

**DEVELOPMENT OF VOCAL EDUCATION MATERIAL  
FOR INDIVIDUALS WITH PUBERPHONIA**

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A dissertation submitted in Part Fulfilment of  
Masters of Science in Speech-Language Pathology  
University of Mysore



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**SEPTEMBER 2021**

## **CERTIFICATE**

This is to certify that the dissertation entitled “**Development of Vocal Education Material for Individuals with Puberphonia**” is a bonafide work submitted in part fulfillment for degree of Master of Science (Speech Language Pathology) of the student Registration Number: **19SLP026**. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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This is to certify that the dissertation entitled “**Development of Vocal Education Material for Individuals with Puberphonia**” has been prepared under my supervision and guidance. It is also being certified that this dissertation has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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## **DECLARATION**

This is to certify that the dissertation entitled “**Development of Vocal Education Material for Individuals with Puberphonia**” is the result of my own study under the guidance of Dr. T. Jayakumar, Associate Professor, in Department of Speech Language sciences, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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September, 2021

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## **Acknowledgment**

*Sincere thanks to our dear guide Jayakumar sir for being most approachable. All credits goes to you for making us quite relaxed and composed during the entire time. Thanks Jesnu sir for all the great help at last minute. Special thanks to Ranjitha Maam for doing the content validation and helping out with the manual development. Will not be complete without mentioning Ravi sir for the technical helps.*

*Eternal grateful to God almighty, for giving the strength and courage to pursue dreams for every cause. As dependent I am for a support system in every difficult times, and also to be grateful for the happiest times in life, I believe the aura of constant energy being in my back throughout.*

*Thanking family would never be enough, but I owe for the trust in me and for never saying 'no' even to any silliest matters till now. The care and love provided, made me happiest adult today is forever indebted. Love to Acha, Amma, Riya, Bijoy chettan and my babies Ayaan and Aadhu. Thankyou Minuty, for being always there.*

*Love to my friends for making beautiful memories to lookback. I forever cherish the time with you guys and how it made me happy and loved. AIISH never will be same without these humans. So much love for Ariya, Chitra, Vyshna, Adithya, Ashita and Anju. I love to spent time with you guys. You people always pampered and loved me no matter what. Thankyou for sticking on tough times and being great listeners. I cannot express the gratitude for being there when I fall sick, and to make me feel important and worth, and most importantly trusting me so much. Vyshna, special thanks to you for helping me out with Kannada language whenever needed without any hesitation. Thanks to dear brother Shirin for being so amiable in these hard times.*

*And Tanvi, I have learnt lot from you. You're a person I always look upto. Directly or indirectly you brought so much light in my life. Sumati, Amrita and Veda, you people are gems I've met here. I appreciate so many loving souls here and SLP19B is forever favorite. Love to the entire Rennovators batch for being so kind and supportive.*

*I am really sorry if anyone missed out to acknowledge. Everyone I've come across shared a smile, matters and made the life here so easy and warm. **Thankyou!***

## **Abstract**

Voice is fundamental in communication. Any deviations in perceptually normal voice can affect the life of an individual at different levels. Puberphonia is a voice disorder that affects an individual on personal, social and emotional domains. The objective of this study was to develop a manual for individuals with puberphonia to increase their understanding of the condition. Information was collected from various sources and compiled to develop this manual. Content validity was done by two speech-language pathologists who have experience in voice research/pathology. Feedback was also collected from five individuals with puberphonia regarding the manual, and all changes were incorporated. The manual is brought forth to guide individuals with puberphonia to better acknowledge the condition and to avail treatments.

*Keywords: Puberphonia, Manual, Voice, Vocal-Education, Self-Reading Material*

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## **Chapter I**

### **Introduction**

The human voice reflects personality, emotions, confidence and feelings. Voice also imparts a great deal about health and mental alertness. The powerhouse of voice is the air from the lungs. The coordination of breathing, phonation and resonance lays the foundation for an effective voice. Phonation is the process of producing the basic sound of voice by the vibration of vocal folds through the airflow from the lungs. From the vocal folds, the sound travels through the throat, mouth and nose and gets modified to be recognised as a human voice. This transformation of voice is known as resonance. Production of perceptually normal and effective voice depends on balancing and coordinating the fundamental components of breathing, phonation and resonance.

The variations in voice can be caused due to different reasons. The main variations can be attributed with respect to pitch, loudness and quality. Pitch is the highness or lowness of the voice. The perception of pitch depends on the speed of vibration of vocal folds, length of vocal folds, and thickness on the edge of vocal folds. Pitch will be higher if the vibration of the vocal folds is faster; the length and thickness of vocal folds are longer and thinner, respectively. In contrast, reduced vibration of vocal folds and shortening and thickening of vocal folds lowers vocal pitch. Variations in pitch level to convey the expressive meaning is called intonation.

The loudness of voice is directly related to the intensity of voice. It depends on the amount of air pressure from the lungs and muscle tension at the level of vocal folds. Loudness increases when the air pressure is high and vocal folds are tense. Respectively, loudness decreases when there is low air pressure in the lungs, and vocal folds are relaxed. Stress refers to the variations in loudness during speech primarily to give emphasis and to differentiate the meaning.

Quality is the clarity of voice. Quality of voice is the product of many factors, including smooth, relaxed functioning of muscles and vocal folds. Laryngeal adduction and abduction also contribute to the quality. Voice will be perceived as rough and hoarse if the muscles are tense and vocal folds are not sufficiently adducted. Voice quality will sound breathy if the vocal folds are paralysed or in an abducted position.

According to Aronson and Bless (2009), a voice disorder occurs when “voice quality, pitch, and loudness differ or are inappropriate for an individual’s age, gender, cultural background, or geographic location.” A voice disorder is present “when an individual expresses concern about having an abnormal voice that does not meet daily needs even if others do not perceive it as different or deviant” (ASHA 1993).

Puberphonia is the persistence of high pitch voice after adolescence in the absence of organic cause. This condition is commonly seen in males. The incidence of puberphonia in the general population is 1 in 900000 (Bannerjee et al., 1995). A retrospective study on the prevalence of puberphonia in a tertiary care Centre in Mangalore, India, revealed that puberphonia accounts for about 3% among the overall prevalence of 21% in voice disorders (Dodderi et al., 2018). During adolescence, the human voice undergoes a significant transition with a shift of almost one octave in males and one-third of an octave in females. The lower descent of the larynx and development of musculoskeletal structures helps in the change of the vocal pitch. Puberphonia or mutational dysphonia is the voice disorder resulting from the voice’s failure to change at adolescence and the inability to acquire developed adult pitch.

Individuals with puberphonia often present themselves in clinics with a high-pitched voice, muscle tension, lack of resonance, vocal fatigue, diplophonia, hoarseness, an inability to shout, and voice breaks. The etiology of puberphonia is complex, including psychological factors, childhood trauma, hormonal changes and

failure to adapt the male adult traits. Increased tension within the intrinsic laryngeal muscles, particularly the cricothyroid muscle, and anatomical abnormalities such as lack of fusion of the thyroid lamina anteriorly are most commonly incriminated with respect to anatomical perspective.

Physiologically, the mutational voice is produced when the suprahyoid and cricothyroid muscles are contracted and the thyroarytenoid muscle is disengaged. The result is a tense laryngeal mechanism that is positioned high in the neck. The vocal folds themselves are elongated and tense, and exhibit decreased vibration and inadequate closure. This posture results in a high-pitched, weak, breathy voice, often accompanied by roughness and pitch breaks. Therapies aimed at engaging the thyroarytenoid muscle and moving the larynx into an improved posture have proven quite helpful in remediating this voice concern.

The diagnosis of puberphonia includes acoustic analysis, auditory-perceptual evaluation and laryngovideostroboscopy assessment. The diagnostic profile of individuals presenting with puberphonia shows the following characteristics such as significant-high vocal pitch perceived similar to females, occasional pitch breaks into male chest register, and breathiness in voice quality. Patients usually lack knowledge with respect to the production of male chest voice and how to maintain the same constantly.

The presence of the mutational voice can be confirmed clinically in several ways. For example, throat clearing, coughing, laughing, and production of the hard glottal attack should engage the thyroarytenoid muscle and result in a dramatic lowering of the pitch into the modal register. Furthermore, digital manipulation of the larynx initially will reveal an elevated larynx that can be gently manipulated to a lower position with systematic digital manipulation of the thyroid cartilage.

The treatment options include voice therapy and surgery. Voice therapy is considered to be effective in most cases when there are no other medical conditions. The initial intervention given to individuals with puberphonia is voice therapy. Injection of botulinum toxin is also a treatment option if the cause is the excessive contraction of suprahyoid muscles. This treatment option has the benefit of reducing the vocal pitch without any structural changes. The major drawback is the effectiveness of botulinum toxin injection, which is limited to 3-6 months.

Surgical treatment options are considered when the individual is unresponsive to speech therapy. Surgery has its complications including, failure of meeting the expected lowering of pitch, psychological issues like anxiety, innate surgical complications, time taken for the recovery and issues in the overall quality of voice.

Muthiah and Kumaresan (2019) investigated 472 individuals with puberphonia to understand the impact of puberphonia in various levels of society. The study was mainly focused on the social effects of the disorder, including marriage and job opportunities. They also found other problems experienced by these individuals, including depression, low self-esteem, loneliness, high inferiority complex, and suicidal thoughts.

Voice intervention in puberphonia primarily entails decreasing fundamental frequency ( $F_0$ ) to levels adequate for age and gender, such as vocal behavior modification techniques, digital laryngeal manipulation, and voice counselling (Bhattarai et al., 2010; Kumaresan & Bharath, 2020, Pannbacker, 1998). Further, pitch reduction through phonosurgery to shorten the vocal folds has been suggested as a last resort when conservative means of treating puberphonia are ineffective (Franca & Bass-Ringdahl, 2015) .

Voice therapy is likely to be successful in cases of puberphonia with no organic impairments when the main goal is lowering  $F_0$  by modifying laryngeal posture and tension level leading to change in vocal behavior (de Alwis, 2018; Vaidya & Vyas, 2006). Most individuals with puberphonia present an excellent therapy outcome in one or two clinical sessions and seemingly rejoice in finding a voice that sounds like other peers. There are only a few anecdotal reports of individuals with puberphonia requiring counseling before releasing the need for continuing the falsetto voice. Following successful elimination of high-pitched voice, SLP should schedule all individuals with puberphonia a three or four week follow up to determine how he is doing both from a voice and an emotional perspective (Boone et al., 2020)

Desai and Mishra (2012) studied 30 individuals with puberphonia in the age group of 14 to 18 years over the period of two years to evaluate the effectiveness of voice therapy in the management of puberphonia. The speech therapy techniques used with the patients included humming-loud and glide, effortful phonation using hard glottal attack, use of vegetative techniques, glottal fry, and digital manipulation. Results showed that five of the 30 patients could establish a normal pitch level by counseling and speech therapy techniques within a single session itself. Only one individual had to be referred for thyroplasty type III as he wanted to decrease the  $F_0$  even below the normal range.

Another study was conducted by Gökdoğan et al., (2016) to determine the speech range profile of individuals with puberphonia pre- and post-speech therapy. Results showed a significant difference between the  $F_0$  and minimum  $F_0$  before and after therapy. Further, a study by Alam et al., (2012) documented the quality of life of 20 individuals with puberphonia who underwent voice therapy. Subjective and objective evaluations were done using GRBAS and PRAAT software. Psychosocial

impact was evaluated using VHI before and after therapy. Results showed significant improvement in both subjective and objective evaluations as well as VHI scores post-therapy.

Roy et al., (2017) studied the effects of manual circumlaryngeal techniques on 12 males with puberphonia (mean age of 17.5 years). Auditory-perceptual and acoustic evaluations are done to evaluate the pre-and post-therapy outcomes. All individuals with puberphonia experienced lowering of  $F_0$  in sustained vowel task and 11 out of 12 individuals demonstrated reduced  $F_0$  in the rainbow passage. Results concluded that the circumlaryngeal massage technique could be considered a primary treatment approach for individuals with puberphonia.

In the study conducted by Muthiah & Kumaresan (2019) to assess the impact of puberphonia, 70% of the participants showed psychological distress and different coping strategies were being used by them to overcome the difficulties. The main reason for this was stated to be the lack of awareness about the condition and its management options.

A manual is a booklet that gives information about a particular topic. A manual on voice disorders is a booklet that explains about voice, voice production, types and causes of voice disorders and assessment and management of voice problems. Puberphonia has effects on an individual's personal, social and environmental domains. A manual for individuals with puberphonia will help them to gain insights on characteristics of the disorder, its assessment and management. Providing awareness to these individuals aid in rudimentary level management, and this will, in turn, improve the quality of life.

**Need for the study:**

Individuals with puberphonia tend to encounter emotional, psychological, social and professional difficulties. Despite the high prevalence of puberphonia in different parts of the country, appropriate therapeutic intervention centres are less (Vaidya & Vyas, 2006). There are also reports of delayed referral (Cohen, 2015) as well as limitations of diagnostic tools, and challenges in accessing professional services (Boominathan et al., 2008). An education material that focuses on the symptoms, characteristics of puberphonia and evidence-based techniques that helps to create awareness about the disorder and about its initial management options is currently lacking. A manual, if devised, could bring confidence and reduce psychological distress; and further enhance the way to seek treatment for puberphonia.

**Objective of the study:**

To develop a manual/vocal education material to increase the awareness in individuals with puberphonia.

## **Chapter II**

### **Method**

The current study was done in two phases. Development of the manual for individuals with puberphonia was done in phase I. Modifications based on the feedback from speech-language pathologists (SLPs) and individuals with puberphonia were incorporated into the manual in phase II.

#### **Phase I: Development of manual**

The Manual was developed through information gathered from various sources, including books and journal articles. Information was compiled and organized in a systematic way as required. Contents of the manual are as follows:

- Introduction
- Speech production
- What is voice?
- Development of voice
- Voice disorders
- What is puberphonia?
- Etiology, Characteristics and presenting complaints
- Psychosocial impact
- Common myths and facts
- Evaluation of Puberphonia
- Management options (surgical and Non-Surgical)
- Importance of counselling

Manual constituted of 15 pages including pictures collected from internet.



**Phase II: Content validation and evaluation of developed material**

The content validity of the manual was examined by two SLPs who were experienced in voice research/pathology. The manual was modified according to their suggestions. Further, the manual was reviewed by five individuals with puberphonia who were undergoing voice therapy at AIISH. Based on their recommendations, additional changes were made to the manual, and the manual was finalized. The final version of the devised manual is provided in Appendix-I.

## **Chapter III**

### **Results & Discussion**

The present study aimed at developing a manual for individuals with puberphonia. A detailed literature review yielded information about the condition of puberphonia, its characteristics, assessment and treatment. This information was compiled and organized, and the manual was devised. Following the construction of the manual, it was given to two speech-language pathologists (SLPs) who are experienced in voice assessment and voice research/pathology. They were asked to provide suggestions regarding any necessary modification in the manual. Based on their suggestions, necessary and feasible modifications were incorporated. Then the manual was presented to five individuals with puberphonia who were undergoing voice therapy at AIISH, Mysore. Feedback was collected from those individuals as well to make further modifications and to finalize the manual.

#### **Content validation of manual**

Two SLPs provided various suggestions to be incorporated into the manual. Major suggestions provided by the first SLP were to include more functions and usefulness of human voice, to cite the development of voice in males and females more in terms of characteristics than anatomical differences and to explain in detail regarding the etiology and symptoms manifested. Further, it was recommended to include details regarding the various hormonal voice disorders.

The second SLP opined to include an introduction, speech production and counseling aspects to the manual. Corrections regarding the importance of alignment and continuity in the manual were also put forth by the second SLP. After incorporating these suggestions, the manual was introduced to five individuals with puberphonia who were undergoing voice therapy at AIISH.

### **Evaluation of developed manual**

The first subject was a 30-year-old individual who was attending therapy at AIISH and later discontinued due to inconvenience in travelling. Presently, he is attending voice therapy at Wayanad, Kerala. This client was of the opinion that the information was useful and appropriate to the context. He also pointed out the severe psychosocial impact due to the disorder (being excluded from marriage proposals and being subject to constant teasing). The importance of seeking help from a psychologist and the necessity to add the professional as a team member was pointed out by this subject.

The second subject was a 20-year-old college student who attended voice therapy sessions at AIISH. This subject reported that all the information in the manual was appropriate and useful for a better understanding of the condition.

The third subject was an 18-year-old individual with puberphonia. Reportedly, he avoided speaking in classrooms as well as in social gatherings to get rid of the embarrassment caused by the high pitch voice. This information was incorporated into the psychosocial impacts section of the manual.

The fourth subject was a 17-year-old individual who was discharged from therapy at AIISH. This individual provided positive feedback towards the manual. He was of the notion that the manual is comprehensible and that the information in the manual was accurate.

The fifth subject was a 21-year-old individual who attended voice therapy at AIISH. He commented that the manual is useful and the content is appropriate. Thus, the feedback from all the subjects was accepted, and necessary modifications were made to manual and finalized.

To conclude, this manual can be used as an effective tool for imparting knowledge and awareness on puberphonia. The manual can also be used as a guide for individuals with puberphonia to get an appropriate and timely evaluation and management.

## **Chapter IV**

### **Summary and Conclusion**

Voice is a fundamental aspect of communication. Any deviations in perceptually normal voice can affect the life of an individual in different domains. Puberphonia is a voice disorder that affects the individual in personal, social and emotional domains. Hence, the aim of this study was to develop a manual for individuals with puberphonia to improve their understanding of the condition. Information regarding appropriate awareness of this condition, including the etiology, characteristics, diagnosis and management, was included in the devised manual.

Phase I of this study consisted of the development of the manual by collecting and compiling necessary information from different sources. In Phase II, the content validity of the manual was carried out by two speech-language pathologists (SLPs). Further, the manual was circulated among five individuals with puberphonia and feedback was obtained. Results discussed the modifications of the manual, including the suggestions received from SLPs as well as individuals with puberphonia. Changes suggested by the SLPs and individuals with puberphonia were accepted and incorporated to finalize the content of the manual. To conclude, this manual could help in guiding an individual with puberphonia to acknowledge better about the condition and to avail treatments.

Future research on puberphonia is necessary regarding societal awareness and the psychological impact of this condition. The was also reflected in the feedback from individuals with puberphonia.

#### **Limitations of the study**

- Feedback from only five patients included
- Statistical analysis for evaluation of manual is not carried out.

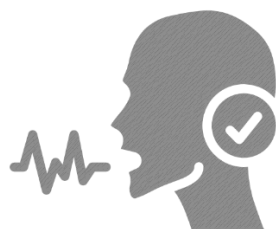
## References

- Alam, N., Sinha, V., Kumar, S. S., Katarkar, A., & Jain, A. (2012). Efficacy of Voice therapy for treatment of Puberphonia: Review of 20 cases. *World Articles in Ear Nose Throat*, 5(1), 1–6.
- Aronson, A. E., & Bless, D. M. (2009). *Clinical Voice Disorders* (4th ed.). Thieme.
- ASHA. (1993). *Definitions of Communication Disorders and Variations*. Available from <https://doi.org/10.1044/policy.RP1993-00208>
- Banerjee, A. B., Eajlen, D., Meohurst, R., & Murty, G. E. (1995). Puberphonia - A Treatable Entity. In *Proceedings of the 1st World Voice Congress*. Oporto, Portugal
- Bhattarai, B., Shrestha, A., & Shah, S. K. (2010). Psychosocial impact on puberphonic and effectiveness of voice therapy: A case report. *Journal of College of Medical Sciences-Nepal*, 6(1), 57–62.  
<https://doi.org/10.3126/jcmsn.v6i1.3605>
- Boominathan, P., Chandrasekhar, D., Nagarajan, R., Madraswala, Z., & Rajan, A. (2008). Vocal Hygiene Awareness Program for Professional Voice Users (Teachers): An Evaluative Study from Chennai. *Asia Pacific Journal of Speech, Language and Hearing*, 11(1), 39-45.  
<https://doi.org/10.1179/136132808805297377>
- Boone, D. R., McFarlane, S. C., von Berg, S. L., & Zraick, R. I. (2020). *The Voice and Voice Therapy* (10th ed.). Pearson.
- Cohen, S. M., Kim, J., Roy, N., & Courey, M. (2015). Delayed Otolaryngology Referral for Voice Disorders Increases Health Care Costs. *The American Journal of Medicine*, 128(4), 426.e11-426.e18.  
<https://doi.org/10.1016/j.amjmed.2014.10.040>

- de Alwis, A. S. R., Rupasinghe, R. J. S., Kumarasinghe, I., Weerasinghe, A., Perera, R., & Jayasuriya, C. (2018). Efficacy of voice therapy in patients with puberphonia- a 15-year experience. *Ceylon Journal of Otolaryngology*, 7(1), 8. <https://doi.org/10.4038/cjo.v7i1.5267>
- Desai, V., & Mishra, P. (2012). Voice therapy outcome in puberphonia. *Journal of Laryngology and Voice*, 2(1), 26–29.
- Dodderi, T., Philip, N. E., & Mutum, K. (2018). Prevalence of voice disorders in the Department of Speech- Language Pathology of a tertiary care hospital of Mangaluru: A retrospective study of 11 years. *Journal of Health and Allied Sciences NU*, 8(3), 12–16. <https://doi.org/10.1055/S-0040-1708757>
- Franca, M. C., & Bass-Ringdahl, S. (2015). A clinical demonstration of the application of audiovisual biofeedback in the treatment of puberphonia. *International Journal of Pediatric Otorhinolaryngology*, 79(6). <https://doi.org/10.1016/j.ijporl.2015.04.013>
- Gökdoğan, Ç., Gökdoğan, O., Tutar, H., Aydil, U., & Yılmaz, M. (2016). Speech Range Profile (SRP) Findings Before and After Mutational Falsetto (Puberphonia). *Journal of Voice*, 30(4), 448-451. <https://doi.org/10.1016/j.jvoice.2015.05.014>
- Kumaresan, M., & Bharath, N. (2020). Fast Track Treatment for Puberphonia. *Scholarly Journal of Otolaryngology*, 3(5), 307–311. <https://doi.org/10.32474/SJO.2020.03.000173>
- Muthiah, K., & Bharath Kumaresan, N. (2019). Assess the Impact of Puberphonia in the Society. *International Journal of Otorhinolaryngology*, 5(2), 39-43. <https://doi.org/10.11648/j.ijo.20190502.12>

- Pannbacker, M. (1998). Voice Treatment Techniques. *American Journal of Speech-Language Pathology*, 7(3), 49-64. <https://doi.org/10.1044/1058-0360.0703.49>
- Roy, N., Peterson, E. A., Pierce, J. L., Smith, M. E., & Houtz, D. R. (2017). Manual laryngeal reposturing as a primary approach for mutational falsetto. *The Laryngoscope*, 127(3), 645-650. <https://doi.org/10.1002/lary.26053>
- Vaidya, S., & Vyas, G. (2006). Puberphonia: A novel approach to treatment. *Indian Journal of Otolaryngology and Head and Neck Surgery*, 58(1), 20–21. <https://doi.org/10.1007/bf02907732>



**APPENDIX - I****VOCAL EDUCATION MATERIAL  
FOR INDIVIDUALS WITH PUBERPHONIA**

ALL INDIA INSTITUTE OF SPEECH AND HEARING  
Manasagangothri, Mysore-6

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## **Introduction**

Voice is fundamental in communication and play central role in daily life. Voice also reflects information regarding personal traits, emotions and social status and health of individual. Voice is produced from the larynx, also called voicebox. Vocal folds are a pair of smooth bands of tissues found inside the larynx. When the edges of the vocal folds vibrate by the airstream from the lungs, voice is heard. The main characteristics of human voice are pitch (perceptual measure of frequency), loudness (perceptual measure of amplitude) and quality (perceptual measure of pleasantness of hearing).

Voice disorders are any conditions that affect the pitch, loudness or quality of voice. Puberphonia is the persistence of high pitch voice even after adolescence. This condition is highly prevalent. People with puberphonia faces many challenges in daily life including social, emotional and personal setbacks. The effective management by voice therapy or surgical methods are available This manual gives brief information regarding the condition, characteristics, diagnosis and management options. Further, the manual helps to give more awareness regarding the condition and to burst the existing myths revolving around it

## **Speech production**

Speech production includes the process word selection, choosing the phonetics of selected word and finally articulating the words with the help of motor system. Speech is the verbal mode of human communication and comprise voice, articulation, fluency and prosody.

**Voice:** Voice is produced through the vibration of vocal folds by the air from larynx.

**Articulation:** is defined as how each speech sounds are produced. (e.g., ‘p’ sound is made by lip closure)

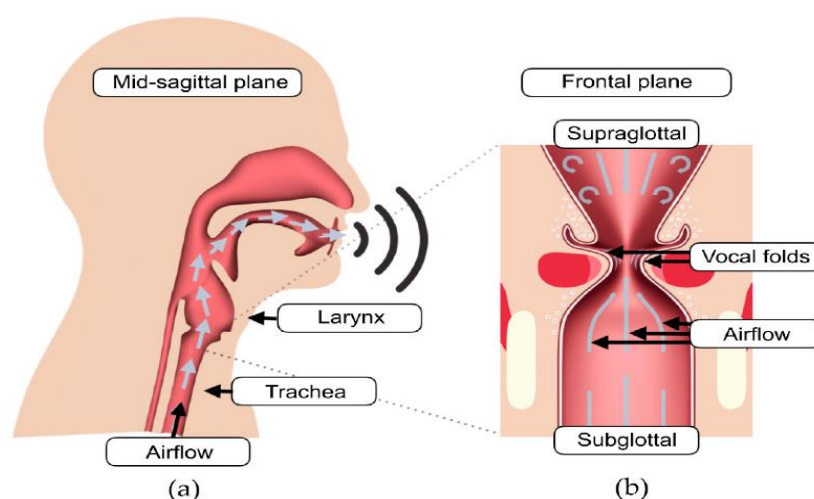
**Fluency:** is the smooth flow of continuous speech

**Prosody:** properties of speech signal that modulate and enhance the meaning. This includes the use of pitch, loudness, tempo, and rhythm etc.

## Voice

The human voice plays a unique role in daily life as the primary means of communication. Voice is essential to express emotions and also helpful in differentiating the age and gender of a specific individual. The usefulness of the human voice is vast, extending from singing to talking, screaming, yelling, crying, and laughing.

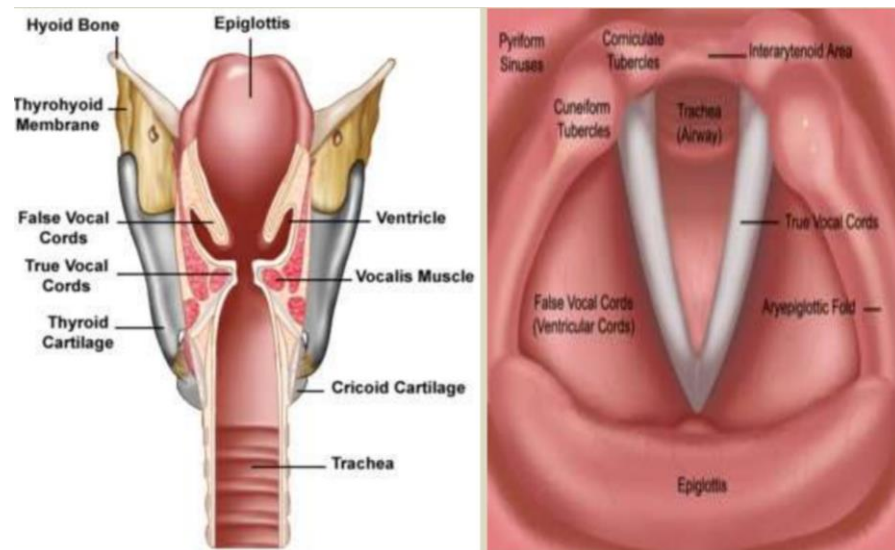
The human voice system comprises of lungs that supply air pressure and airflow to the vocal folds. The vocal folds vibrate, and the modulated airflow results in the source of the voice. The vocal tract changes the voice source from the vocal folds to create specific speech sounds.



[Source: Internet]

Vocal folds are positioned inside the larynx and create a constriction for the passage of air from the lungs, resulting in the vibration of the same. The length of the

vocal folds is different in males and females. Length is greater for an adult male, approximately 17-21 mm, and the length in adult females is 11-15 mm. The larynx is made up of both paired and unpaired cartilages. The vocal fold is attaching from the thyroid to arytenoid cartilage. The space between two vocal folds is called the glottis.



Source: Falk et al (2021)

Phonation is the process of producing voice resulting from the adduction and abduction of vocal folds, that is, the approximation of glottis and vice versa. Air from the lungs causes increased pressure under the glottis. When it becomes greater than the threshold pressure, vocal folds initiate vibration.

### **Development of voice**

Newborns and infants with their tiny vocal folds have increased pitch. A decrease in pitch with maturation is expected, given the increasing length and thickness of the developing vocal folds. Maturation in terms of the development of the brain allows the infant a greater degree of control over voice. In the childhood years, the

larynx starts to increase in size and descend in the neck. Vocal folds lengthen, and there will be a drop in the pitch than infancy.

Puberty is a time of enormous growth and change. Growth is mainly regulated by male and female sex hormones present in males and females in different proportions. Growth of cartilages contributes to the overall enlargement of the larynx, with male larynx increasing two to three times more than female in both dimension and weight. The length of the vocal fold also increases. These changes typically occur for an extended period of time and are usually more noticeable in males. Boys going through voice change tend to experience pitch breaks, during which the voice pitch abruptly shifts upward or downward. There will be voice quality changes also. In general, males pitch decreases steadily throughout this period. Age of onset, duration, and ending time of voice change is highly variable. The onset of voice change in puberty is between the ages of 12.5 and 14.5 years. However, the process can start as early as age 10.5 years. There are also cases of onset that do not begin until 16.5 years. The duration of voice change can continue upto 18 years for boys.

After puberty, the female voice is subject to significant fluctuations resulting from cyclical changes related to menstruation due to the influence of hormones post-puberty. In males, puberty, voice, and pitch stabilize. The larynx will be fully mature at this point with its adult size shape and structure.

### **Voice disorder**

A voice disorder can be explained as any deviations in the quality of voice, pitch, and loudness of an individual compared to age, gender norms, and cultural background. Voice disorders are categorized as:

**Structural:** Voice disorders result from structural changes in the larynx (e.g., structural changes in the larynx due to aging)

**Organic:** Organic voice disorders result from the problems in anyone or more mechanisms that contribute to voice. (e.g., respiratory or vocal tract)

**Neurogenic:** Any voice disorders result from the insult to the innervation of the nervous system to the larynx leads to disorders with neurogenic causes. (e.g., paralysis of vocal folds)

**Functional:** If the structural aspects are normal and voice disorders stem from the inappropriate or inefficient use of the vocal mechanism, then it is called functional voice disorders. (e.g., muscle tension dysphonia)

The human voice is also affected by hormonal changes throughout the lifespan, especially from adolescence to senescence. The vocal apparatus is immensely influenced in terms of both structure and function by the thyroid, gonadal, and growth hormones. This is evident during menstruation times as well as in puberty. Various endocrinal disorders can also affect the quality of voice. Voice disorders can also be caused by psychological roots and are referred to as psychogenic voice disorders or psychogenic conversion aphonia/dysphonia.

### **General Evaluation of voice disorders**

A team renders voice evaluation, consist of at least an otolaryngologist and a speech-language pathologist (SLP) and Psychologist. Even though some instruments and procedures are overlapping for both team members, the purpose is different. Otolaryngologists diagnose medical conditions related to voice pathology and

determine management strategies, including medications or surgery. Psychologists also play an integral role, when the individuals with puberphonia needs help.

The evaluation of speech-language pathologist evaluates the production of voice and determines the quality of life of an individual. The evaluation also includes prognosis, recommendation for appropriate management, and referrals when it is appropriate.

In general, voice can be assessed by subjective or perceptual and objective or instrumental methods and techniques. Subjective methods include mainly auditory–perceptual measures and also observes for posture, breathing patterns, etc. Qualitative/subjective evaluations are done perceptually using standardized rating scales like GRABS, CAPE V, and self-rating of voice is carried out using scales such as VHI, VDOP etc.

Quantitative/objective evaluations are done using instruments. It can be invasive or non-invasive. Invasive methods are usually carried out by medical personnel or under their supervision. It includes video laryngoscopy and stroboscope, which provide visual information about vocal fold vibratory characteristics. Thus, the structure and function of vocal folds and related structures can be observed. Non-invasive methods include recording and subsequent analysis of quantified values by the examiner or by the instrument itself (semi-objective or purely objective).

The aerodynamic analysis provides information regarding respiratory capacities, pressure, and flow, and related measures. In contrast, the acoustic analysis provides frequency and its related measures, intensity, and related measures, noise-



related measures, tremor-related measures, etc. These two are among the few examples of non-invasive objective voice analysis methods.

### **Puberphonia**

Puberphonia is the continued use of a high-pitched voice even after puberty. Puberphonia can be caused by the psychological causes or delay in the development of sexual maturity. This common condition is seen in males. This disorder is also seen in females, where the manifestation is rare, as females generally have high pitch voices. This condition in female is known as "Juvenile Resonance Disorder" or "Little Girls' Voice."

### **Etiology**

Puberphonia may be related to the larynx or an undeveloped natural tenor voice. Due to the reduced development of structures related to the larynx, voice can remain as high pitch. The changes in the proportion of hormones required for growth can be attributed to the cause of puberphonia. Vocal fold asymmetries and congenital deficits in the structures of the larynx leads to the persistence of high pitch voice. Even the minor structural differences and paralysis of the single vocal cord can lead to this condition. Neurological problems can lead to the incoordination of the vocal folds and can cause the problem. And also, in persons with hearing impairment, high pitch in voice quality is observed due to the lack of auditory feedback. Psychological causes also lead to these issues.

### **Characteristics**

Persons with puberphonia presents with the characteristics of abnormally high-pitched voice for the age and gender norms. Pitch breaks and vocal instability is often

seen, and they barely have any control over the voice. Usually, power in the voice is lacking and phonation of sound is effortful. The position of the larynx commonly appears high in position results in supralaryngeal pain. Patient reports being highly distressed by the abnormal voice produced

### **Complaints:**

Common complaints are unusual high pitch existing even after adolescence. Hoarse and breathy voice qualities are often reported. Many of the patients are unable to shout or scream. complaints of Vocal fatigue soon after the use of voice for a particular time period is also common

### **Psychosocial impact**

- Critical aspects of communication skills have been impacted by puberphonia.
- Persons with puberphonia are often ignored and bullied
- Reduced job opportunities.
- Social stigma towards the condition and individuals with puberphonia are isolated and teased.
- Depression and suicidal thoughts are common.
- Issues related to high pitched voice rise in marriage proposals and high emotional stress from the part of family and relationships.
- Avoiding social situations

### **Common myths and facts**

The myths following this condition should be burst, and extensive awareness must be implemented among the public and various medical professionals.

- The incidence of puberphonia is very high.
- Various treatment options, including surgical and non-surgical methods, are available.
- There is no direct correlation between puberphonia and intelligence. They are capable and intelligent as any other person.
- Bad parenting is not the cause of puberphonia
- The causes of disease can be structural, physiological or psychological as well.

### **Additional Evaluation for Puberphonia**

After a general evaluation of the voice, additional information is also required in the diagnosis of puberphonia. Complete physical examination of the person is done, including the examination of genitals, secondary sexual characteristics, and endocrinal or hormonal problems. Psychological issues are also given great importance, and referrals are made if necessary

### **Management of Puberphonia**

Management of puberphonia mainly includes voice therapy and surgical methods. Both approaches help to reduce the pitch levels suitable for the age and gender norms. Surgery is only considered as an option when therapy is ineffective.

## Common speech therapy techniques

These are few therapy techniques usually practiced for puberphonia. All these techniques should be done under the supervision of a speech language pathologist

- **Cough:** The patient is asked to cough and clear the throat before phonation. Coughing spontaneously elicits the low pitch. In the next step, the patient is also asked to apply slight pressure over Adam's apple. This facilitates descending of the larynx and reduced length of vocal folds resulting in low pitched voice.
- **Glottal attack before a vowel:** Vowels are considered prominent sounds that easily facilitate change in voice therapy. This technique approximates the vocal folds by gently asking the patient to inhale and building up pressure in the subglottic area.
- **Yawn technique:** primarily relaxes the vocal mechanism by asking to yawn and then producing a sighing voice. the tension of the vocal folds get reduced by this procedure
- **Chewing technique:** This technique is also suggested to reduce the tension in laryngeal muscles. The first step is exaggerated chewing followed by adding sounds, words, and sentences to it.
- **Visipitch:** This is an objective method using an instrument and is commonly used for various voice disorders. The major advantage of dispatch is the real-time display of vocal parameters. The visual feedback helps the patient to achieve the therapy goals by a quick understanding.

- **Half swallow Boom technique:** In the first stage, the patient is asked to swallow and say "Boom". The patient is asked to turn the head to various sides in the following steps and say "Boom". Later patient is instructed to say "boom" by lowering the chin. Gradually words are added to "Boom". This technique is mainly used to increase the closure of the larynx and to improve the pressure buildup. All these effects gradually lead to lower pitch voice.

### **Surgical methods**

When voice therapy is ineffective in situations where the intervention is delayed or the patient is unwilling, surgical methods can be considered. There are many successful surgical methods to lower the pitch. One of the first is relaxation thyroplasty involving bilateral excision of 2 to 3 mm vertical strips of thyroid cartilage which reduces the vocal pitch through anteroposterior relaxation and shortening of the vocal folds. This is performed under local or general anesthesia.

A more recent, less invasive intervention is the window relaxation thyroplasty. This approach involves creating a window at the anterior commissure, which is then displaced posteriorly. Voice therapy is considered an ideal management option for individuals with puberphonia. Therapy can induce drastic changes in the voice that consequently helps to improve the quality of life.

Proper counseling is vital. Appropriate counseling by the professionals helps to improve the motivation, Counselling also helps to acknowledge the progress made throughout sessions and to be more aware of the condition. As psychosocial impacts are present along with this disorder, effective counselling is crucial for the overall well-

being of individual. Motivated and understanding patient with a team of professionals aid successful management of puberphonia.

## References

- Alam, N., Sinha, V., Kumar, S. S., Katarkar, A., & Jain, A. (2012). Efficacy of Voice therapy for treatment of Puberphonia: Review of 20 cases. *World Articles in Ear Nose Throat*, 5(1), 1–6.
- Aronson, A. E., & Bless, D. M. (2009). *Clinical Voice Disorders* (4th ed.). Thieme.
- ASHA. (1993). *Definitions of Communication Disorders and Variations*. Available from <https://doi.org/10.1044/policy.RP1993-00208>
- Bhattacharai, B., Shrestha, A., & Shah, S. K. (2010). Psychosocial impact on puberphonic and effectiveness of voice therapy: A case report. *Journal of College of Medical Sciences-Nepal*, 6(1), 57–62. <https://doi.org/10.3126/jcmsn.v6i1.3605>
- Boone, D. R., McFarlane, S. C., von Berg, S. L., & Zraick, R. I. (2020). *The Voice and Voice Therapy* (10th ed.). Pearson.
- Colton, R. H., Casper, J. K., & Leonard, R. J. (2011). *Understanding voice problems: A physiological perspective for diagnosis and treatment*. (4th ed.). Wolters Kluwer Health Adis (ESP).
- de Alwis, A. S. R., Rupasinghe, R. J. S., Kumarasinghe, I., Weerasinghe, A., Perera, R., & Jayasuriya, C. (2018). Efficacy of voice therapy in patients with puberphonia- a 15-year experience. *Ceylon Journal of Otolaryngology*, 7(1), 8. <https://doi.org/10.4038/cjo.v7i1.5267>
- Desai, V., & Mishra. P. (2012). Voice therapy outcome in puberphonia. *Journal of Laryngology and Voice*, 2(1), 26–29.
- Dodderi, T., Philip, N. E., & Mutum, K. (2018). Prevalence of voice disorders in the Department of Speech- Language Pathology of a tertiary care hospital of Mangaluru: A retrospective study of 11 years. *Journal of Health and Allied Sciences NU*, 8(3), 12–16. <https://doi.org/10.1055/S-0040-1708757>
- Falk, S., Kniesburgs, S., Schoder, S., Jakubaß, B., Maurerlehner, P., Echternach, M., Kaltenbacher, M., & Döllinger, M. (2021). 3D-FV-FE Aeroacoustic Larynx Model for Investigation of Functional Based Voice Disorders. *Frontiers in Physiology*, 12. <https://doi.org/10.3389/fphys.2021.616985>
- Gökdoğan, Ç., Gökdoğan, O., Tutar, H., Aydil, U., & Yılmaz, M. (2016). Speech Range Profile (SRP) Findings Before and After Mutational Falsetto (Puberphonia). *Journal of Voice*, 30(4), 448-451. <https://doi.org/10.1016/j.jvoice.2015.05.014>
- Hamdan, A. L., Khalifee, E., Ghanem, A., & Jaffal, H. (2019). Injection Laryngoplasty in Patients With Puberphonia. *Journal of Voice*, 33(4), 564–566. <https://doi.org/10.1016/j.jvoice.2018.02.017>
- Harries, M. L. L., Walker, J. M., Williams, D. M., Hawkins, S., & Hughes, I. A. (1997). Changes in the male voice at puberty. *Archives of Disease in Childhood*, 77(5). <https://doi.org/10.1136/adc.77.5.445>
- Hudgins, P. A., Siegel, J., Jacobs, I., & Abramowsky, C. R. (1997). The Normal Pediatric Larynx on CT and MR. *American Journal of Neuroradiology*, 18, 239–245.
- Kumaresan, M., & Bharath, N. (2020). Fast Track Treatment for Puberphonia. *Scholarly Journal of Otolaryngology*, 3(5), 307–311. <https://doi.org/10.32474/SJO.2020.03.000173>

- Larynx and vocal fold. (n.d.). [Illustration].  
<https://cupdf.com/document/presentation1pptx-radiological-anatomy-of-the-larynx-and-trachea.html>
- Muthiah, K., & Bharath Kumaresan, N. (2019). Assess the Impact of Puberphonia in the Society. *International Journal of Otorhinolaryngology*, 5(2), 39-43.  
<https://doi.org/10.11648/j.ijo.20190502.12>
- Pannbacker, M. (1998). Voice Treatment Techniques. *American Journal of Speech-Language Pathology*, 7(3), 49-64. <https://doi.org/10.1044/1058-0360.0703.49>
- Roy, N., Peterson, E. A., Pierce, J. L., Smith, M. E., & Houtz, D. R. (2017). Manual laryngeal reposturing as a primary approach for mutational falsetto. *The Laryngoscope*, 127(3), 645-650. <https://doi.org/10.1002/lary.26053>
- Stemple, J. C., Glaze, L., & Klaben, B. (2018). *Clinical Voice Pathology: Theory and Management* (6th ed.). Plural Publishing.
- Vaidya, S., & Vyas, G. (2006). Puberphonia: A novel approach to treatment. *Indian Journal of Otolaryngology and Head and Neck Surgery*, 58(1), 20–21.  
<https://doi.org/10.1007/bf02907732>
- Woodson, G. E., & Murry, T. (1994). Botulinum toxin in the treatment of recalcitrant mutational dysphonia. *Journal of Voice*, 8(4). [https://doi.org/10.1016/S0892-1997\(05\)80283-8](https://doi.org/10.1016/S0892-1997(05)80283-8)