAS diagnosis through clinical examinations, particularly polysomnography, ensures the accuracy and validity of the patient selection, enhancing the overall robustness of the review [23]. As far as MFT is concerned, it still has many limitations; there are not many publications that can validate protocols that make MFT fundamental for the treatment of OSA [11].

There is a clear lack of cooperation among the various medical professionals involved in the treatment of OSAS.

Study limitations

This systematic review has several limitations that should be acknowledged. First, the number of RCTs available on MFT in OSAS is still limited, and the sample sizes of most included studies were relatively small, which may reduce the generalizability of the findings. Second, the included trials were highly heterogeneous in terms of study design, patient populations (adults versus children, varying severity of OSAS), and especially in the type, frequency, and duration of MFT exercises. The absence of a standardized protocol makes it difficult to establish optimal treatment parameters and reduces comparability across studies. Third, although AHI reduction was consistently reported and remains the main outcome, other clinically relevant endpoints such as snoring intensity, sleep quality, daytime sleepiness, and patient-reported quality of life were inconsistently measured across the trials. These outcomes were therefore not omitted from our analysis but were often unavailable due to study design limitations. Moreover, long-term follow-up data are largely lacking, since most included trials assessed outcomes only over short periods (2–6 months). As a result, the durability of MFT effects beyond the intervention phase remains uncertain. Finally, some studies presented methodological weaknesses, including unclear allocation procedures, incomplete reporting of outcomes, or potential sources of bias, as highlighted in our risk of bias assessment. Publication bias cannot be ruled out, since only English-language articles were included. Taken together, these limitations suggest that while current evidence supports a potential role for MFT in OSAS management, further large-scale, well-designed, and standardized trials with longer follow-up are required before firm conclusions can be drawn.

In conclusion, this systematic review indicates that MFT can reduce the AHI and may improve snoring, oxygen saturation, and mouth breathing, with particularly encouraging signals in pediatric populations. To establish its role in routine care, future multicenter trials should adopt standardized exercise protocols (clearly defined sets, frequency, and duration), monitor adherence systematically, include core outcome sets encompassing both objective sleep metrics and patient-relevant measures, and ensure longer follow-up to assess durability. Comparative designs against, or in combination with, CPAP and MADs will help position MFT within integrated OSA pathways.

Abbreviations

AHI: apnea-hypopnea index

AT: adenotonsillectomy

CPAP: continuous positive airway pressure

IMT: inspiratory muscle training

IOPI: Iowa Oral Performance Instrument

MADs: mandibular advancement devices

MEP: maximal expiratory pressure

MFT: myofunctional therapy

MIP: maximal inspiratory pressure

OE: oropharyngeal exercises

OMT: orofacial myofunctional therapy

OSA: obstructive sleep apnea

OSAS: obstructive sleep apnea syndrome

PICO: population, intervention, comparison, outcome

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PSG: polysomnography

QOL: quality of life

RCTs: randomized controlled trials

RME: rapid maxillary expansion

SCR: sleep clinical record

SDB: sleep-disordered breathing

TI: temporal interference

TMJ: temporomandibular joint

Declarations

Author contributions

SS: Resources, Data curation, Formal analysis, Software. CV: Resources, Data curation, Formal analysis, Software. MP: Conceptualization, Formal analysis, Data curation. SES: Investigation, Visualization. FI: Formal analysis, Supervision. LF: Validation, Formal analysis, Writing—review & editing. ADI: Methodology, Investigation. AP: Software, Formal analysis. GI: Methodology, Software. GD: Conceptualization, Formal analysis. AMI: Validation, Investigation. All authors read and approved the submitted version.

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

This study does not involve original data; all data analyzed are publicly available and have been appropriately cited.

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