Research article

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Kumaresan oropharyngeal facilitation technique (KOFT)

Abstract

Background: Puberphonia is characterized by the persistence of a high-pitched voice after puberty, often affecting communication and social functioning. Existing management strategies include behavioral therapy and surgical interventions, with variable outcomes. Uvula Manipulation and Resonance (UMAR) is a technique designed to oropharyngeal facilitation in phonation from the larynx to the pharynx to facilitate pitch lowering.

Methods: The UMAR technique was applied in 1,650 individuals diagnosed with puberphonia. The intervention involves coordinated uvular movement during phonation combined with diaphragmatic breathing to modify airflow and resonance. Repeated practice was used to establish a conditioned neuromuscular pattern aimed at replacing the habitual high-pitched voice.

Results: Among the 1,650 cases, a majority demonstrated a measurable reduction in vocal pitch and improvement in voice quality following implementation of the technique. Maintenance of lower pitch was observed with continued practice. Reports of improved social interaction and self-perception were also documented.

Conclusion: UMAR represents a non-invasive, low-cost intervention for puberphonia that facilitates pitch reduction through modification of resonance and airflow. The technique shows consistent outcomes across a large case series. Further controlled studies with objective acoustic measures and long-term follow-up are required to validate efficacy and generalizability.

Keywords: oropharyngeal facilitation phonation, umar, puberphonia, breath of fire, phonation valves, kulavai, ululation

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Introduction

Background

Puberphonia (also referred to as mutational falsetto or functional falsetto) is a functional voice disorder characterized by the persistence of an abnormally high-pitched voice after puberty despite normal anatomical development of the larynx and secondary sexual characteristics.[1] It predominantly affects adolescent and young adult males and may lead to significant psychosocial distress, including reduced self-confidence, social withdrawal, and impaired quality of life.[2]

The production of normal voice depends on coordinated interaction between respiratory airflow, vocal fold vibration, and supralaryngeal vocal tract resonance. The vocal folds serve as the primary sound source by converting aerodynamic energy into acoustic energy, while the pharynx, oral cavity, and nasal cavity modify this sound through resonance and articulation.[3] Among these supralaryngeal structures, the velopharyngeal mechanism-including the soft palate and uvula-plays an important role in regulating airflow between the oral and nasal cavities and contributes to resonance control during speech production.[4] Although the uvula itself is not a primary generator of voice, its mobility and position may influence upper airway airflow dynamics and resonance characteristics.

Human beings possess highly developed speech, unlike animals, and the presence and active function of the uvula contribute significantly to speech production. During speech, the uvula and the attached velum (soft palate) play a major role in regulating airflow and resonance within the vocal tract. Although the vocal cords are essential for sound generation, the uvula is highly active during articulation and remarkably does not become painful or fatigued even after prolonged speech. Magnetic resonance imaging (MRI) of the vocal tract is an effective method for visualizing and measuring the dynamic movements of articulators such as the uvula and velum during speech production, as demonstrated in Figure 1A-C.[5]

A B C

Figure 1A - C Role of the uvula in human speech production: MRI visualization of velopharyngeal movement.

In puberphonia, vocal fold vibration is restricted mainly to the thin edge of the vocal folds, producing a high-pitched, weak, and breathy voice. This incomplete vibration creates a phonatory gap between the vocal cords during speech, reducing the efficiency of phonation and vocal strength. The principle of UMAR aims to improve vocal fold function by facilitating better approximation and effective vibration of the vocal folds, thereby enhancing voice quality, resonance, and phonatory efficiency. Figures 2 A-D illustrate the phonatory gap and the altered vibratory pattern of the vocal folds observed in puberphonia (Figure 2 A-D).

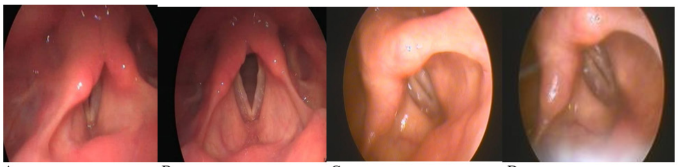


Figure 2 A-D Principle of UMAR in the treatment of puberphonia: restoration of effective vocal fold vibration and phonation.

Current challenges in puberphonia treatment

Conventional management of puberphonia primarily includes behavioral voice therapy, counseling, and manual laryngeal reposturing techniques. These approaches are generally effective; however, treatment outcomes may be limited by delayed presentation, poor patient compliance, psychological resistance, and recurrence of high-pitched phonation patterns.[6] In refractory cases, surgical interventions such as type III thyroplasty have been described, though they remain invasive and are usually reserved for treatment failures.[7]Despite high success rates reported with traditional voice therapy, there remains a subgroup of patients who do not respond adequately or require prolonged treatment. This highlights the need for alternative or complementary therapeutic strategies.

Research gap

Current puberphonia treatment methods largely focus on modifying laryngeal behavior or external manual manipulation of the larynx. Limited research has examined whether targeted manipulation of supralaryngeal structures-particularly the velopharyngeal and oropharyngeal components-can facilitate rapid pitch reduction and stabilization.

Furthermore, there is insufficient evidence regarding the potential therapeutic role of uvular or pharyngeal stimulation in altering resonance patterns and supporting long-term voice normalization. Novel techniques such as UMAR have been reported clinically, but their physiological basis and reproducibility remain underexplored in the scientific literature.[8]

Physiological rationale for UMAR

The UMAR technique is based on the concept that modifying upper airway resonance and enhancing patient awareness of pharyngeal resonance may facilitate production of a lower-pitched, more age-appropriate voice. UMAR is proposed to influence resonance behavior by stimulating the uvular and oropharyngeal region, thereby encouraging more efficient use of the pharyngeal resonating cavity.

This mechanism may resemble the naturally lower resonance patterns observed during non-speech vocal behaviors such as coughing, throat clearing, or snoring, where pharyngeal involvement is more prominent.[9] However, this proposed mechanism remains theoretical and requires objective validation through acoustic, aerodynamic, and imaging-based studies.

Significance of the study

Developing a rapid, minimally invasive, office-based intervention for puberphonia could reduce treatment duration, improve patient compliance, and expand access to care-especially in settings where specialized voice therapy services are limited. If validated, UMAR may serve as a useful adjunct or alternative to conventional therapy.

Study objective

The primary objective of this study is to evaluate the effectiveness of UMAR in achieving immediate and sustained reduction of vocal pitch in patients with puberphonia.

Hypothesis

We hypothesize that targeted uvular and pharyngeal manipulation through the UMAR technique can facilitate lower-pitched voice production by optimizing supralaryngeal resonance and improving pharyngeal resonance awareness, thereby producing a more stable and adult-like voice in patients with puberphonia.

Methods and materials

Study design

This study was designed as a prospective interventional clinical study evaluating the effectiveness of UMAR therapy in patients diagnosed with puberphonia. The study was conducted at Siva ENT Hospital. A total of 1,650 patients with puberphonia were treated, including 1,612 patients from different states of India and 38 international patients. We are treating puberphonia globally. These maps give a clear picture of the statistics of puberphonia treated. We had patients from all the states of India. These maps give a clear picture of the statistics of puberphonia treated (Figure 3, Figure 4 A&B).

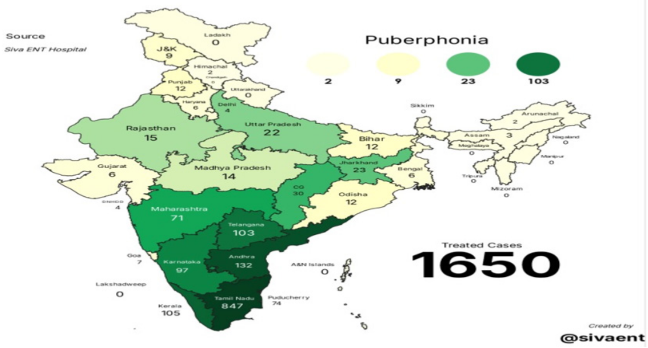
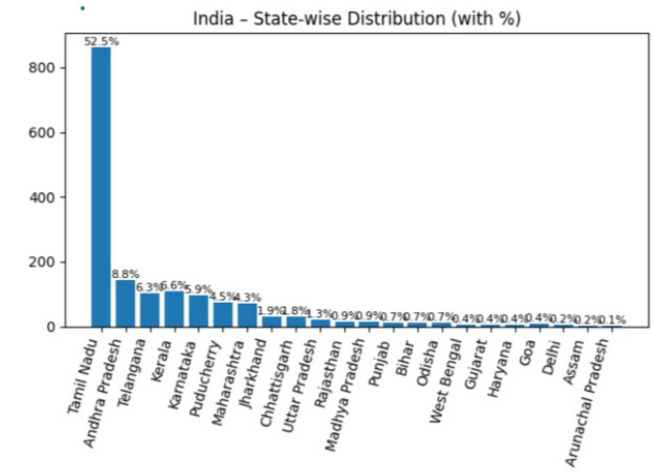


Figure 3 Puberphonia treated patient in India -1612, Puberphonia Foreign treated patient - 38



A

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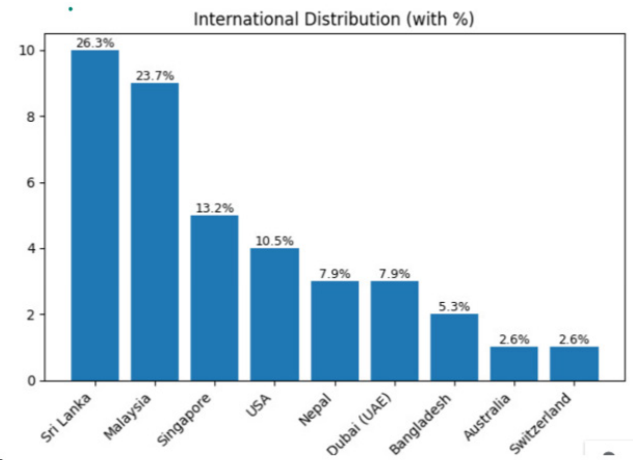


B

Figure 4A&B Geographical distribution and statistics of puberphonia patients treated in india and abroad

Illustrates the geographical distribution and statistical overview of puberphonia patients treated globally. The treatment program has managed patients from all states across India as well as from several foreign countries, demonstrating the wide reach and acceptance of the treatment approach. A total of 1,612 patients with puberphonia were treated from different regions of India, while 38 patients were treated from abroad. Top: The maps provide a clear visual representation of the national and international distribution of patients who underwent treatment for puberphonia. Middle: The graph represent Indian puberphonia treated state wise with percentage. Bottom: The graph represents International puberphonia treated in our center with percentage.

Study population

Male patients presenting with persistent high-pitched voice following puberty and clinically diagnosed with puberphonia were included in the study.

Inclusion Criteria

- Male patients with persistent high-pitched voice after puberty
- Age above 15 years
- Clinical diagnosis of puberphonia confirmed by ENT and laryngeal examination
- Patients willing to undergo UMAR therapy and follow-up evaluation

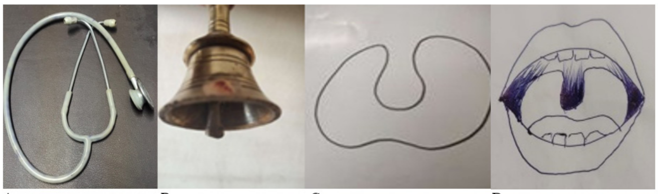
Exclusion criteria

- Structural vocal cord lesions or laryngeal paralysis
- Neurological disorders affecting speech or phonation
- Endocrine abnormalities associated with voice disorders
- Previous laryngeal surgery or ongoing voice therapy elsewhere
- Psychiatric illness interfering with compliance or voice assessment

Clinical evaluation

All patients underwent detailed otorhinolaryngological examination, including video laryngoscopic and stroboscopic assessment of the vocal folds to exclude organic pathology and to evaluate phonatory behavior.

The acoustic principle of uvular vibration may be compared with the sound production of a bell. A large bell produces a lower-pitched sound because its greater size results in slower vibration compared to a smaller bell (Figure 5 B). Similarly, in a medical stethoscope, the bell component is designed to detect low-frequency sounds, whereas the diaphragm is used for high-frequency sounds (Figure 5A). These comparisons help explain the role of uvular vibration and resonance in the generation of low-frequency vocal sounds.



A B C D

Figure 5 A-D Role of the uvula in speech production and comparison with bell acoustics in low-frequency sound generation.

The uvula functions as both a passive and active articulator in speech production. In several languages, including French, Arabic, Hebrew, and German, the uvula actively participates in producing uvular consonants and trills. During the production of the voiced uvular trill [ʀ], airflow directed over the back of the tongue causes the uvula to vibrate rapidly against the tongue, generating characteristic speech sounds, as illustrated in (Figures 5C & D).

Voice assessment

Baseline and post-treatment voice assessments were performed using perceptual and acoustic evaluation methods.

Perceptual assessment

Voice quality was assessed using the GRBAS scale, which evaluates:

- Grade
- Roughness
- Breathiness
- Asthenia
- Strain

In addition, the Kumaresan Voice Pitch Index was used as a supplementary clinical tool to evaluate the severity of puberphonia and treatment-related voice changes. The index assesses multiple voice characteristics associated with puberphonia, including vocal fatigue, inaudibility, and child-like voice quality.

Acoustic assessment

Objective acoustic voice analysis was performed using fundamental frequency (F0) measurements before and after treatment. Changes in pitch range and voice frequency were documented and graphically analyzed in selected cases. Sustained phonation and conversational speech samples were recorded for comparison during follow-up.

Intervention: UMAR Procedure

The UMAR procedure was performed in a minor operation theater under aseptic precautions. Patients were placed in the supine position, and topical local anesthesia (Xylocaine) was applied to the uvula.

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A sterile silk suture was temporarily placed through the uvula to facilitate manipulation and resonance training.

Following the procedure, patients underwent intensive resonance-based voice therapy aimed at facilitating lower-pitched phonation and improving pharyngeal resonance. Training sessions were conducted over a 5-day period and included:

1. Breathing exercises ("Breath of Fire" technique)
2. Resonance and pitch-lowering exercises
3. Instrument-assisted pitch practice (piano-based exercises)
4. Audio-visual and karaoke-assisted training
5. Virtual audience and microphone stage practice
6. Treadmill-assisted voice exercises
7. Vibration-assisted resonance training
8. Interactive AI-assisted speech practice
9. Uvular sound

Uvula to vibrate rapidly against the back of the tongue, thereby generating the characteristic guttural sound (Figure 6 D). This uvular sound is generally low pitched in nature and resembles the low-frequency vocalization heard in cows (Figure 6 C). Production of uvular sounds involves posterior arching of the tongue with backward movement of the anterior tongue, resulting in increased oral cavity space and enhanced resonance (Figure 6A). The resulting guttural quality of the sound is illustrated in (Figure 6 B). Together, these figures demonstrate the articulatory and acoustic mechanisms involved in low-pitched uvular sound production.

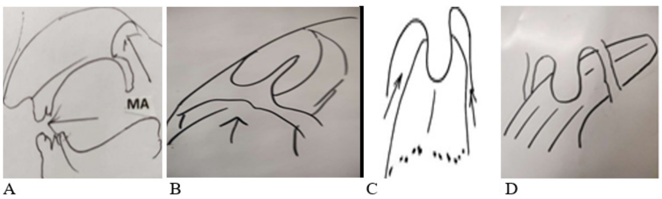

Figure 6 A-D Uvular consonants and low-pitched uvular sound production during speech.

By changing the direction of airflow, which also contributes to sound production, airflow changes direction within the vocal tract to produce sound. When the airflow moves from the neck (or larynx) to the mouth there is a change from a vertical direction to a horizontal direction towards the mouth, it helps create sound. In animal the tract is straight (Figure 7 A). This change in airflow direction is crucial in shaping the sounds we produce. At the turning point, junction of nasopharynx and oropharynx uvula is freely hanging. It moves and vibrates. Naturally it makes sound (Figure 7 B).

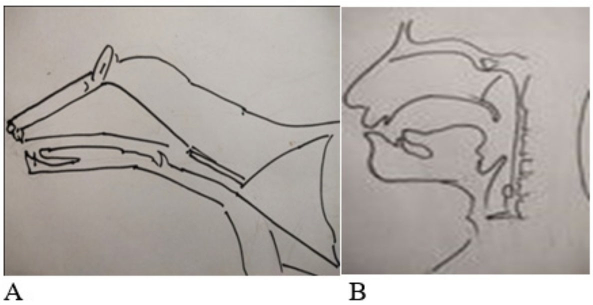

Figure 7 A & B Role of airflow direction change and uvular vibration in human sound production.

In humans, airflow traveling from the larynx toward the mouth undergoes a directional change from a vertical pathway in the neck to a horizontal pathway within the oral cavity. This alteration in airflow direction plays an important role in the generation and modulation of speech sounds. At the junction of the nasopharynx and oropharynx, the uvula hangs freely and is positioned at the turning point of the airflow pathway. As air passes through this region, the uvula can move and vibrate naturally, contributing to sound production and resonance (Figure 7 B). In contrast, animals generally possess a comparatively straight vocal tract with less angular change in airflow direction (Figure 7A). The anatomical difference between the human and animal vocal tract may contribute to the greater complexity and modulation of human speech sounds. The treatment protocol emphasized continuous supervised practice to reinforce habituation of the newly acquired voice pattern. The silk thread was removed after completion of the 5-day therapy period.

Outcome measures

The primary outcome measure was reduction in voice pitch toward age-appropriate male fundamental frequency. Secondary outcome measures included:

- Improvement in perceptual voice quality (GRBAS scale)
- Reduction in vocal fatigue
- Stability of lowered pitch during follow-up

UMAR therapy a minimally invasive and generally well-tolerated treatment modality for puberphonia when performed under appropriate ENT supervision. No major complications were reported in the published series; however, minor transient adverse effects such as throat discomfort, gag reflex, uvular irritation, and temporary voice fatigue may occur. Comprehensive safety monitoring should include pre-treatment laryngeal evaluation, acoustic voice analysis, peri-procedural observation, and long-term follow-up to assess recurrence, vocal stability, and patient-reported outcomes.

Results and statistical analysis

A total of 1,650 patients with puberphonia diagnosed with puberphonia underwent UMAR treatment and completed follow-up evaluation. Treatment success was defined a priori using objective and subjective criteria. A successful outcome was considered when the patient demonstrated:

1. Stable lowering of speaking fundamental frequency (F0) into the age-appropriate male range,
2. Maintenance of the new voice without relapse during follow-up, and
3. Perceptual improvement confirmed by clinician assessment and patient satisfaction scores.

Objective success criteria included

- Reduction in mean speaking fundamental frequency (F0) to <150 Hz or within the normal adult male range,
- Significant improvement in acoustic parameters such as jitter, shimmer, and harmonics-to-noise ratio (HNR),
- Improvement in perceptual voice quality scores (e.g., GRBAS scale),
- Improvement in Voice Handicap Index (VHI) scores where available.[10]

Statistical analysis

Pre- and post-treatment acoustic parameters, including fundamental frequency (F0), jitter, shimmer, and maximum phonation duration, were compared using the paired *t*-test for normally distributed data. The Wilcoxon signed-rank test was used when data were not normally distributed. Categorical outcome variables were analyzed using the chi-square test or Fisher's exact test where appropriate.

A graphical representations of 50 cases pf puberphonia, before and after frequency range (Figure 8). It illustrates the comparison of vocal frequency range in 50 patients with puberphonia before and after UMAR training. The graph demonstrates a significant reduction in abnormally high-pitched voice frequency following UMAR training, indicating improvement toward a normal male voice range and confirming the effectiveness of UMAR training in the treatment of puberphonia.

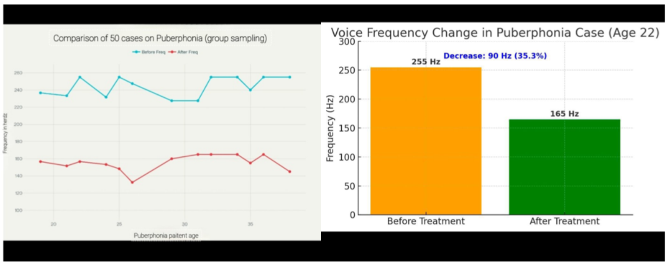

Figure 8 Frequency range before and after umar training in 50 cases of puberphonia.

A graphical representations of 50 cases pf puberphonia, before and after UMAR training in treating puberphonia, frequency range, A *p*-value <0.05 was considered statistically significant.

Outcome measures

Following UMAR treatment, the mean speaking fundamental frequency decreased significantly from pre-treatment values to the post-treatment male frequency range ($p < 0.001$). Significant improvements were also observed in perceptual voice quality and patient-reported satisfaction scores. The majority of patients maintained stable voice outcomes during follow-up, indicating sustained treatment effectiveness. The overall treatment success rate was reported with a 95% confidence interval (CI) to improve interpretability and statistical reliability.

Discussion

The present study explored the management of puberphonia, with particular emphasis on pharyngeal resonance training and uvular facilitation. The findings suggest that this approach may assist selected patients in achieving a stable lower-pitched voice with reduced vocal strain. However, the physiological mechanisms underlying these changes remain hypothetical and require further validation through objective acoustic, aerodynamic, and imaging studies.

Conventional management of puberphonia primarily includes behavioral voice therapy, digital laryngeal manipulation, counseling, and, in resistant cases, surgical interventions such as type III thyroplasty.[11] Behavioral therapy remains the standard treatment because it is non-invasive and focuses on establishing an appropriate phonatory pattern using techniques such as pitch glides, vegetative phonation, respiratory training, and resonance exercises. Digital laryngeal manipulation can provide rapid lowering of pitch by reducing excessive laryngeal elevation and muscle tension. Surgical approaches are generally reserved for patients who fail to respond to conservative treatment. In comparison with these established methods, the redirected phonation technique described in the present study may be considered an adjunctive resonance-based therapeutic approach rather than a replacement for laryngeal voice production.

The rationale of UMAR is based on modifying supraglottic resonance and facilitating a lower habitual pitch through altered vocal tract configuration. The uvula and soft palate contribute to modulation of airflow and resonance within the vocal tract, particularly during production of uvular consonants and trills in several languages.[12] These articulatory mechanisms may provide sensory and proprioceptive feedback that helps patients access a lower pitch register.

In puberphonia, the vocal folds are structurally normal, and voice production continues to originate at the glottic level. Therefore, the proposed technique is more appropriately interpreted as facilitating resonance adjustment and reduction of maladaptive phonatory behavior rather than replacing laryngeal phonation.

Exercises involving prolonged trill sounds, posterior tongue positioning, diaphragmatic breathing, and resonance focus may contribute to relaxation of supralaryngeal tension and improved voice stability. Similar principles are recognized in conventional resonant voice therapy and semi-occluded vocal tract exercises, which are widely used in clinical voice rehabilitation.[13] The use of diaphragmatic breathing techniques may further improve respiratory support and reduce excessive laryngeal effort during phonation.

Uvular sounds that may aid in the treatment of puberphonia are present in several Indian cultural vocal practices. Ululation is a varied-pitch vocal sound resembling a howl with a trilling quality, produced by generating alternating high- and low-pitched vocalizations accompanied by rapid back-and-forth movements of the tongue and uvula. Such uvular sound practices are traditionally familiar and easy to perform in many cultural regions of India, particularly in Tamil Nadu.

In Tamil culture, the *Kulavai* sound is regarded as auspicious and is commonly performed during weddings, Pongal festivals, temple rituals, and housewarming ceremonies (Figure 9 A). Ancient Sangam literature also describes *Kulavai* as a war cry associated with the goddess of victory, Korravai (Figure 9 B). Similarly, *Kuravai* is performed during religious ceremonies, including divine wedding rituals and temple street processions in which deities are carried ceremonially (Figure 9 C).

Figure 9 A-G Uvular sounds, ululation, and traditional tamil cultural practices related to voice production.

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During Korravai processions, ritual practices such as blowing the conch to enhance resonance (Figure 9 D), ululation, and symbolic tongue piercing with needles (Figure 9 E-G) are traditionally performed. These vocal and ritualistic activities are believed to facilitate the production of a strong, clear, and resonant voice, thereby supporting the generation of effective uvular sounds relevant to voice modulation and puberphonia treatment.[14]

Limitations of this study

The present study has several limitations. The absence of a control group limits direct comparison with standard speech therapy techniques. Objective outcome measures such as acoustic analysis, cepstral measures, aerodynamic assessment, and validated voice handicap scales were not comprehensively evaluated. Long-term follow-up is also necessary to determine the stability of the achieved voice changes and the risk of relapse. Future studies should include randomized controlled designs comparing pharyngeal modulation of airflow and resonance with established voice therapy methods and should incorporate laryngeal imaging and standardized acoustic analysis to better understand the underlying mechanisms.[15–17]

Results

Overall, Oropharyngeal Facilitation Technique appears to be a potentially useful adjunctive technique in selected patients with puberphonia, particularly in facilitating resonance awareness and lowering habitual pitch. However, additional scientific evidence is required before definitive conclusions can be made regarding its physiological basis and comparative efficacy.

Ethical considerations, Ethical approval

All procedures performed in studies involving human participants were by the institutional research committee (USWR ethic approval) and with the 1964 Helsinki Declaration and its later amendments.

Informed consent

Informed consent was obtained from all individual participants and their parents included in the study.

Author contributions

K. Navin Bharath: Conceptualization of the study, analysis of the data

Dr.Sabasan Karupiah: writing the manuscript

Dr.Jeevith Iseriya.K: finalizing the manuscript

Nanjil Natarajan: acting as the guarantor of the paper

Kalai Selvi Aruldass: Edited and critically evaluated the manuscript

M. Kumaresan: collection of cases.

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Conflicts of interest

The authors declares that they have no conflict of interest.

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None.

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