2023 EDITION

INDIAN JOURNAL OF COMMUNICATION SCIENCES

VOLUME - II ISSUE - II

INDIAN JOURNAL OF COMMUNICATION SCIENCES

Volume II, Issue 2

Disclaimer

The authors are solely responsible for the contents of the papers compiled in this volume. The publishers or editors do not take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

Publisher:

Autonomous Institute of Health Sciences

N2/41, IRC Village, Bhubaneswar-751015, Odisha
E-mail: ihsbbsr@margdarsi.org
Web: www.ihsindia.org

INDIAN JOURNAL OF COMMUNICATION SCIENCES

Volume II, Issue 2

FOCUS:

- The major focus of the journal is to provide information and to promote the innovation in the field of communication sciences.
- Indian Journal of Communication Sciences promotes discussion on a broad range of current clinical and theoretical issues.
- Submissions may include experimental, review and theoretical discussion papers, with studies from either quantitative and/or qualitative frameworks.
- This journal is an Indian response for both fundamental research on communication science, with clinical evidence-based research covering diagnosis, and management of communication disorders as well digging into etiologies and future perspectives of these disorders.
- It seeks to advance evidence-based practice by disseminating the results of new studies as well as providing a forum for critical reviews and meta-analyses of previously published work.
- The broad field of communication sciences and disorders, including speech production and perception; anatomy and physiology of speech and voice; genetics, biomechanics, and other basic sciences pertaining to human communication; mastication and swallowing; speech disorders; voice disorders; developmental disorders, Normal language processes and language disorders.

Editorial

Founder-Director, Institute of Health Sciences, Bhubaneswar

The land of traditional wisdom, Bharat or India, home to 20% of all the languages spoken in the world. From the best codified and refined language of the world "Sanskrit" to unscripted languages of original inhabitants of classical communities is still available in India. Interdependence of language, cognition and behaviour has been studied over several thousands of years with classical texts of Maharshi Patanjali and Panini is the testimony. Indian Journal of Communication Sciences is the humble effort at contemporarising the communication science with focus on research and innovation. Autonomous Institute of Health Sciences will march ahead with responsibility of creating such avenues where innovators can devise solutions and products for various disorders and disabilities. The second issue of the volume 2023 is dedicated to those pathbreaking innovators because of whom the world will have more optimism and more opportunities.

Prof. Satya Mahapatra
Chief Editor

Editor's Message

Dear Readers

On behalf of **Indian Journal of Communication Sciences** I would like thank to all the authors for their interest and sharing of their scientific data. The most evolved human activity is learning,teaching and sharing of knowledge. Content of all the scientific research data and studies has been explained their own method of knowledge enlighten. I am very thankful to **Institute of Health Sciences and family** especially I am deeply indebted to **Prof Satya Mahapatra** sir for giving me a new assignment and such a cherished work which I would fulfill to the best of my abilities. It is such a pleasure to be a part of these scientific and learning journals. I shall assure all our readers, young upcoming learners and students of speech and hearing sciences, cycle publication of this scientific journal will be more aimed and tool to gather and bringing out all new happenings in this communication science. Standing on this spirit of ongoing improvement, all form of support, scientific data and constructive research work inputs for this process are most welcome. I am very thankful to all the members for their support and effort to get this journal and the scientific even success. I am grateful to Ms. Subhasmita Sahoo for keeping continuous update in time.

Wishing this volume to be a highlighting issue.

Dr. Rajanikanta Pradhan
Editor

- INDEX -

Unveiling the Silence: A Systematic Odyssey into Yoga's Efficacy for Stuttering Management

Author Details: *[1]Mr Satyam Hota; [2]Mr. Vivek Kumar,*

1-BASLP Intern, Institute of Health Sciences

2-Assistant Professor in the Department of Speech, Language, Cognition and Swallowing Disorders

Introduction:

Stuttering is a speech disorder characterised by message disturbances that makes it challenging to communicate throughout daily tasks, according to Yaruss and Quesal et al., (2004). This definition of stuttering, which is based on the ICF, states that it is a multidimensional handicap with obvious abnormal speech characteristics, limitations on functional communication, and a detrimental impact on quality of life. Stuttering has an impact on the structure and operation of the body in addition to observable behaviours. Both immediate affects during a verbal interaction and long-term implications that can prohibit speaking in the future are possible with stuttering.

Furthermore, current theories on stuttering are multifactorial models that suggest a connection between speech motor control problems and modulating factors (physiological arousal) that causes both acute and chronic stuttering. According to Packman and Attanasio et al., (2010) and Walden et al. (2012), highly reactive people are more prone to respond to speech interruptions with increased anxiety or stress. Unpleasant speaking occasions may cause feelings of embarrassment and remorse (Ginsberg 2000). According to Bloodstein and Ratner et al., (2008), these feelings may eventually lead to anxiety and avoidance of social interactions. The results of extensive empirical study into the relationship between stuttering and anxiety show that stuttering is associated with higher than typical levels of anxiety (Craig & Tran, 2014; Ezrati-Vinacour & Levin, 2004; Tran, Blumgart, & Craig, 2011).

Traditional Treatment Approaches:

Fluency shaping and stuttering modification are frequently combined in traditional treatment plans for stutterers (Guitar, 2006). By "shaping" dysfluent speech into more fluent utterances during the therapeutic session, fluency shaping aims to increase fluent speech (Snider, 2009; Wan, Rüber, Hohmann, & Schlaug, 2010). When shaping fluency, the clinician instructs the client to breathe fully while speaking slowly and repeatedly. This changes the speech rate, while also teaching the client to breathe more slowly and steadily to change their breathing (Blomgren, Nelson, Callister, & Merill, 2005). Numerous of these strategies include techniques for controlling your breath that are comparable to yoga breathing.

And Stuttering modification aims to "control fluency or produce acceptable stuttering" (Zebrowski & Kelly, 2002, p. 39) in order to help someone stutter more fluently and comfortably. With this approach, the emphasis is on reducing the unfavourable attitudes and avoidance behaviours that are frequently associated with stuttering. Stuttering correction can make people stammer less frequently, more easily, and with greater intention (Guitar & Peters, 2008; Shapiro, 2011).

Yoga and its potential use:

In order to enhance one's physical condition, relax the nervous system, and balance the body and mind, yoga as a discipline integrates breathing, better posture, and meditation (Barnes, Bloom, & Nahin, 2008). According to research by Lazar et al. (2000), Pramanik et al. (2009), Riley (2004), and Takahashi et al. (2005), practising yoga causes parasympathetic nervous system activation (PNS) and suppresses

sympathetic nervous system activation (SNS), which is in charge of the stress response and the release of cortisol and epinephrine.

Uma, Nagendra, Nagarathna, Vaidehi, and Seethalakshmi (1989) claim that numerous research have demonstrated how yoga can help people feel less anxious and hostile, alleviate their depression, and possibly even enhance their fluency. Yoga addresses numerous possible stuttering-related anatomical systems, such as the respiratory, articulatory, and laryngeal systems.

Similar to yoga, speech can be seen as the fusion of several physiological systems to carry out a series of motions and deliver a message.

Yoga improves breathing and posture, which are both crucial for producing speech (Ristuccia & Ristuccia, 2010). Asanas (postures), pranayama (breathing techniques), and meditation are all a part of yoga (Sherman, 2012), which might eventually make PNS activity dominate even in stressful settings (Ross & Thomas, 2010). Additionally, Williams (2010) noted that breathing is a crucial component of a yoga breathing programme that emphasises the coordination of breathing with movement. Further according to Balakrishnan (2009), yoga can help someone learn to relax their laryngeal muscles to prevent strain or tension while speaking. An intriguing comparison was made by Parry (2009), who put up the Valsalva theory, which holds that dysfluent speech is caused by interference between the respiratory system and the Valsalva mechanism, which includes the muscles of the larynx, chest, belly, and rectum. Parry proposed that people who stutter have an overactive version of this process, which interferes with the synchronisation of the musculature and airflow necessary for effective speech output. A modified yoga breathing programme could potentially be used in conjunction with more conventional fluency treatments.

Apart from this, Mindfulness-Based Stress Reduction (MBSR) program which is a two and a half hour long, eight-week training programme which begins with a body scan to train participants to pay systematic attention to their entire body while simultaneously perceiving sensations in various body parts, followed by yoga poses that stretch and pose participants in order to increase awareness of their muscular system. Finally, a sitting meditation is used to focus participants' attention on their breathing, physical sensations, thoughts, and emotions. The participants also received a compact disc with the body scan, yoga, and sitting meditation exercises after the first, third, and fifth sessions. This teaches participants how to relax attentively (Kabat-Zinn, 1990). The MBSR programme was initially created for patients who were experiencing the stress and discomfort brought on by physical problems (Kabat-Zinn, 2003), but it was later applied to and investigated in patients in a variety of other medical contexts. It was on persons who stutter by reducing stress and anxiety about speech situations and improving self-efficacy beliefs, coping behaviour, locus of control and attitude towards speech situations.

With all of these factors in mind, this systemic review aims to clarify the effectiveness of the yoga intervention in the stuttering management process and identify potential outcomes for a combined or modified therapeutic approach in stuttering management depending on the actual knowledge of yoga exercises to add or things to be taken into consideration alongside the traditional approaches.

Methodology:

Identification and Selection of articles:

A thorough literature search was conducted utilising a number of search engines, including SpringerLink, ResearchGate, SAGE Journals, SciELO, Academia.edu, PubMed, CICSD, European Journal of Psychotherapy and Counselling, and Google Scholar, to discover potential research articles for this systemic review. The search terms were "Yoga and breathing control in stuttering," "Effect of

Yoga in stuttering management," and "Yoga and its effect in fluency disorder." In the pre-selection phase, papers were scanned for titles and abstracts that discussed using yoga or meditation as an intervention programme for people who stammer. Discussion and referral were used to settle any disagreements between the writers. The inclusion and exclusion criteria for the systemic review were then defined by the authors in accordance with the conditions of the research problem. After a thorough review of the original batch of papers, studies that did not satisfy the eligibility requirements based on the established inclusion and exclusion criteria were disqualified. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was utilised as a guide to establish inclusion and exclusion criteria and expedite the selection of publications that were eligible for the systemic review.

Inclusion Criteria:

We chose research that made use of yoga asanas individually or in combination with meditation techniques to treat patients. Additionally, research populations with diagnoses of stuttering and associated comorbidities were used in the studies publications. There were no limitations on gender, publication date, or language in the selection criteria.

Exclusion Criteria:

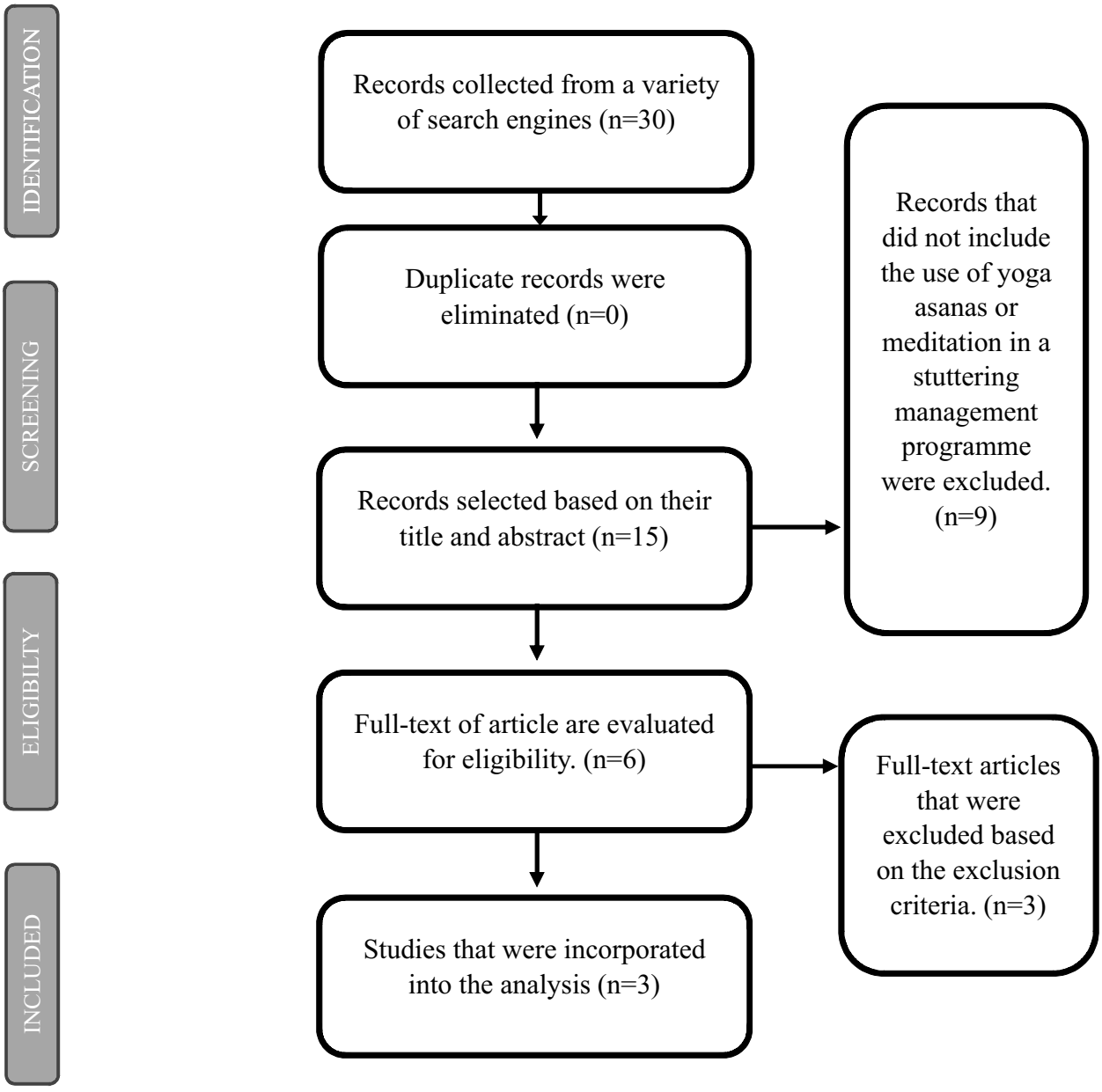
Articles that didn't adhere to specified criteria were not taken into consideration. The research that didn't discuss any type of yoga asanas, meditation, or related principles was first excluded. Second, research that omitted discussing specifics of yoga's effects and the specific interventions employed to achieve these results. Thirdly, we disregarded papers that didn't concentrate on applying these exercises to stuttering sufferers. Furthermore, studies that lacked sufficient pre- and post-evaluation data on the test population.

Results:

Study selection:

Through the methodical searches, 30 distinct articles were discovered. After a thorough assessment of 30 abstracts, which had the most relevance to the research issue during the pre-selection phase, was made, 15 publications were rejected based on the exclusion criteria. The authors were able to include three papers for their analysis out of the 15 that were left for full-text reading.

Fig: 1 PRISMA flow diagram showing the search method for the systematic review



Study characteristics and outcome obtained:

S. Gatzonis et al. (2015) carried out an exploratory study on 4 participants who has stuttering as the only speech and language problem. The four adult participants included—two males and two females—who were aged 27 to 39.

Participant 1 was a 31-year-old African American male who claimed having been diagnosed with a stuttering issue as a youngster and having had stuttering treatment as a child and once as an adult. He indicated that he had no recollection of what he did in treatment as a youngster and that he only attended treatment on an irregular basis as an adult. He last had stuttering treatment in 2012. He also claimed about having genetic proclivity for stuttering; as his parents stuttered, but he regarded his dysfluencies as more severe than his parents'. He reported having no experience of Yoga as a practice.

Participant 2 was a 33-year-old Caucasian male who reported being diagnosed with a stuttering issue at the age of three in Russia. He stated that he is fluent in both English and Russian and that he stutters in both. He believed he stuttered because "his brain was not working properly." He denied any genetic tendency to stuttering and got treatment in both languages. During dysfluent speaking, he displayed secondary behaviours such as stiffening his fists and clenching and squeezing his eyes tightly. Finally, he claimed that he was eager in learning new approaches such as yoga and meditation to help him improve his fluency. He had prior experience with yoga but did not attend classes.

Participant 3 was a 27-year-old African American girl who reported having been diagnosed with a stutter as a child and having a familial susceptibility to stuttering because her great-uncle had a fluency impairment. She was having medical treatment. The secondary behaviours of her were noticeable. She had noticeable and tense facial expressions, a trembling and frequently clamped jaw, and rapid eye blinking. She reported that she had prior yoga experience but was not currently enrolled in any lessons.

Participant 4 was a 39-year-old Caucasian girl who stated that she was diagnosed with a stutter as a child. She quit treatment as a youngster in the second grade because her clinician stated she was cured; nonetheless, she resumed treatment at the age of 22. She stated on the client intake form that her last speech therapy appointment was roughly 16 years ago, when she was 23. She claimed to be quite excellent at concealing her stuttering. She mentioned that her family has a genetic predisposition to stuttering, although she did not specify who in her family stuttered. Participant 4 also disclosed a lengthy medical history, which included hypothyroidism, fibromyalgia, and knee and back issues. She stated that her stuttering had improved since infancy, but her anxiousness had not. She claimed that her stuttering nervousness caused her to strain her throat, upper chest, and neck. She also blamed her stuttering on her introverted demeanour, and she felt "unheard" at home and in class. The person displayed mildly related behaviours, especially jaw-clenching stress. Participant 4 stated that she regularly held her breath and was now taking a low dose of clonazepam to help with her anxiety. She also stated that she had prior yoga experience but was not currently enrolled in any classes.

Each of the four people participated in a 6-week therapy course that involved a weekly meeting and practise sessions at home. The participants' speech was evaluated before and after the intervention using the Overall Assessment of the Speaker's Experience of Stuttering (Yaruss & Quesal, 2006) and the Stuttering Severity Instrument for Children and Adults-Fourth Edition (Riley, 2008).

Following the pretesting, the participants participated in a one-hour Vinyasa yoga practice. The lead researcher vocally discussed and demonstrated each stance, along with the appropriate inhalation and expiration breaths. During each session, the following poses were taught in the following order: breath awareness, chanting/bee's breath, Surya namaskar, a triangle/right angle, tree pose, chair pose, warrior 1 and 2, staff pose, left intense stretch, right intense stretch, seated spinal twist, bridge pose, forward bend, fish pose, supine twist, and savasana. The sessions began and ended with a meditation.

All of the individuals showed a decrease in the intensity of their stuttering after the yoga breathing programme. The percentage of stuttering, the length of dysfluencies, and accessory behaviours were all reduced as a result of these improvements. After the 6-week trial, the individuals' self-perception scores remained unchanged. Each segment showed severity reductions in the SSI-4, especially for spontaneous speaking and physical concomitants. Average reductions in severity ratings ranged from one to two, however, one Participant 3 had a reduction from very severe to mild. This significant decrease was mostly related to a decrease in physical concomitants after the yoga programme.

H. Kauffman et al. (2016) obtained fairly comparable findings from his exploratory study on four Caucasian English-speaking volunteers with ages ranging from 39 to 63. All participants reported stuttering since childhood, received intermittent speech therapy in the past, and displayed secondary

behaviours (poor eye contact, grimacing, and leg/arm movements) as well as commonly recognised types of dysfluencies (silent blocks, repetitions). In order to evaluate the impact of the yoga intervention on participants' quality of life, speech, and anxiety, stuttering severity, anxiety, and experiences regarding stuttering and communication were measured at baseline, post-intervention, and at a 4-month follow-up. For this study, SSI-4, OASES, The Burns Anxiety Inventory, and a 6-question, open-ended questionnaire were used. The participants attended once-weekly 1-hour classes taught by a licenced yoga instructor. There were seven group meetings in total. Yoga positions and breathing techniques with a focus on the throat were chosen. For a total of at least 8 hours during the intervention, participants were required to practise for at least 10 minutes each day on their own.

Improvements in self-reported anxiety, quality of life, and a decrease in stuttering intensity from baseline were observed across the assessments. Pre- to post-intervention SSI-4 score changes were 27% from baseline, and 4 weeks after therapy, they were 17%. The percentage change from baseline for the OASES was 5% at treatment's conclusion and 19% at the 4-month follow-up. The Burns Anxiety Inventory showed the greatest percentage change from baseline: 58% post-treatment and 71% at the 4-month follow-up.

S. de Veer et al., (2009) conducted a pilot study on 37 people who stuttered, 29 men and 8 women with a mean age of 36.57, and after they were matched according to gender, age, and education, and then divided at random into two groups FTG (first trained group) which is an experimental group with 19 people and STG (second-trained group) which was a waiting list control group who were trained later with 18 people. Both groups were diverse in terms of greatest educational level and type of therapy their participants had previously undergone. All individuals had experienced speech therapy, psychotherapy, and a variety of stuttering therapies. Considering the tools used, Stress was assessed using the "Perceived Stress Scale," Anxiety about speech situations was assessed using the "Speech Situation Checklist," Coping was assessed using the "Perceptions of Stuttering Inventory," Locus of Control was assessed using the "Locus of Control of Behaviour Scale," and Attitude towards speech situations was assessed using the "condensed S-scale." The MBSR programme consisted of eight weekly sessions lasting 2.5 hours each, during which the participants performed the following exercises: a body scan, which was designed to help them pay systematic attention to their entire body while simultaneously perceiving sensations in various parts of it; yoga poses that involved stretching and striking poses to increase awareness of the muscular system; and sitting meditation, during which the participant's attention is drawn to breathing, physical movement, and mental focus; all of these exercises were part of the MBSR programme. The participants were also given a compact disc with the body scan, yoga, and sitting meditation exercises following the first, third, and fifth sessions. Participants in the MBSR programme were informed during a personal admission interview that they should spend at least 45 minutes per day, six days per week, performing one or more of the activities. Between the pre-test (O1A) and the first post-test (O2A), FTG participated in the MBSR programme. A second post-test was taken four weeks after O2A (O3). After the FTG's O2A, the STG members were made to participate in the MBSR programme. The members of the STG were tested twice (O1B and O2B) before they participated in the MBSR programme, i.e., concurrently with the FTG's O1A and O2A, in order for the STG to serve as a control group. Post-tests were administered immediately after the MBSR programme (O4) and four weeks later (O5), just like in the case of FTG. Each example (O1-O5) utilised the exact identical tools.

The outcomes demonstrated that participants who stutter experienced less stress and related complaints, such as tension and fatigue, immediately following the eight-week MBSR programme as well as four weeks later. They also appeared to have less anxiety about speech situations, had more self-efficacy trust, felt more in control of life events, and were less likely to avoid certain social situations.

However, compared to those who were not trained (later received training), stutterers who had received training did not have significantly higher levels of self-efficacy fluency. The programme had similar impacts on stress and anxiety for both groups.

Discussion and Conclusion:

This systemic review took a thorough approach to determine the potential effects of the discipline of yoga exercises on stuttering and, if applicable, how to incorporate them into stuttering management. It also helped determine the best application for a given programme or technique. To put it another way, we can say that understanding the reasoning behind a given set of exercises can help determine whether they have any effect on factors that contribute to stuttering. The publications examined were the best in terms of study methodology for establishing a link between yoga and stuttering among the scant number of thorough investigations. Two of the three studies that were included had direct yoga exercises of various kinds and meditation on various people in terms of the beginning and behaviours of their stuttering, and one special article performed research using a proper programme that was based on yoga principles. Each article contained the appropriate pre- and post-tests for each element of stuttering, including stress, anxiety, secondary behaviours, self-confidence, severity, and stuttering behaviour, using a variety of instruments and questionnaires.

Basically, incorporating yoga activities into treatment for stuttering had the biggest influence on lowering stress and anxiety, which then helped to lower irritability and bad sentiments and improved fluency in stressful settings and, most crucially, secondary behaviours. Surprisingly, when the percentage of dysfluencies and time of stuttering dropped, the severity of stuttering also appeared to lessen significantly. As individuals avoided fewer social encounters, their quality of life improved. individuals also felt more in control as self-efficacy and trust levels rose. However, the outcomes were not very significant for self-efficacy, fluency, or self-perception, although people reported feeling more aware of their speech and respiratory systems.

Therefore, it is clear that yoga exercises have an impact on the psychological side of stuttering rather than just from the perspective of behaviour. As a result, the participants' overall severity improves to some extent. This is because stress and anxiety are reduced, physical side effects are decreased due to coping and avoidance, and situation-based dysfluencies are somewhat reduced. Additionally, these strategies are beneficial because they aid with the discrepancy between the respiratory and speech systems, which is one of the potential causes of stuttering and may provide an explanation for the Valsalva Hypothesis. But in addition to conventional methods like fluency shaping techniques and stuttering modification techniques, yoga exercises must be utilised to improve self-perception, reduce the overall severity of stuttering in all scenarios, and significantly reduce stuttering behaviour.

Given that excessive types of exercise with different target areas may result in divergent recovery and given that a wide range of stuttering situations are need to be checked in a large number of test populations required in order to increase the efficacy of this results. But these findings are somewhat helpful for further research in order to separate specific yogic rationale and how they can be included inside the current treatment continuum so that a comprehensive final outcome is reached in this topic is achieved and that helps clinicians and people with stuttering eventually.

References:

1. Yaruss, J. S., & Quesal, R. W. (2004). Stuttering and the international classification of functioning, disability, and health (ICF): An update. Journal of communication disorders, 37(1), 35-52.
2. Packman, A., & Attanasio, J. S. (2010, November). A model of the mechanisms underpinning

early interventions for stuttering. In Seminar presentation at the annual convention of the American Speech-Language and Hearing Association Philadelphia, USA.

3. Walden, T. A., Frankel, C. B., Buhr, A. P., Johnson, K. N., Conture, E. G., & Karrass, J. M. (2012). Dual diathesis-stressor model of emotional and linguistic contributions to developmental stuttering. Journal of abnormal child psychology, 40(4), 633-644.
4. Ginsberg, A. P. (2000). Shame, self-consciousness, and locus of control in people who
5. stutter. The Journal of Genetic Psychology, 16(4), 389–399.
6. Bloodstein, O., & Ratner, N. B. (2008). A Handbook on stuttering. 6th edn Clifton Park. NY: Delmar Learning.
7. Craig, A., & Tran, Y. (2014). Trait and social anxiety in adults with chronic stuttering: Conclusions following meta-analysis. Journal of fluency disorders, 40, 35-43.
8. Ezrati-Vinacour, R., & Levin, I. (2004). The relationship between anxiety and stuttering: A multidimensional approach. Journal of fluency disorders, 29(2), 135-148.
9. Tran, Y., Blumgart, E., & Craig, A. (2011). Subjective distress associated with chronic stuttering. Journal of fluency disorders, 36(1), 17-26.
10. Guitar, B. (2006). Stuttering: An integrated approach to its nature and treatment. Baltimore, MD: Lippincott, Williams, and Wilkins.

Implications of voice therapy in a case of postoperative cervical vagal nerve schwannoma

Author Details: *[1]Karbhari-Adhyaru Medha; [2]Maule Rajshri; [3]Solanki Krupa; [4]Khushboo Raghav*

1,2,3,4-ENT department, Sir J. J. Group of hospitals, Mumbai, India.

Background and Objectives:

Cervical vagal nerve schwannoma is a rare and benign tumour exclusively developed from the cell of Schwann that presents itself as an asymptomatic slowly growing lateral neck mass that can be palpated along the medial border of the sternocleidomastoid muscle. About one third occur in the head and neck region. It has a very low lifetime risk of malignant transformation in the general population. It is usually reported to occur in patients between 30 and 50 years of age. There does not seem to be a sex-related predisposition and schwannomas are well-circumscribed, encapsulated mass growing slowly at a rate of approximately 2.5 mm to 3 mm per year always intimately adherent to its nerve of origin and displacing the internal jugular vein laterally and the carotid artery medially.

Preoperative diagnosis of schwannoma is difficult because many vagal schwannomas do not present with neurological deficits leading to several differential diagnoses for tumor of the neck, including paraganglioma, branchial cleft cyst, malignant lymphoma, metastatic cervical lymphadenopathy.

Vocal cord paralysis being the outcome of the surgery is reported to have an 85% incidence rate, but hoarseness is almost always present following surgery. Hoarseness is the most common specific symptom due to vocal cord palsy, whereas, the pathognomonic sign for vagal schwannoma is a paroxysmal cough during palpation of the mass due to vagal stimulation. This is a clinical sign, unique to vagal schwannoma. Therefore, pre-operative assessment of vocal cord mobility is strongly recommended.

Treatment of vagal nerve tumors is a complete surgical excision. At surgery, these tumors appear as yellowish-white, well-circumscribed masses. Dissection of the tumor from the vagus with preservation of the neural pathway should be the primary concern of surgical treatment for these tumors. However, diagnosing and making a complete surgical decision with a promising preservation of the neural pathway is challenging due to the anatomical and regional proximity of the vagus nerve, its origin and its fibers.

OBJECTIVES OF THE STUDY:

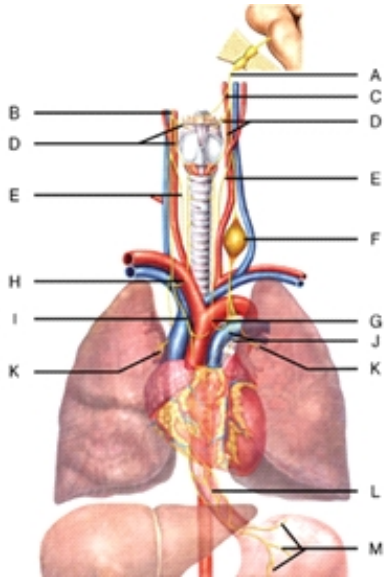
To assess severity of voice impairment and its effects on the quality of life of the professional voice user in post-operative cervical vagal nerve schwannoma-unilateral vocal cord palsy case

To quantify the effectiveness of voice therapy and required evidence-based intervention duration to improving quality of life for professional voice user in post-operative cervical vagal nerve schwannoma-unilateral vocal cord palsy case. Quantifying the role of Voice Therapist in Preoperative counselling and post operative voice rehabilitation Understanding about realistic expectations in terms of voice rehabilitation post operatively. To state importance of preoperative counseling to patient and family member about implications on voice post operatively.

Distribution of the vagus nerve

(A) left vagus nerve, (B) right vagus nerve, (C) pharyngeal branches, (D) superior laryngeal nerve, (E) superior cervical cardiac branch, (F) tumor, (G) left recurrent laryngeal nerve (RLN), (H) right RLN, (I)

inferior cervical cardiac branch, (J) cardiac plexus, (K) pulmonary plexus, (L) esophageal plexus, (M) gastric plexus.



Method:

We present a case of a vagal nerve schwannoma in a 25-year-old male, a level 2 professional voice user, complaining of breathy voice quality. Thorough history taking revealed swelling over the right side of the neck, an insidious onset followed by gradual progression. On physical examination, a swelling measuring to the size of 3*4cm, right side of the neck 4cm from angle of mandible, upon palpating a non-tender, soft and firm mass was reported. A contrast-enhanced computed tomography (CECT) scan of the neck showed heterogeneously enhanced hypodense lesions in the right carotid sheath with splaying of the right internal carotid artery and right internal jugular vein, confirming the diagnosis of a benign vagal nerve schwannoma. Thereafter, a surgical excision of the tumor was recommended. Postoperative 70degree scopy findings revealed a right vocal cord paralysis with resultant hoarseness and breathiness of voice.

History taking revealed that the patient reported bouts of aphonia when subjected to longer duration of speaking. Due to professional demands, he also engaged in excessive and loud speaking activities in noisy environments as well as during rehearsals. These vocal misuse and abuse behaviors were reported to have an impact on the individual's voice, ultimately affecting his quality of life.

Oral peripheral mechanism examination, perceptual, subjective and objective voice evaluation was carried out.Oral peripheral mechanism examination revealed all articulatory structures were normal in appearance and adequate in functions. On observation, the breathing pattern was thoracic and rate of speech was within normal limits. Muscle tension was observed around the neck and shoulder region. Perceptual evaluation was done by the Speech Language Pathologist (SLP) on the following parameters:

Habitual pitch: normal

Pitch breaks: present

Pitch range: limited

Loudness level: low

Maximum phonation time (MPT): /a/=4 seconds

Speech intelligibility: 3

GRBAS (Japanese Society of Logopeadics and Phoniatrics; 1997) scale was utilized for evaluating the hoarseness of voice:

Grade: 3 (extreme)

Rough: 2 (moderate)

Breathy: 2 (moderate)

Asthenic: 2 (Moderate)

Strain: 2 (Moderate)

Subjective voice evaluation was carried out using Voice Handicap Index (VHI) (Jacobsen et al., 1997), which was used to assess the patient's judgment about the relative impact of his or her voice disorder upon his daily life. The total score for each subscale was as follows:

Functional: 38

Physical: 33

Emotional: 25

Total score: 96

A score of 96 was suggestive of severe perceived voice disturbance that significantly impacts on aspects of daily life.

Objective voice assessment was done using PRAAT software. The parameters considered on PRAAT were the average fundamental frequency (avg Fo), jitter, shimmer and standard deviation.

All findings were assimilated and a diagnosis of hypofunctional voice disorder in k/c/o unilateral vocal cord palsy was made by the SLP. Post assessment, the patient was recommended voice therapy with a dosage frequency once a week. Voice therapy was initiated 20 days post-surgery for this individual.

Initial week consisted of counselling the patient and the caregiver with a complete vocal rest (the process of resting the vocal folds by not speaking and singing that typically cause harm to vocal folds) and a vocal hygiene program (these include eliminating inappropriate vocal habits and situations that place unnecessary wear and tear on the voice). Until the next follow up, the patient was advised to follow the treatment plan.

The later session focused on counseling the patient regarding the importance of:

abdominal breathing (involves breathing deep into the stomach and fully engaging the diaphragm), relaxation exercises hard glottal attack (technique that involves excessive glottal closure before phonation resulting in loud and sudden voice onset).The patient was asked to perform a hard glottal attack twenty times each day.

In the third session, perceptual improvement of voice quality was evinced. Relaxation exercises such as chewing and yawn sigh were introduced. (The yawn expands the pharynx and stretches the laryngeal muscles to encourage greater airflow. The sigh with phonation that follows is relaxed. Once this technique is mastered with a phoneme, then the yawn-sigh technique is used with words and sentences). The patient was asked to perform these exercises ten times each day and also practice the previous exercises.

Lastly, exercises to target pitch range and loudness range were introduced. Pitch glides from low to high and high to low were taught to the patient where he was expected to glide up and down the scale. Loudness range exercises targeted a gradual increase in loudness along with the pitch glide.

Re-evaluation of voice was carried out post one month to document progress.

Result:

Perceptual re-evaluation post therapy was done by the same Speech Language Pathologist (SLP) which revealed improvement in the following parameters:

Habitual pitch: normal

Pitch breaks: absent

Pitch range: normal

Loudness level: normal

Maximum phonation time (MPT): /a/=16 seconds

Speech intelligibility: 1

Significant progress was also seen on VHI post therapy.

Functional: 11

Physical:9

Emotional: 3

Total: 23

A score of 23 was suggestive of mild perceived voice disturbance that shows significantly improved voice quality.

Pre and post voice therapy findings: on GRBAS scale

Parameters	Pre therapy	Post therapy
GRBAS scale		
Grade	3	0
Roughness	2	0
Breathy	2	1
Asthenic	2	1
Strain	2	0
Objective PRAAT	/a/	/a/
Average f0	127.59 Hz	169.17 Hz
Jitter	2.3%	0.4%
Shimmer	11%	6.5%

The patient was then asked to follow up on a monthly, quarterly and biannual basis to maintain and generalize improved voice quality in daily aspects of life.

Conclusion

Schwannoma arising from the cervical vagus is a rare, benign pathology usually giving unspecific symptoms and requiring surgical excision, but frequently postoperative complications can affect patients, so, surgical indications should be based carefully on the balance between risks and benefits.

Surgical options for cervical vagal schwannomas certainly have posing effects on the voice and the quality of life. Preoperative counseling to the patient and their caregivers would be really beneficial for post operative health care. Therefore, a preoperative assessment of vocal cord mobility should be strongly recommended. Preoperative counseling followed by intensive voice therapy for voice restoration can work very well in some rare cases, especially in professional voice users. Elimination of the postoperative hoarseness and breathiness can be achieved wonderfully with voice therapy and regular follow up.

Acknowledgement

The authors deeply acknowledge the patient and his family members, the Department of ENT, Sir J. J. Group of Hospitals, Mumbai.

References:

1. Cavallaro, G., Pattaro, G., Iorio, O., Avallone, M., & Silecchia, G. (2015). A literature review on surgery for cervical vagal schwannomas. *World Journal of Surgical Oncology*, *13*(1). https://doi.org/10.1186/s12957-015-0541-6
2. Jacobson, B. H., Johnson, A., Grywalski, C., Silbergleit, A., Jacobson, G., Benninger, M. S., & Newman, C. W. (1997). The voice handicap index (VHI). *American Journal of Speech-Language Pathology*, *6*(3), 66–70. https://doi.org/10.1044/1058-0360.0603.66
3. Noh, S. H., & Zhang, H. Y. (2017). Hoarseness after section of a cervical vagus nerve schwannoma. *The Nerve*, *3*(1), 18–20. https://doi.org/10.21129/nerve.2017.3.1.18
4. Prajapati, R., Thapa, A., Yadav, J. K., Lama, M., Shrestha, P., Kc, A., Gurung, P., & Pant, B. (2022). Cervical vagal schwannoma, a rare differential of a neck swelling: A case report. *Clinical Case Reports*, *10*(11). https://doi.org/10.1002/ccr3.6560
5. Satpathy, S., Mondal, G., Bhowmick, A. K., & Dam, A. (2016). Cervical vagal schwannoma: A case report. *Bangladesh Journal of Otorhinolaryngology*, *21*(2), 115–118. https://doi.org/10.3329/bjo.v21i2.27651
6. Sreevatsa, M. R., & Srinivasarao, R. V. (2011). Three cases of vagal nerve schwannoma and review of literature. *Indian Journal of Otolaryngology and Head & Neck Surgery*, *63*(4), 310–312. https://doi.org/10.1007/s12070-011-0220-z

Resonating Beyond Puberty: A Systematic Review of Puberphonia's Multifaceted Impacts on Psychological, Emotional, Social, and Professional Dimensions

Author Details: *[1]Ms. Deepti Pradhan; [2]Mr. Vivek Kumar,*

1-BASLP Intern, 2-Assistant Professor in Speech, Language, Cognition, and Swallowing Disorders

Introduction

Puberphonia, a voice disorder characterized by the persistent use of a high-pitched voice beyond puberty, presents a unique challenge that extends beyond its physiological characteristics. This disorder is not uncommon, and its impact is subject to a myriad of variables, including individual personality, environment, family dynamics, occupation, and overall psychological constitution. These variables collectively shape the nuanced ways in which Puberphonia affects each person.

Moreover, the emotional toll of Puberphonia cannot be overlooked. Individuals afflicted with this condition may grapple with emotions such as depression, loneliness, and feelings of inadequacy. Low self-esteem and an inferiority complex can compound these emotional challenges, potentially leading to a vulnerable state of mind.

The profound psychosocial effects of Puberphonia can extend to the point of individuals contemplating drastic measures such as suicide. It is crucial to recognize that the emotional struggles faced by those with Puberphonia warrant significant attention and support.

This study's insights emphasize the gravity of the psychosocial challenges associated with this condition. Beyond the clinical aspects of treatment, the emoti014'onal well-being of individuals with Puberphonia should be at the forefront of intervention strategies. Awareness and education about Puberphonia within both the general population and healthcare professionals can foster understanding and contribute to more empathetic and effective care.

In summation, the multifaceted impact of Puberphonia underscores the necessity of a holistic approach that acknowledges the emotional, psychological, and social dimensions of the disorder. As we advance our comprehension of Puberphonia psychosocial effects, we pave the way for improved diagnosis, treatment, and support for individuals navigating the intricate challenges of this condition.

Method

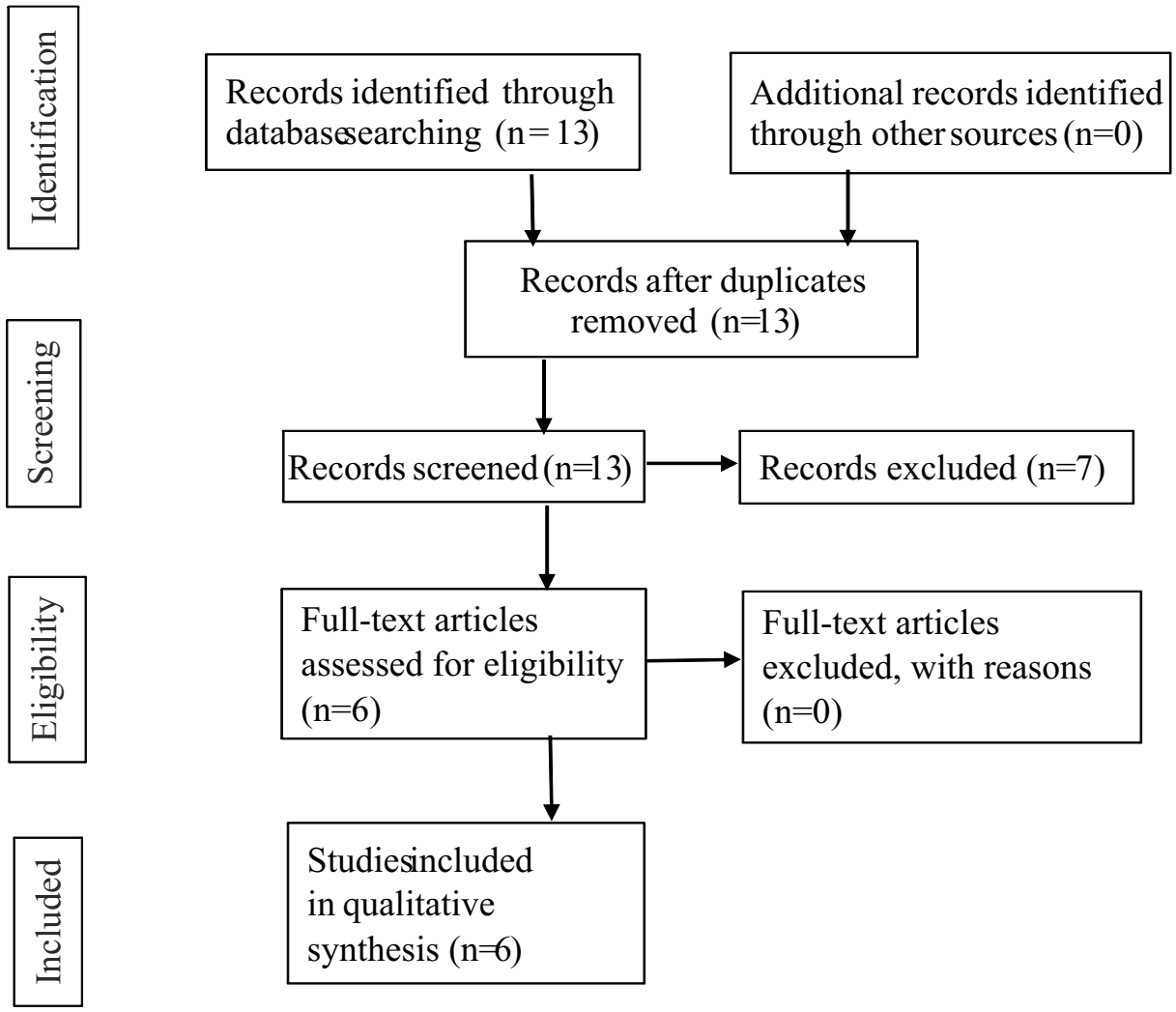
In this systematic review, a thorough and extensive search was conducted across multiple reputable databases, including cjo.sljol.info, Digital Repository, Core.ac.uk, Elsevier, ResearchGate, and Google Scholar. The search strategy will be developed using a combination of keywords and controlled vocabulary terms related to Puberphonia, voice disorders, psychological impact, emotional consequences, social interactions, and professional implications. The search will include articles published up to the present date. The search strategy will be peer-reviewed by an independent researcher to ensure comprehensiveness.

Inclusion and Exclusion Criteria:

Out of the 13 reviewed abstracts, a total of 6 studies met the pre-defined inclusion criteria and were included in the systematic review. This systematic review will include peer-reviewed journal articles, reviews, meta-analyses, and systematic reviews written in English that directly address the topic of Puberphonia and its impacts on psychological, emotional, social, and professional dimensions in human participants of any age.

Conference abstracts, editorials, letters to the editor, commentaries, opinion pieces, and non-English publications will be excluded, along with studies that solely focus on medical treatment methods without discussing impacts, studies lacking clear methodologies or assessment details, and studies with insufficient data for proper analysis. Additionally, animal studies, duplicate publications, and studies without direct relevance to human impacts will also be excluded from this review.

Figure 1. Preferred Reporting Items for Systematic Review Flow Diagram:



Result

A systematic search of databases was conducted to identify relevant studies focusing on the psychological, emotional, social, and professional effects of puberphonia. Articles that met predetermined inclusion criteria were selected, and their findings were synthesized to provide a comprehensive understanding of the broader impacts of this condition :

One particular study used a questionnaire with two parts: one focused on communication and social participation, and the other on emotional responses. Participants completed the questionnaire and individual interviews. Difficulties were universally reported in telephone conversations and talking to same-age peers. Challenges in workplaces or education were also widespread. (1)

Communication methods included writing on paper (10%) and text messages (87%). Psychological distress was observed in 70% of participants, particularly among adolescents. Beyond voice impact, Puberphonia affected social and psychological aspects, often with limited awareness and research on the disorder's broader effects. (1)

Related research highlighted similar challenges: phone communication (87%), talking to peers (73%), and workplace/education issues (60%). Social situations posed difficulties for 77%, whereas only 20% faced problems with family interactions [1,2].

The study also raised concerns about puberphonia's link to suicide, a growing public health issue affecting individuals aged 15 to 30. Those with suicidal tendencies often face mental health issues, depression, or substance abuse, and factors like puberphonia-related rejection or bullying could exacerbate this. Addressing this requires increased awareness of treatment options, early intervention, and non-invasive medical support. (1,3,4)

Over 15 years, the study involved 71 participants aged 14 to 24, diagnosed with Puberphonia via assessments by an ENT Surgeon using perceptual analyses and stroboscopic findings.

The study highlighted significant psychosocial impacts. Prior to therapy, 69% felt unheard while speaking; 100% were questioned about their voice, often mistaken for a female on the phone. Peer pressure affected 54.9%, personal relationships posed difficulties for 50.7%, and occupational challenges were lower (25%) than prior studies (60%). Dissatisfaction with voices was expressed by 88.6%. (5)

After therapy, 85% reported improved audibility, 94% were no longer questioned about their voice identity. Peer pressure and relationship issues reversed for 74.3% and 77.7% respectively. Remarkably, 95.8% experienced improved psychosocial well-being and satisfaction ($p<0.01$). Only 2 patients (2.8%) opted for surgery with OSR scores below 7 post-therapy. (5)

Voice disorders impact emotions, social interactions, and physical well-being (Krischke et al., 2005). Puberphonia leads to rejection and shame, often due to perceived effeminacy or different sexual orientations (Anelli, 1999; Boone & McFarlane, 2000). In the study, puberphonia individuals noted high-pitched voice, avoiding group conversations, and perceptions of a different sexuality. (6)

PEMUV's "sexual identification" question showed no case-control differences. Literature suggests feminine identification or sexual orientation struggles might contribute (Van den Broek et al., 2016; Alam et al., 2012). Puberphonia treatment's impact relates to job, environment, family, and personality factors, requiring comprehensive evaluation (Thiagarajan, 2015). (6)

Open-ended PEMUV responses reveal job hindrance due to high-pitched voice, aligned with Neto's findings (1999) on fragility projection. Insecure personality and low self-esteem, linked to the high-pitched voice, are workplace concerns. (6)

Another issue raised is an absent father figure during childhood, in line with Molina et al.'s findings (2006) on maternal overprotection and weak father figures. (6)

PEMUV is valuable for characterizing individuals and tracking psychosocial progress in speech therapy. Early intervention is crucial due to discomfort. Treating Puberphonia enhances voice and self-image (Kothandaraman & Thiagarajan, 2014; Alam et al., 2012). (6)

Intervention and Strategies:

Voice therapy, the primary treatment for Puberphonia, not only targets vocal pitch but also addresses the psychological, emotional, social, and professional dimensions affected by the condition. Tailored

interventions that incorporate cognitive-behavioral techniques, communication skills training, and confidence-building exercises could enhance outcomes.

Conclusion:

Puberphonia's impact extends far beyond the realm of vocal quality, affecting psychological well-being, emotional expression, social interactions, and professional pursuits. This systematic review underscores the need for a holistic approach to managing Puberphonia, one that recognizes its far-reaching consequences and integrates interventions that address the multifaceted challenges individuals with this condition face. By acknowledging and addressing the broader effects of Puberphonia, clinicians, researchers, and educators can contribute to enhancing the overall quality of life for those affected by this condition.

REFERENCE:

1. Muthiah, K., & Kumaresan, N. B. (2019). Assess the Impact of Puberphonia in the Society. *Int J Otorhinolaryngol*, *5*(2), 39.
2. Premarathna, M. S. S., Wijeratne, L. T., Perera, I., & Wickremasinghe, A. R. (2014). Psychosocial Impact of Puberphonia.
3. Horowitz, L. M., Bridge, J. A., & Boudreaux, E. D. (2014). Screening youth for suicide risk in medical settings: time to ask questions. *American journal of preventive medicine*, *47*(3), S170-S175.
4. Muthiah, K. (2018). An immediate and permanent cure for Puberphonia. *J Otolaryngol ENT Res*, *10*(4), 231.
5. 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).
6. Carvajal, L. N. (2018). Perfil vocal y psicosocial de los sujetos con puberfonía. *Revista de logopedia, foniatría y audiología*, *38*(2), 45-51.
7. Srikamakshi, K., & Balasubramanian, T. (2014). Mutational falsetto: A panoramic consideration. *Online Journal of Otolaryngology*, *4*(1), 89.
8. Balasubramanian, T. (2015). Puberphonia Conservative approach A review. *Online Journal of Otolaryngology*, *5*, 38.

Profiling incidence, co-occurrence, and pathological findings of acquired neuro-communication disorder

Author Details: *[1]Ms. Nikita Subudhi M*

1-Assistant Professor, Department of Speech Language Pathology, Institute of Health Sciences, Bhubaneswar

Abstract

Acquired neuro-communication disorders are the most observed consequences of the neurological disorder. Profiling communication characteristics is a sensitive indicator in tertiary care centre that helps to plan an individualized management strategy to improve the quality of life in an individual with a neuro-communication disorder. The aim and objectives of the current study was profiling communication characteristics of individuals with acquired neuro-communication disorder in a tertiary care centre. The study followed a cross-sectional design and used a convenient sampling process for sample collection. A total number of seventy-six participants recruited for the study based on selection criteria. Descriptive statistical analysis was done. Result indicated a greater proportion of participants were from the middle-aged adult group than in the older aged adult group and males having higher frequency occurrence of neuro-communication disorder than females. Cortical pathology was observed as the most underlying pathology for impairments, whereas the least underlying pathology was observed in LMN & UMN pathology with and without cortical pathology. Among all impairments with co-morbidities, the highest occurrence was observed for dysarthria with dysphagia, whereas the least co-occurrence was observed for dysphagia with aphasia.

Introduction:

WHO defines the neurological disorder as "a clinical disorder of central and peripheral nervous system, which includes the brain, spinal cord, autonomic nervous system, cranial nerves, peripheral nerves, nerve roots, neuromuscular junction, and muscles". These are the most prevalent disorders that detrimentally affect an individual's life in all aspects and can even cause permanent disability. Engelter et. al. (2006) and Katzenellenbogen et. al. (2016) have reported that approximately one-third of people following neurological pathologies have acquired communication disorders. Impairment in communication characteristics and swallowing abilities are the most common consequence of neurological disorders for these individuals. The pathological locations can be cortical, subcortical, or mixed, significantly influencing their communication characteristics. The type and severity of impairment are based on the specific lesion site and the extent of damage to the brain area. Communication disorder has been described as a terrifying experience for patients with an acquired neurological disorder. There are multiple etiological factors such as cerebrovascular accidents, traumatic brain injury, infarctions of the central nervous system, degenerative disorders, haemorrhage, tumour or neoplastic conditions, multiple sclerosis, spinal cord injury, post-surgical conditions, metabolic disorders that are known to be leading causes of acquired communication disorder.

The most observed consequences of the acquired neurological disorder are neuro-communication disorders such as aphasia, dysarthria, apraxia, cognitive-communication disorders, and dysphagia. Aphasia is a language disorder involving impairment in comprehension and expression skills and classified as fluent and non-fluent type by Goodglass and Kaplan (1972). Dysarthria is a speech disorder owing to disruption of muscular control caused due to central and peripheral nervous system damage (Darley et al.,1975). This is characterized by impairment in breath control; loudness, pitch,

quality of the voice; pronunciation accuracy, and oral versus a nasal projection of the voice, resulting in slowness and poorly coordinated speech. Apraxia is a motor speech disorder due to disruption in sending planning and programming commands directing necessary speech movement (Darley, 1967). Cognitive-communication disorders are communication impairments because of cognitive deficits due to underlying neurological impairment; which impairs attention, memory, discourse, pragmatic skills, and social communication; seen in disorders such as Alzheimer's disease, primary progressive aphasia, dementia (Buckingham & Sneed, 2017). Dysphagia is a disorder characterized by difficulties in swallowing food and liquids, which can be caused due to structural deformity or deficit in neurological control of the mechanism (Malandraki & Robbins, 2013).

Aim of the Study

The present study is aiming at profiling the communication characteristics of individuals with acquired neuro-communication disorder in a tertiary care setup

Method

The study followed a cross-sectional design and used a convenient sampling process for sample collection. The participants were recruited from the Kasturba Medical College in patient unit, Mangalore, referred from the Department of Neurology to the Department of Audiology and Speech-Language Pathology for speech, language, and swallowing assessment. Prior to the study, informed consent was obtained from all the participants. A detailed case history was documented on the selected participants by a trained Speech-Language Pathologist, using proforma to collect the participant's demographic data and medical history. Demographic detail includes name, age, and gender of the participants. Each case file was separately analyzed for the detailed history of medical information, including onset and progression of disease/disorder, neuro-imaging evidence, pre-morbid and post morbid history, any other medical and surgical intervention. The pathological findings were investigated for the neuro-communication disorders and broadly categorized into Cortical pathology, Subcortical pathology, Upper Motor Neuron & Lower motor neuron (UMN & LMN) pathology, and Other pathology. Multiple pathologies like Cortical with Subcortical pathologies, Cortical with LMN & UMN pathologies, Cortical with other pathologies were also observed. Cortical pathology was considered for conditions like an acute cerebrovascular accident, cerebral edema, left MCA infarct, vasculitis, etc.; when the lesion site was in the cerebral cortex region such as frontal, parietal, temporal, and occipital lobes. Subcortical pathology was considered for conditions such as thalamic bleed, basal ganglia bleed, pontine infarct, lateral medullary syndrome, Guillain-Barre syndrome, etc.; when the lesion site was in subcortical structures such as the thalamus, cerebellum, basal ganglia, internal capsule, brainstem. Other pathologies included neurological conditions like seizure disorder, encephalitis, and chronic obstructive disorder. The comprehensive bedside screening tool for adult language disorder (Nagendra, 2015) was administered to assess the participant's performance on various neuro- communication domains as part of the standard operating protocol followed in the tertiary care setup. The administration was done using on 76 individuals with neuro-communication disorders, recruited based on inclusion and exclusion criteria. Individuals with the cortical or subcortical lesion as ascertained from MRI Scan were included for the study; where as individuals previously diagnosed with any psychological or cognitive disorder and individuals with a prior developmental disability were excluded from the study.

Result

The data obtained under all the domains of neuro-communication was profiled under each measure for all participants. The data were subjected to statistical analysis. Statistical analysis was carried out using

the licensed version of SPSS. Descriptive statistics were used to analyze pathology and impairment across age and gender. Test of normality was performed using Kolmogorov Smirnov and Shapiro Wilk tests on the obtained data to check for normal distribution.

The data obtained were organised into 3 categories for analysis and arranged under the following sections:

Participant demographics

Pathology and impairment

A. Participant demographics (Age and Gender)

The distribution of individuals with acquired neuro-communication disorder across age and gender was analysed. In age distribution, the mean age and standard deviation were 54.93 ± 6.78 years for the middle-aged adult group (40- 65 years) and 71.16± 7.16 years for the older aged adult group (older than 65 years). A greater proportion of participants was observed in the middle-aged adult group (52.63%) than in the older aged adult group (47.36%). In gender distribution, males were observed to have a higher frequency of neuro-communication disorder (69.73%) than females (30.26%). The age and gender distribution of participants are summarised in Table 1.

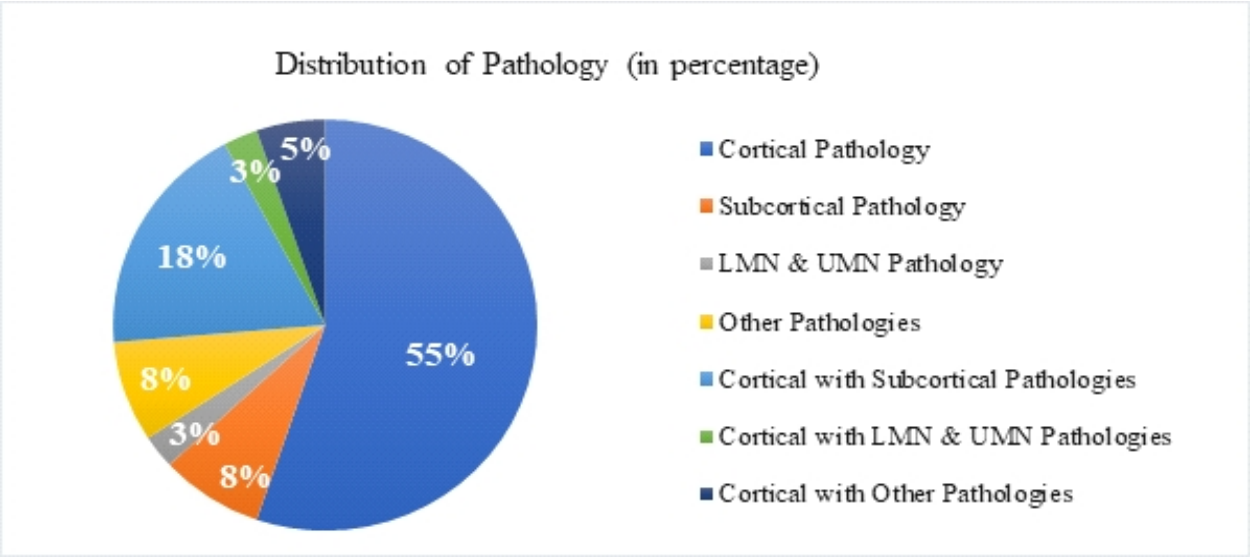
Table 1: *The Age and Gender Distribution of the Participants*

Demographic Variables	Participants	
	N	%
Age (in years) (N=76)		
40-65 (middle aged adult)	40	52.63
65< (older aged adult)	36	47.36
Gender (N =76)		
Male	53	69.73
Female	23	30.26

B. Distribution of Pathology and Impairment

The current study analysed the distribution of various pathologies for acquired neuro-communication disorder among the participants. The underlying pathologies were categorised into cortical pathology, subcortical pathology, lower motor neuron (LMN) & upper motor neuron (UMN) pathology, other pathology, and multiple pathologies (cortical with subcortical pathologies, cortical with LMN & UMN Pathologies, cortical with other pathologies). Overall distribution showed that cortical pathology was observed as the most occurred pathology, with a total aggregate of 81% with the distribution of 55% having only cortical pathology, 18% having cortical with subcortical pathologies, 3% having cortical with LMN & UMN pathologies, and 5% having cortical with other pathologies. The least occurring pathology was observed in LMN & UMN pathology with cortical and without cortical pathology at 3%. The distribution of aetiologies for participants are summarised in Figure 1.

Figure 1: *Distribution of Pathology for Individual with Neuro-Communication Disorder*



Cortical pathology was observed to be main contributor of all the impairments. The distribution of impairments with respect to the pathologies are depicted in table 2. In the distribution of impairment, it was observed that impairments like dysphagia, dysarthria, and aphasia occurred with and without the presence of co-morbidities. The result revealed that dysarthria was the most common impairment among all neuro-communication disorder, whereas least frequency was observed in aphasia. Among the impairments with co-morbidities, the highest occurrence was observed for dysarthria with dysphagia, whereas the least co-occurrence was observed for dysphagia with aphasia. The distribution of impairment for participants are depicted in Figure 2.

Figure 2: *Distribution of Impairment for Individual with Neuro-Communication Disorder*

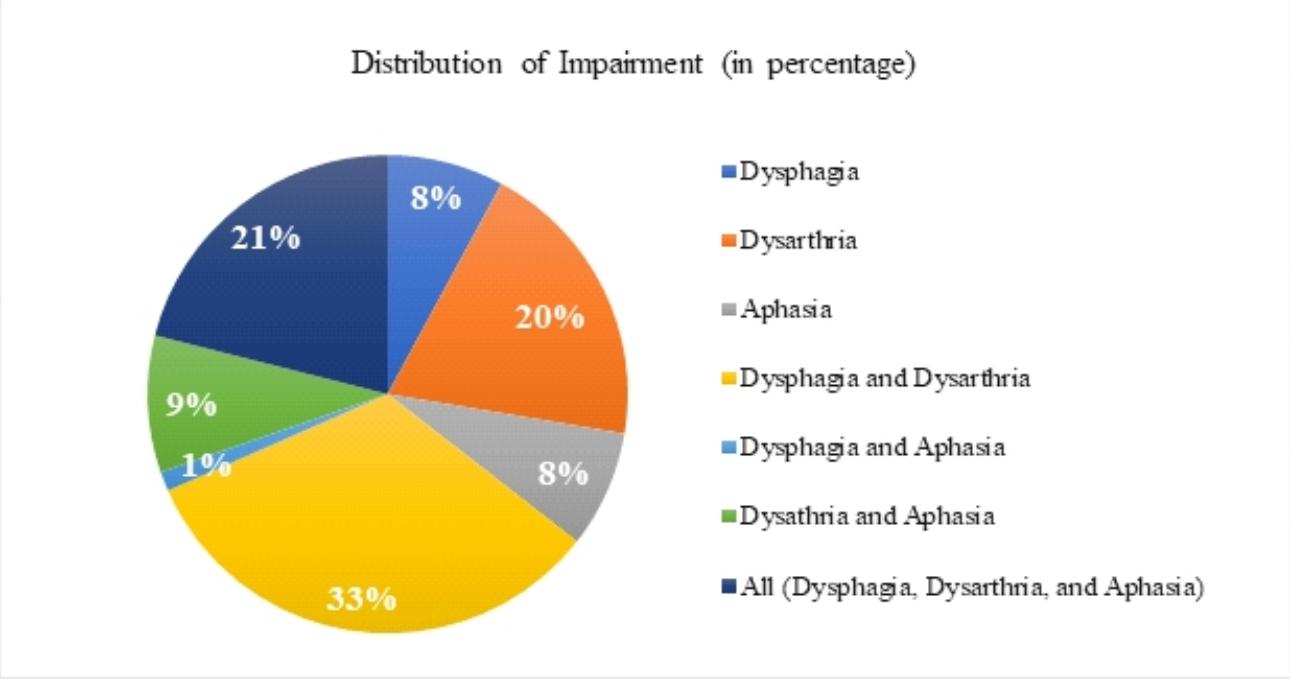


Table 2 : *Distribution of with Impairment respect to Pathology*

Impairment (n)	Pathology, n				Multiple Pathology, n		
	CP	SP	LMP	OP	CSP	CLMP	COP
Dysphagia (6)	2	1	1	1	1	0	0
Dysarthria (15)	9	1	0	1	1	2	1
Aphasia (6)	4	0	0	0	0	0	2
Dysarthria with Dysphagia (25)	11	2	1	2	9	0	0
Dysphagia with Aphasia (1)	0	0	0	0	1	0	0
Dysarthria with Aphasia (7)	6	1	0	0	0	0	0
All (Dysphagia, Dysarthria, and Aphasia) (16)	10	1	0	2	2	0	1

Note: CP: Cortical Pathology, SP: Subcortical Pathology, LUP: LMN & UMN Pathology, OP: Other Pathology, CSP: Cortical with Subcortical Pathologies, CLMP: Cortical with LMN & UMN Pathologies, COP: Cortical with Other Pathologies

Discussion:

The study finding of overall distribution depicts a high occurrence of the acquired neuro-communication disorder in middle-aged adults. The high occurrence could be attributed to several reasons. Firstly, studies report the high occurrence of premorbid systemic diseases like hypertension, diabetes mellitus, hypercholesterolemia, atrial fibrillation, and transient ischemic attacks in middle aged adults. Secondly, severe psychological stress due to socioeconomic conditions, marital status, and health deterioration tend to increase during middle-aged adulthood. Thirdly, the risk associated with substance use like alcohol abuse and smoking often aggravates during middle-aged adulthood, which are potential risk factors for causing cerebral infarction (Harmsen et al. 1990; Inatomi et al., 2008).

The neuro-communication disorder's global occurrence can be majorly accounted as the consequence of cortical pathology (Flowers et al., 2017; Jani & Gore, 2014), which is also observed in the current study. A closer look at the data reveals that acute cerebrovascular accident involved an extensive neuroanatomical substrate lesion, confirming it to be the major underlying pathology of the acquired neuro-communication disorder. The high occurrence of cerebrovascular accident in cortical areas could be due to many vascular factors. One of the primary reasons could be atherosclerosis as atherosclerotic plaques often rupture and cause local thrombosis, leading to a high occurrence of brain infracts (Liberato et al., 2005; Walhovd et al., 2005).

In the current study, dysarthria was observed as the highest occurring impairment, which is in consonance with an Indian study by Jani and Gore (2014), which also reported a similar trend of the high occurrence of dysarthria followed by dysphagia and aphasia. However, the findings of the current study contrast with the global trend, which reports dysphagia as the highest occurring impairment followed by dysarthria and aphasia (Enderby, 2013; Flowers et al., 2013; Stipancic et al., 2019). Such

occurrence patterns could be explained due to the high incidence of cortical pathologies among participants in the current study. Areas in the cortical regions include multiple motor areas that facilitate the execution and coordination of voluntary movements. The areas involved in functional integration include motor areas in the frontal lobe, such as the premotor cortex, primary motor cortex and supplementary motor areas, which activate different muscles (Cheung et al., 2009). The essential roles taken up by the motor areas underlie the impairments that are observed as a consequence of cortical pathologies. For instance, a lesion in the frontal lobe's motor cortex impairs the voluntary muscular control movements associated with muscle for speech, consequently impairing the execution of speech movements, therefore reducing speech intelligibility (dysarthria). In the current study, dysarthria is also observed in participants with Subcortical pathology. This could be due to the motor functions controlled and coordinated by the subcortical regions like the anterior left insula and basal ganglia. For instance, a lesion in the anterior left insula could affect the coordination of muscles involved in complex speech articulation, leading to unintelligible speech production. Another possible reason could be generalized muscle weakness at the onset of neurological disorders characterized by motor and physical weakness, which in turn could have also contributed to poor speech intelligibility (Flowers et al., 2013). Following the high occurrence of dysarthria, dysphagia was observed as the subsequent most occurring impairment. Like dysarthria, cortical pathology was observed to be a significant contributor to the high occurrence of dysphagia. As the cortical regions control significant motor functions, there is a high probability that lesion in the cortical region involving the precentral gyrus could produce structural and functional impairments in motor control of oral structures (Martino et al., 2012), which could be one contributing reason for observing dysphagia at the oral and pharyngeal phase of the swallow. There are also high instances of patient intubation in the intensive care unit during the initial stages of medical treatment, which could have also contributed to the paresis or paralysis of the vocal folds at the laryngeal level, leading to dysphagia at the pharyngeal level (Medeiros et al., 54 2014).

The current study's findings provide insight into understanding the occurrence of impairment and underlying pathologies among individuals with acquired neuro-communication disorder. This will advocate Speech-Language Pathologists for understanding the etiological factors and plan the intervention strategy accordingly.

References:

1. Engelter, S. T., Gostynski, M., Papa, S., Frei, M., Born, C., Ajdacic-Gross, V., Gutzwiller, F., & Lyrer, P. A. (2006). Epidemiology of aphasia attributable to first ischemic stroke: Incidence, severity, fluency, etiology, and thrombolysis. Stroke, 37(6), 1379–1384.
2. Cheung, V. C. K., Piron, L., Agostini, M., Silvoni, S., Turolla, A., & Bizzi, E. (2009). Stability of muscle synergies for voluntary actions after cortical stroke in humans. Proceedings of the National Academy of Sciences, 106(46), 19563-19568
3. Enderby, P. (2013). Neurological Rehabilitation: Chapter 22. Disorders of communication: dysarthria (Handbook of Clinical Neurology 110). Elsevier
4. Flowers, H. L., Silver, F. L., Fang, J., Rochon, E., & Martino, R. (2013). The incidence, co-occurrence, and predictors of dysphagia, dysarthria, and aphasia after first-ever acute ischemic stroke. Journal of Communication Disorders, 46(3), 238–248.
5. Jani, M. P., & Gore, G. B. (2014). Occurrence of communication and swallowing problems in neurological disorders: Analysis of forty patients. NeuroRehabilitation, 35(4), 719–727. https://doi.org/10.3233/NRE-141165

6. Liberato, B., Chong, J. Y., & Sacco, R. L. (2005). Focal brain ischemia. Clinical features, epidemiology, risk factors and outcome. Cerebrovascular Diseases, Kalimo H, editor. Basel: ISN Neuropath Press, 176-85

7. Martino, R., Foley, N., Bhogal, S., Diamant, N., Speechley, M., & Teasell, R. (2005). Dysphagia after stroke: Incidence, diagnosis, and pulmonary complications. Stroke, 36(12), 2756–2763.

8. Medeiros, G., Sassi, F., Mangilli, L., Zilberstein, B., & Andrade, C. (2014). Clinical dysphagia risk predictors after prolonged orotracheal intubation. Clinics, 69(01), 8–14. https://doi.org/10.6061/clinics/2014(01)02

9. Stipancic, K. L., Borders, J. C., Brates, D., & Thibeault, S. L. (2019). Prospective Investigation of Incidence and Co-Occurrence of Dysphagia, Dysarthria, and Aphasia Following Ischemic Stroke. American Journal of Speech-Language Pathology, 28(1), 188–194. https://doi.org/10.1044/2018_AJSLP-18-0136

Neurological dysphagia sequelae followed by partial hanging: A case report

Author Details: *[1]Gunasagar S M; [2]Rakshitha Srihari; [3]Anukiruba B; [4]Ashwini T; [5]Niharika M K; [6]Harshan Kumar H S*

1 Clinical Speech Language Pathologist Grade I, JSSISH, Mysore, India

2,3,4 M.Sc. Speech Language Pathology, JSSISH, Mysore, India.

5,6 Assistant Professor, JSSISH, Mysore, India

Abstract:

The present study highlights a case of a 31-year-old male diagnosed as sever dysphagia with hypoxic-ischemic encephalopathy following partial hanging. Prospective data of this patient during a stay in the hospital from admission to discharge was collected. The subsequent assessment was done using Glasgow Coma Scale (GCS) (to check the level of consciousness), Gugging Swallow Screen (GUSS) (to check the severity of dysphagia) and monitoring of suctioning frequency (to check the secretions management). Further, the management focused on improving oral secretion management, active and passive motor exercises, sensory stimulation and postural management for swallowing. After four weeks of therapy, the patient showed a good improvement in swallowing, which was evident through GCS and GUSS scores. Furthermore, suctioning frequencies were reduced; henceforth, the patient was decannulated and tolerated oral feed. Therefore, monitoring tracheal suctioning frequency may help in dysphagia assessment.

Key Words: *Neurogenic Dysphagia, Hypoxic Ischemic Encephalopathy (HIE), sensory stimulation, cognition.*

Introduction

Neurogenic dysphagia (ND) is a swallowing disorder characterized by difficulty in the oral preparation of the bolus or moving of food from the mouth to the stomach due to an insult to the brain. Dysphagia is one of the common complications following partial hanging due to Hypoxic Ischemic Encephalopathy (HIE). Partial hanging is often called incomplete hanging; it characterizes life-threatening injuries. Literature focussed on swallowing issues in partial hanging cases needs to be improved. Patients with HIE secondary to hanging exhibit problems in the physiologic swallowing process like delayed oral phase, consistent with dysfunction of the volitional execution of swallowing mainly consistent with a massively delayed oral phase and delayed intra-oral bolus transportation. Additional lesions in the brainstem may affect the integrity of the central pattern-generating circuitry for swallowing, resulting in additional dysfunction of the non-volitional reflexive component.[1] A clinical case report suggests that nearly all patients with HIE develop severe dysphagia, irrespective of age.[1]

Further, the case studies [2,3] on flaccid dysarthria due to HIE secondary to hanging showed difficulties in swallowing. Moreover, the study[1] revealed lateral face and tongue weakness, small mouth opening, poor lip seal, and weak glottal cough in three conditions, i.e., mouth and tongue where at rest, sustained position, or during movements through oral peripheral mechanism (OPM) assessment. These characteristics may affect the oral phase of swallowing.

Despite speech, previous literature suggests that patients with dysphagia secondary to HIE due to partial hanging may present with cognitive, behavioural, and linguistic problems.[4] Concerning cognition, these patients were identified to have mild to severe cognitive impairment (compared to pre-morbid mental state). [1,2,4,5] Further, a study [6] suggests that the cognitive status of these patients varies

across time; therefore, cognitive status should be consistently monitored through Glasgow Coma Scale (GCS) scores. However, the literature concerning swallowing complications in patients with HIE secondary to partial hanging is limited. Therefore, the current case report attempts to highlight the swallowing deficits and treatment strategies used in a case of partial hanging.

Aim

This study aimed to describe the neurogenic dysphagia following a suicide attempt by partial hanging, the treatment strategies, and the prognosis in one such case from admission to discharge.

Method

Brief history

A case of a 31-year-old male diagnosed with hypoxic-ischemic encephalopathy following partial hanging was studied. The data were collected prospectively during the patient's stay in the hospital from admission to discharge. The patient had depression in the last three to four months (unevaluated and untreated) was found to be partially hanging (toe tips touching the ground) himself onto a fan with a cotton cloth (dhoti) on 24/11/22 around 2:40 pm. The patient was found unconscious and gasping, and he was taken to a nearby hospital and admitted.

Medical evaluation

During the admission, the patient had unstable vitals, and developed generalized clonic tonic seizures on the same day, where he was treated with medications for the same. The drugs were tapered on 26/11/22, and the patient developed another seizure episode, so the drugs were restarted. Following that, patient developed multiple episodes of generalized clonic tonic seizures and was shifted to multi-speciality hospital, Bengaluru, where the chest and spine radiological investigations revealed the following findings: no cervical spine/ cervical fractures bilateral basal patches noted. Computed tomography scan (CT) revealed diffusion restriction in the bilateral central semiovale, corona radiata, and left frontal and occipital regions with diffuse cortical hypodensity and in bifronto occipital regions. Refer to figure 1 for CT findings. These features could suggest hypoxic anoxic injury. Electroencephalography (EEG) was not suggestive of status epilepticus.

The patient was mechanically ventilated. On 6/12/22, the patient was shifted to multi-speciality hospital, Mysuru, for further management with the complaint of the last seizure episode on 5/12/22 at 10:00 am. Referrals to various departments were made for further assessment and management.

Swallowing evaluation

The patient was referred to the dysphagia clinic on 17/1/23, where the patient was on a non-oral mode of feeding (nasogastric tube) with a tracheostomy tube in situ. On initial assessment, Glasgow Coma Scale (GCS) was administered to check the level of consciousness, and the scores were $E_3V_TM_3$. The patient was drowsy most of the time. However, there was an eye-opening response to name call (3/10). Oral peripheral motor examination and laryngoscopy could not be done since the patient did not cooperate for the procedure. Gugging Swallow Screen (GUSS), a swallow screening tool, was administered to check the severity of dysphagia, and the scores were three, which inferred severe dysphagia. Following that, the suctioning frequency was monitored to check the secretions management every two hours before the Ryles tube (RT) feed.

Results

Initially, the patient underwent 20-minute sessions of therapy for six days for two weeks. Therapy

focuses on improving oral secretion management by targeting all sensory modalities: gustatory stimulation, olfactory stimulation, and thermal and tactile stimulation. After two weeks of therapy, the patient showed improvement in a GCS score; that is, nine. GUSS scores were five, and suctioning frequencies were reduced to seven times a day. Further, the patient started following one to two step commands.

As the patient progressed in terms of swallowing, the oral trial was introduced with semi-thick consistency. Active and passive motor exercises were carried out along with sensory stimulation and postural management for swallowing. During the third week of swallow management, the patient was able to indicate his willingness to do oral trials by mouth opening. Therefore, the patient was started with an oral trial of thick liquids of 5-10 ml per day under the supervision of a speech-language pathologist. The patient was made to sit upright, and the signs of aspiration were monitored. Initially, jaw opening was noted only with oro-motor stimulation. Gradually, the quantity and frequency of oral trials were increased, and the patient could tolerate the oral trials without any signs of penetration and aspiration. At the end of four weeks, GCS scores were 10, and suctioning frequencies reduce to two to three times daily. Laryngoscopy was conducted; no saliva pooling at pharyngeal level and normal vocal cord movement were found. Simultaneously, the patient could tolerate deflation and blocking of the tracheostomy. The patient underwent decannulation on 15/2/23. Post decannulation, the patient tolerated a soft solid oral diet under supervision in adequate quantity and showed no signs of aspiration. Underwent nasogastric tube removal and was advised on a soft and solid oral diet.

Discussion

Typically, hanging induces brain damage due to HIE subsequent obstacles to cervical blood flow.[2] This diffuse hypoxia-ischemia can result in complete cerebral damage of the brain region, which is responsible for the voluntary control of swallowing, consciousness and alertness.

As the patient exhibited diffusion restriction in, corona radiata, left frontal diffuse cortical hypodensity from Computed tomography (CT) scan findings, deficits in swallowing and cognition observed are a direct consequence of the trauma induced due to the hanging.[3] Patient exhibited a delayed oral phase, consistent with dysfunction of the voluntary execution of swallowing.[1]

Based on the swallowing evaluation, the patient was provisionally diagnosed with severe dysphagia with low GCS these results were supported by the previous study [6] and GUSS scores. During the initial two weeks of therapy, swallowing strategies focused only on sensory stimulation because the patient could follow only limited commands and alertness was affected. In the late third week consciousness and alertness improved; GCS score were improved since the patients moved from comatose to normal. Furthermore, the participant could follow simple commands, so management strategies were focused on passive and active oro-motor stimulation with postural adjustment.[6] As cognitive abilities improve, the ability to clear the pooling secretions at the pharyngeal cavity increases, which in turn, reduces the risk of aspiration and suctioning frequency. With subsequent reduction of suctioning frequency, the patient underwent decannulation of the tracheostomy tube. Henceforth the patient had tolerance to oral feed. However, no study in the dysphagia literature has pointed out the relationship between suctioning frequency and swallowing abilities.

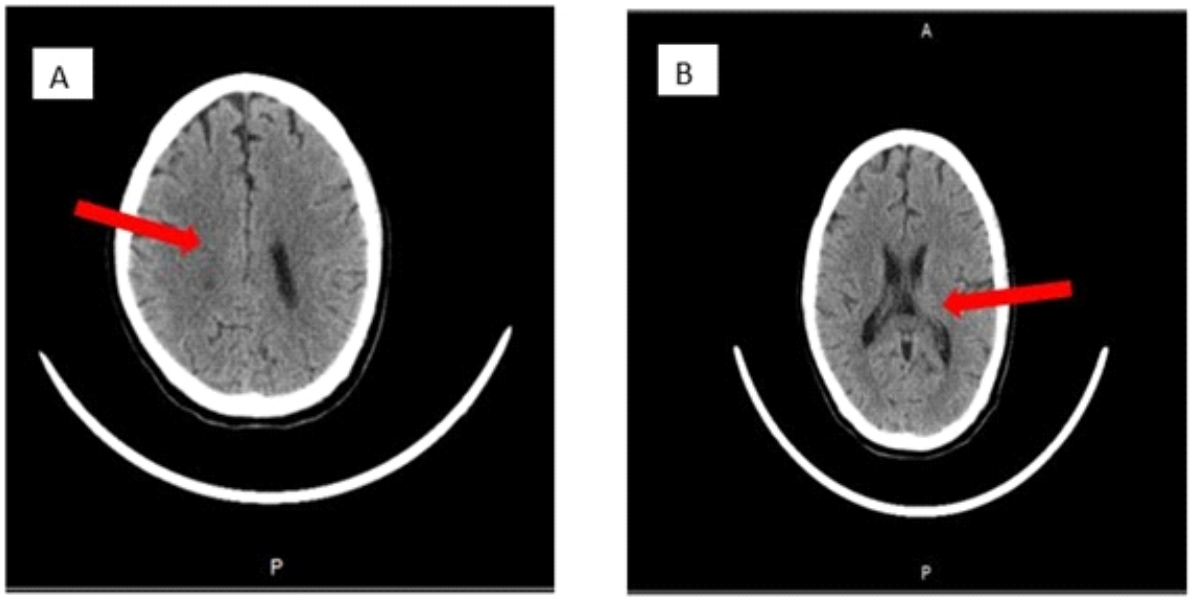
Conclusion

In conclusion, dysphagia as seen in patients with cerebral hypoxia may share similar mechanisms as seen and reported in patients with cerebrovascular and neuroimmunology disorders. Monitoring tracheal suction frequency in patients with cognitive deficits due to HIE can be a one of the indicators in diagnosing dysphagia.

References

1. Ruecker M, Zepharovich K, Zorowka P, Matzak H, Kofler M, Saltuari L. Dysphagia in cerebral hypoxia. NeuroRehabilitation. 2019;43(4):387–93.
2. Kumar S, Chatterjee I, Kumar N, Kumari A. Management of flaccid dysarthria in a case of attempted suicide by hanging. East J Med. 2011;16(1):66–71.
3. Muhammed Wazeer M, John S, Rajashekhar B. Neurogenic speech sequelae following suicide attempt by hanging: A case report. Int J Adolesc Med Health. 2017;29(2):12–5.
4. Wang X, L C, X J. Cognitive impairment caused by hypoxia: from clinical evidences to molecular mechanisms. Metab Brain Dis. 2022;37(1):51–66.
5. Rogers B, Msall M, Shucard D. Hypoxemia during oral feedings in adults with dysphagia and severe neurological disabilities. Dysphagia. 1993;8(1):43–8.
6. Jawaid MT, Amalnath SD, Subrahmanyam DKS. Neurological Outcomes Following Suicidal Hanging : A Prospective Study of 101 Patients. 2017;106–9

Figure 1: CT brain of a case with neurological dysphagia secondary to partial hanging



Note: A refers to diffuse cortical hypodensity; B refers to diffusion restriction in the bilateral central semiovale, corona radiata.

Retroactive and pro-active interference in young neurotypical individuals

Author Details: *[1]Varna KS; [1]Sruthi Sandhya & [2]Abhishek BP*

1-Post-Graduate student, All India Institute of Speech and Hearing

2-Assistant Professor, Centre of SLS, AIISH, Mysore

Abstract:

Recall refers to the process of retrieving information from the memory. It involves three stages encoding, storage and retrieval. When the competitive process challenges the encoding, it would affect the retrieval. This process is called as interference. Interference could be due to old traces of memory or new traces of memory (replacing the old memory). These two processes are called as retrospective and pro-active interference respectively. Two unique but related experiments were carried out on the participants, the first experiment tapped retrospective interference and the second experiment tapped prospective interference. Retrospective interference was more robust compared to pro-active interference.

Key Words: *Recall, learning, competitive stimulus, interference*

Introduction:

Memory is the faculty of mind wherein information is taken from the environment, stored and retrieved/recalled based on the need. The three core process of memory includes encoding , storage and recall. Among which, the mental process of retrieval of information from the past is called recall. Recall is affected by interference, which is a phenomenon in which retrieval of some information is intruded by the other. The interference can be of two types. Proactive interference (PI) refers to old learning interfering with new learning while retroactive interference (RI) refers to new learning interfering with old learning (Bondi et al, 1984). Competition among candidate responses is the basic source of proactive interference (PI), which itself is a primary source of momentary forgetting (Underwood, 1957; Crowder, 1976,). RI is believed to occur via two mechanisms: (1) retrieval interference, where two or more memories sharing the same/highly similar retrieval cue compete for retrieval, and (2) consolidation interference, where new incoming information disrupts the memory strengthening of recently acquired memory traces (Craig, 2015). These interference effects can be best observed when the subject has to learn two competing lists of targets that share semantic categories. (Bondi, 1994). Variables that could affect interference includes participants level of attention, duration and complexity of the task given.

Need:

In the present study we have tried to introduce interference using a competent word list which is semantically related to the target word list. The memory focused in the study is modality specific.

Aim:

To compare the number of items recalled correctly in Group 1 (participants of Experiment 1) and in Group 2 (participants of Experiment 2)

Method:

The study was carried out as two independent experiments with similar stimuli.

Participants:

Mutually exclusive group of 15 participants (18- 25 years of age) each were selected for the study using convenient sampling method. The participants selected varied in their first language but had native like proficiency in English which was their second language. Each participant was tested individually for approximately 10 min with their informed consent.

Experiment 1:

Stimuli:

The stimuli consisted of 3 sets of target and competent stimulus each having 8 meaningful words which were semantically related. The audio stimulus was recorded with an inter-stimulus interval of 4 seconds using Praat software in such a way that the competent sets followed by target sets were alternatively recorded in male and female voices to reduce the issues with internal validity. The materials used were mutually exclusive for the two experiment groups.

Procedure:

The participants were presented with the audio stimuli and were instructed to listen carefully to both the sets in each list and then immediately recall only the target set words of List 1 spoken by a particular gender that the examiner suggests at the end of the presentation. The words in the competitive word list were semantically related to the items in the target list. Similarly List 2 and List 3 were also presented and the responses were elicited in the same manner. The number of target words that were accurately recalled by the participants was carefully observed and recorded. Each correct recall of the target word was given a score of 1. The maximum score obtained by the participants at the end of each list were calculated separately and total score was tallied out of the maximum score of 24.

Experiment 2:

Stimuli:

For experiment 2, the stimuli were created using the same protocol for the experiment 1.

Procedure:

The participants were presented with the words in List 1 in the auditory modality in the morning they were asked to recall only the target list of items (by specifying the speaker's gender to the participant) at the end of the presentation. The participants were then presented with List 2 words in the afternoon but they were asked to recall the target words that he/ she has heard in the morning again by specifying the gender of speaker. The same task was carried out in the evening wherein they were presented with List 3 words and were asked to recall the target words that he/ she has heard in the morning. The participants responses for each time were noted giving special attention to the number of target words correctly said. Scoring was also similar to the Experiment 1.

Results and Discussion:

The performance of participants of group 1 was compared with the performance of participants of group 2. The mean and median scores for group 1 participants was 14 and 15 respectively. The mean and median scores for group 2 participants was 12 and 10.5 respectively. The mean as well as median

scores was better for group 1 compared to group 2. Further in order to verify if the difference in the scores were significant statistically, Mann Whitney U test was used (as the data did not abide by the properties of normal distribution evident on Shapiro Wilks test of normality; $p<0.05$). The Z score obtained was 2.33 ($p<0.05$). Thus, there was a significant difference between the two groups in other words, the performance varied on the two experiments.

Participants of each group were subjected to the target and competent words in parallel. The competent words were semantically related to the target words. The only difference between in experiment 1 and experiment 2 was that the competent word list was presented concurrently in the former while the competent words/new list of items were presented episodically in experiment 2. The other note-worthy element is that the participants of experiment 2 were asked to recollect the list presented on the first occasion at the three different time intervals.

Experiment 1 tapped for pro-active interference while the experiment 2 tapped for retroactive interference. Mutually exclusive participants were used for two experiments. The participants were part of cohort group with native like proficiency in the second language. It was observed that the performance was not homogenous within each group and there was disparity in performance within each group. The other observation was that the items in the competent word list was retrieved in place of the target item leading to errors and this was observed in both the experiments (group 1 as well as group 2) (Bondi, 1984). Following this, deletion of target items was seen in participants of both the groups. For experiment 2, the salient observation was that the items in the target list were replaced with the items presented subsequently in the day for participants of this group (Craig, 2005) As the study used a novel method, the findings of the study could not be compared with any of studies carried out in the past. However, the interference was evident in both the experiments

Summary and Conclusion:

Two related experiments were carried out on two mutually exclusive set of participants. The first experiment tapped pro-active interference while the second group tapped retro-active interference and retro-active interference was more robust than the pro-active interference.

REFERENCES

1. Bondi MW, Monsch AU, Galasko D, et al. Preclinical cognitive markers of dementia of the Alzheimer's type. Neuropsychology. 1994;8:374–384)
2. Crowder, R. G. (1976). *Principles of learning and memory.* Lawrence Erlbaum.
3. Craig, M., Dewar, M., & Della Sala, S. (2015). Retroactive Interference. Elsevier eBooks, 613–620. https://doi.org/10.1016/b978-0-08-097086-8.51042-3
4. Underwood, B. J. (1957). Interference and forgetting. Psychological Review, 64, 49-60.

Resounding Transitions: A Systematic Review of Age-Related Changes in Swallowing Sound Acoustic Characteristics and Diagnostic Implications Across the Lifespan

Author Details: *[1]Mr Satyam Hota; [2]Mr. Vivek Kumar,*

1-BASLP Intern, Institute of Health Sciences

2-Assistant Professor in the Department of Speech, Language, Cognition and Swallowing Disorders

Introduction:

Swallowing process and Impact of age:

Swallowing is a coordinated neuromuscular action that combines voluntary and largely involuntary actions. However, there are certain anatomical and physiological changes that occur with ageing that have an impact on feeding and the related swallowing function. This is referred to as sarcopenia by (McCoy & Desai, 2018; Sasegbon & Hamdy, 2017; Sporns et al., 2017) [1,2,3], and it results in decreased tongue pressure, decreased hyolaryngeal elevation, prolonged duration of upper oesophageal sphincter opening, and a narrower opening diameter of the upper oesophageal sphincter. For instance, Aronson et al., (1985) [4] stated the changes as atrophy of intrinsic laryngeal muscles, drying of the laryngeal mucosa, decrease of the flexibility of the laryngeal ligaments, flaccidity and bowing of the vocal folds. Tracy et al., (1989) [5] said these modifications have an impact on the duration and degree of laryngeal vestibule closure and hyolaryngeal excursion.

According to Tracy et al., (1989) [5] even if the ability to chew is still present, decreased muscle strength and tooth loss have an impact on food preferences, chewing effectiveness, and oral residue after swallowing. Further reduced tongue pushing force and slight delays in the swallow reflex cause an increase in pharyngeal residue, which increases the rate of clearing swallows without increasing penetration or aspiration. Up to the age of 60, laryngeal excursion and closure are maintained, but beyond that, they start to shorten (Rademaker et al.,1998) [6]. Generally, the ageing eating and swallowing system's general slowdown matches age-related slowness in other systems, like locomotion and mobility and adding to this there is noticeable sensory alterations, such as a loss of taste and a decrease in olfactory perception (smell) described by Pelletier et al., (2007) [7].

These age-related alterations raise the chance of developing dysphagia in older persons with a decreased functional reserve or capacity to adjust to health stressors, even though the efficiency and safety of the swallow are not jeopardised. The ability to swallow in an older adult may be severely compromised in the event of acute sickness, crossing the line between Presbyphagia and dysphagia (Namasivayam-MacDonald & Riquelme, 2019; Sasegbon & Hamdy, 2017) [8,9].

Considering the infant's head and neck are anatomically different from those of adults is also makes the swallowing process different between them. The hard palate is flatter, the larynx is higher in the neck relative to the oral cavity in the infant, and teeth have not yet come in. The larynx is open to the nasopharynx because the epiglottis touches the back of the soft palate, but the oral cavity is kept separate from this airway by a soft tissue barrier. However, when a person grows, their pharynx's anatomy changes. The larynx moves down to a point lower in the neck as the neck lengthens. The pharynx lengthens vertically as the soft palate and epiglottis no longer make contact with one another (Matsuo and Palmer et al., (2008) [12]. Additionally, the central and peripheral neural systems, including motor neurons, sensory receptors, and their connections, continue to grow throughout late childhood. Children's swallowing tracts are shorter and made up of muscle fibres with different sizes and histologies (Bawa et al., (1981); Kent et al.,1976; Vignon et al., (1980); Kramer et al., (1993). [13,14,15,16]

Impact on Diagnosis of Swallowing Sounds:

Considering the above changes in the distinct changes in anatomical and physiological healthy ageing of the swallowing process should have a significant impact on the swallowing sounds generated by the distinct events of the entire swallowing process from the oral preparatory phase to the end of the oesophageal phase. According to Hamlet et al., (1988) [17], mechanical movement of the hyoid, larynx, or epiglottis contributes to the swallow's acoustic characteristics. In 1990, he further hypothesised that weak or minimal spectral peaks would appear in the swallow signals if the bolus was ejected by the tongue in a weak way or if the cricopharyngeus muscle was exceptionally relaxed [18]. Hamlet et al., (1992) [19] lastly concluded that structural change to larynx alters the acoustic properties of the swallowing sound.

Furthermore, when age-related changes are thought to be less clear, expedition begins to decode the diagnosis basis of these swallowing sounds from its regular knowledge of implements as swallowing evaluation by various methods such as cervical auscultation, Sonar doppler, and accelerometer still requires that distinct separation in the characteristically distinction in its various components. In order to establish when children should develop more mature swallowing habits and when the absence of these patterns might raise concerns, a greater understanding of swallowing in children and adults is required.

Methodology:

Identification and Selection of articles:

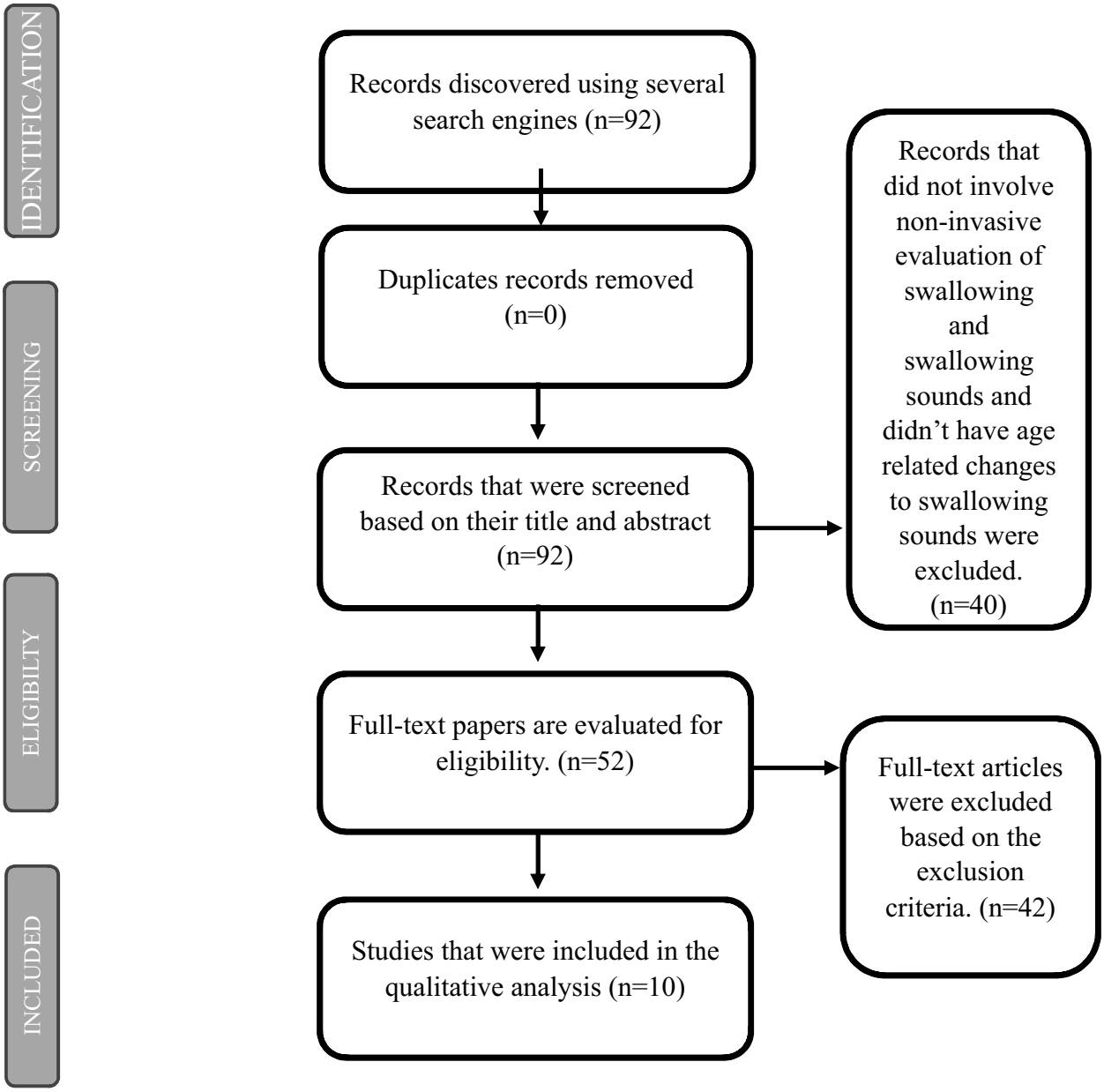
To find potential research articles for this systemic review, a thorough literature search was carried out using a number of search engines, including IEEE Xplore, SpringerLink, Wiley Online Library, ResearchGate, SAGE Journals, SciELO, Academia.edu, PubMed, and Google Scholar. The search terms were "swallowing sounds," "clinical swallowing evaluation," "swallowing sounds and age," "acoustic characteristics of swallowing sounds," "acoustic analysis of dysphagia," and "non-invasive swallowing evaluation." Pre-selection phase involved the scanning of papers, titles and abstracts revealed those that dealt with non-invasive clinical evaluation of swallowing and swallowing noises. Any discrepancies between the authors were resolved through discussion and referral.

Inclusion Criteria:

We selected studies that examined the diagnostic utility of analysing the acoustical properties of swallowing sound using a variety of techniques, including cervical auscultation, swallowing accelerometers, doppler sonar, acoustic analysis using Cepstrum analysis, and algorithm-based approaches, and that were used to assess swallowing sound in healthy individuals without a history of dysphagia or neurological disorders. Additionally, the studies included publications with research populations that includes a comparison between children and adults or included alterations in swallowing sounds results between varied age groups. The selection criterion was devoid of restrictions regarding gender, publication date, or language.

Exclusion Criteria:

Articles that didn't meet certain requirements were disqualified from consideration. The study firstly eliminated out research that used animals as test subjects. Second, studies that did not employ non-invasive methods to assess clinical swallowing were discarded. Thirdly, we excluded articles that focused solely on the acoustic analysis of swallowing noise in individuals with dysphagia or other neurological co-morbidities. Additionally, studies that didn't go into detail about how age-related changes impact the acoustical properties of swallowing sounds.



Results:

92 unique items were found through the systematic searches. 42 articles were excluded based on the exclusion criteria after a thorough evaluation of 52 abstracts, which had the greatest relevance to the research topic, was done during the pre-selection phase. This left 10 articles for full-text reading and inclusion for the authors' qualitative analysis.

Ten investigations were examined, and they were conducted between 2002 and 2018. The participants in the study were all healthy people without any type of swallowing difficulties, according to the study's population. Table 1 lists the sample population and study characteristics of the included papers.

Fig: 1 PRISMA flow diagram of the systematic review's search procedure

Author	Year	Title	Sample Population	Instrumentation used and Acoustic Analysis	Food consistency used
T. Sheila Almeida et al. [26]	2008	*Assessment of swallowing sounds by digital cervical auscultation in children*	118 children ranging in age from 3 to 11 years	An acoustic detector (piezoelectric microphone) and a preamplifier with filter were connected to a computer, and the spectrogram was produced (Raven software, version 1.1) using the fast Fourier transform. The equipment was put above the tracheal lateral edge, immediately beneath the cricoid cartilage.	5 mL of fruit juice and 5 mL of yoghurt were given in a 20-mL syringe.
A. W. Anaya et al. [27]	2017	*Neck auscultation using acoustic analysis to determine the time and the sounds of swallowing mechanics*	306 participants in the age range 20 -50 years were divided into three groups: 20-30 years (156 people), 31-40 years (67 people), and 41 -50 years (83 people), comprising 130 men and 176 women.	A stethoscope coupled to SIL's Speech-Analyzer, version 3.0.1, an acoustic analysis programme, was utilised in the Digital Cervical Ausculta technique with no data of site of placement.	5 ml (clear liquid)

J. A. Cichero et al. [28]	2002	*Acoustic signature of the normal swallow: characterizatio n by age, gender, and bolus volume*	59 individuals were divided into th ree groups based on their age. Group 1 (18 to 35 years) included 10 men and 10 women. 10 men and 10 women made up Group 2 (ages 36 to 59). Group 3 (60+ years) included 10 males and 9 women.	A single -sided surgical tape was used to fix a microphone (EK3l32 Knowles electret) to the cervical region at the midline of the cricoid cartilage, which was connected to a preamplifier (prechamp K - 5608), which delivered the acoustic signal directly into the Computerised Speech Laboratory (CSL4300, Kay Elemetrics).	40 mL Cottees Diet Fruit Cup cordial with 500 mL water divided into three volumes: 1) bolus swallow of 5 mL room temperature cordial, 2) 10 mL room temperature cordial, and 3) 15 mL room temperature cordial.
Hennes sey et al. [29]	2018	*Developmental changes in pharyngeal swallowing acoustics: a comparison of adults and children*	31 healthy children (12 male and 19 female) between 4-5.2 years, 29 healthy adults (14 male and 15 female) between 20.8-28.3 years	A Sony Hi -MD Walkman MZ - RH1 portable mini-disk recorder coupled to an Optimus 33-3013 electret condenser lapel microphone, digitally stereo - recorded, and acoustically processed in PRAAT software were placed at the participant's throat, just below the midline of the cricoid cartilage.	Two different forms of boluses: 4 ml of a typical, thin liquid (fruit cordial, diluted one part cordial to four parts water) in a 200 ml cup, and 4 ml of a smooth puree consistency, (chocolate yoghurt)

Youmans et al. [30]	2005	*An acoustic profile of normal swallowing*	97 subjects (48 males and 49 females) mean age 48.47 years with group of 10-year age interval	Accelerometer (PCB Model 352C22, PCB Piezotronics, Depew, NY, USA); powered by ICP sensor signal conditioner (PCB Model 480E09), with zero amplification, and acoustic analysis in Computerised Speech Lab (CSL) (model 4400, Kay Elemetrics, Lincoln Park, NJ, USA) positioned at the midline of the cricoid cartilage.	Nectar and honey thick liquids (pre - thickened apple juice), 5- and 10 -ml boluses of thin (bottled water), 5 - ml boluses of mechanically soft (three sliced canned peaches), and 10-ml boluses of puree (applesauce).
Youmans et al. [31]	2011	*Normal swallowing acoustics across age, gender, bolus viscosity, and bolus volume.*	96 healthy adults divided into Young aged group (between 20-39) Middle aged group (between 40-59), Older age group (60 and older). All have 32 members each composed of 16 males and 16 Females	Acoustic analysis was performed in the Computerised Speech Lab (CSL) (model 4500, Kay/Pentax, Lincoln Park, NJ) with an accelerometer (model 352C22, PCB Piezotronics, Depew, NY) positioned at the midline of the cricoid cartilage.	Used liquids with the following consistencies: puree (applesauce), honey-thick (apple juice and thickening from the "Thick-It" brand), thin (tap water), and mechanical soft (four diced canned pears).

Cichero et al. [33]	2003	*What happens after the swallow? Introducing the glottal release sound*	59 non-dysphagic divided into 3 groups: Group 1 (18-35 years); Group 2 (36-59 years); Group 3 (60+ years) each group having 10 males and 10 females except Group 3 having 9 females	Placed at the midline of the cricoid cartilage, a microphone (EK3132 Knowles electret) connected to a preamplifier (prechamp K - 5608) and connected to a Computerised Speech Laboratory (CSL-4300, Kay Elemetrics) for acoustic analysis.	Cottees Diet fruit cup cordial combined with water yielded a thin fluid consistency. Thickened cordial was created by combining a thin fluid mixture with Ketrol food thickening to achieve the desired consistency.
W. Reynolds et al. [34]	2009	*Variability of swallow-associated sounds in adults and infants*	20 he althy adults (10 males and 10 females between 26 to 59 years	An accelerometer (Vibro-meter Corp., Boston MA, Model 501-FB) and an electret microphone (Optimus [Radio-Shack/Tandy Corp], Fort Worth TX, Model 33 -3013) and Cool Edit 2000 v1.1 (Syntrillium Software Inc., Phoenix, AZ) were used for acoustical analyses and were placed at the right lateral neck, on the tracheal lateral border, just below the cricoid cartilage	Water, coffee, and soft drinks are options for thin liquid consistency, applesauce is an option for puree consistency, and cookies are an option for solid food.

Cagliari et al. [35]	2009	*Doppler sonar analysis of swallowing sounds in normal pediatric individuals*	90 healthy individuals divide into 3 groups, 2 -5 years; 5 -10 years; 10 -15 years having 15 males and 15 females each	Portable ultrasound detector (DF-4001 type from Martec) placed on the tracheal lateral border at the right lateral neck, exactly below the cricoid cartilage. The ultrasound detector is linked to a Positivo notebook computer that runs Windows XP Professional, has an Intel Celeron M360 1.4GHz processor, 240MB of RAM memory, a video card with an integrated graphics accelerator Via Uni Chrome PRO IGP and 64MB of memory, a combo drive (DVD player and CD recorder), and integrated high definition ALC655 audio. The signals were analysed acoustically using VoxMetria software, version 2.8h22.	2.5ml of water for liquid food consistency and 2.5ml of Danoninho (frozen yoghurt-like product) for pasty food and saliva swallowing

Table 1: Study Characteristics of the 10 included research papers

T. S. Almeida et al., (2008) [26] administered the duration variables of swallowing sounds, i.e., the Duration of Swallowing sound (DAS), where the means ± SD for 5ml liquid and 5ml of yoghurt were 0.73 ± 0.16 seconds and 0.75 ± 0.15 seconds, respectively, in children between the ages of 3 and 11 years. He came to the conclusion that there was no significant relationship between age and duration of the swallowing sounds for either consistency.

A.W. Anaya et al., (2017) [27] estimated DAS for the age category of 20 to 50 years, noted similar variations in milliseconds, with 20 to 30 years having an average DAS of 0.323 seconds, 31 to 20 years having 0.379 seconds, and 41 to 50 years having 0.3174 seconds.

Regarding comments on changes in acoustic characteristics with age, *J. A. Cichero et al., (2002)* [28] deviate from these two findings. She examined duration, intensity, and frequency variables in the study for 5ml, 10ml, and 15ml of a cordial mix on 3 age groups 18-35 as young, 36-59 as middle-aged, and 60+ as older group. In a sample size of 5 ml, she discovered a strong relationship between age and volume. The younger group recorded a DAS of 0.377s, while the middle group and senior group recorded 0.485s and 0.524s, respectively. In 15ml volume, a similar trend was seen, although it wasn't statistically significant. All three groups' durations for the 10 ml volume were clustered around the same values. In the youngest group, the 10-mL scores were substantially longer than the 5- or 15-mL scores. The middle-aged group's 15-mL swallowing sound duration scores were significantly shorter than the 5- or 10-mL scores, while the oldest group's 5-mL swallowing sound duration scores were much longer than the 10- or 15-mL scores. Another durational variable i.e., Duration of peak intensity (DPI) is stable across ages and 0.993s after beginning of acoustic signal and 0.193s from beginning of swallowing sound.

Intensity variables, like Peak intensity (PI) was stable at 43 dB and insensitive to age. Lastly Frequency variables like Frequency of peak intensity (FPI) of 550.96Hz which was stable across ages.

Hennessey et al., (2018) [29] compared pharyngeal swallowing acoustics between 31 children with age range of 4-5.2 years and 29 adults with age range between 20.8-28.3 years using 4ml thin liquid and 4ml smooth puree consistency. The average TD_{mean} (Total Duration) which is total duration of swallow signal from beginning of the first sound burst to the end of the last sound burst measured in millisecond. For children the TD_{mean} was 780ms for thin fluid and 789ms for puree. And for the adults were significantly shorter with 688s for thin fluid and 628s for puree. TD_{cv} (total duration coefficient of variation) is numerically larger for children than adults, though difference is not significant. The DPI_{mean} was 212ms and 239ms for thin fluid and puree respectively for adults and for children it was larger with 255ms and 319ms in thin fluid and puree respectively. There were no significant age effects for the mean or CV of the intensity measures (PI or SDI), showing that these acoustic measures are not sensitive to maturation of neuromotor control of swallowing. There were no age impacts in the spectral M_{mean} or mean, as well as the variability of the spectral SD (standard deviation), skewness, or kurtosis.

Youmans et al., (2005) [30] derived results on a population of 97 subjects with means age 48.47 years and group with 10-year interval with thin, nectar and honey thick, mechanically soft and puree boluses. DAS_{mean} across bolus type was 530ms and age was significantly correlated with this variable and with increased age longer swallowing duration is obtained. Just like DAS, DPI variable correlated significantly and increased with age, with a mean DPI of 210ms across bolus types. The mean PI of 60.8 dB, and it also significantly correlated with age but negatively, i.e., with increased age its decreases.

Youmans et al., (2011) [31], investigated research on 96 adults divided into young, middle and older group with 10-gap interval between 20-60+ years with puree, honey thick, thin liquid and mechanically soft consistencies. Derived results were similar that with increased age DAS increases and DPI relation

were similar for 5ml consistent volume but with varying volume and viscosities there is no significant effect on DPI with age, so smaller bolus volumes produced longer DPIs and larger volumes do not. But PI in this study had a trend of increment as age increases. Peak frequency (PF) of older persons had significantly higher peak frequencies than younger persons. The SD of DAS and PF was markedly higher in adults than the younger groups.

Huckabee et al., (2005) [32] *again* only administered DAS out of 30 adults divided into younger group (22-28 years), Middle aged (43-48 years), and elder adults (61-70 years) using saliva swallowing, thin liquid and pudding consistency yogurt, completely presented different results in which duration of swallowing slows with increases in age. And youngest participants produced swallows with shorter duration than middle aged and elder participants.

W. Reynolds et al., (2009) [34] investigated variability swallowing sounds between adults and infants on 20 individuals between 26-59 years who used thin liquid, puree and solid food, and concluded that the morphology of the IDS signal in adult swallows is similar to that of the previously studied infants, and the IDS (Initial Discrete sounds) waveform of low-risk preterm infants becomes more uniform with advancing PMA Postmenstrual age). However, as the infants approach the "term" PMA, the overall stability of the waveform approaches that of healthy adults. Which results in the value of VI (Variable Index), which is 49.0 for infants before 36 weeks PMA and it is 36.3 for infants after 36 week and lastly for adults it is 30.

Cagliari et al., (2009) [35] who used doppler sonar effect to detect swallowing signals on 90 individuals of age range 2-5 years,5-10 years and 10-15 years using 2.5ml Water and 2.5ml of Danoninho as pasty and saliva swallowing.

Mean frequency and mean peak intensity for all the 3 consistencies are lowest in 2-5 years and highest in the 5-10 age range and only in female individuals a significance is marked with therein increase in DAS from younger to older ages.

Cichero et al., (2003) [33] had its study done on glottal release sounds in a swallowing sound spectrum on 59 individuals divided by 3 groups of 18-35 years;36-59 and 60+ years and food consistencies having thin fluid, and thick fluid having the thin fluid mixed with a thickener. Three acoustic variables were revealed to have changed with age as a result of the study. Age-related changes were seen in the glottal release sound's duration as it increases with ageing, peak intensity location's experience a temporal displacement, and the latency between the swallowing sound and the glottal release sound increases with ageing.

Discussion and Conclusion:

This in-depth review looked at how swallowing sounds and its acoustical characteristics change with age in order to determine the correlation between the anatomical structures and physiological processes that change as people age. This information is crucial for clinical swallowing evaluations as well as the clinical management of swallowing disorders to make up for swallowing process that has been compromised. This systemic review investigated the same sort of clinical procedure across a wide range of age groups, including children, adults, and the elderly, to determine whether age affects the characteristics of swallowing sounds quantitatively and qualitatively.

Duration Variables:

Out of 10 studies, the duration variable DAS stood out as being the most investigated and showed significance difference with age. And in the articles where no significant difference was found, we observed the same general trend: younger populations produced shorter durations than middle-aged

and elderly populations, with elderly populations producing the longest durations. This may be caused by deteriorated respiratory capacity as well as decreased coordination of the pharyngo-oesophageal motor sequence of swallowing. (Boiron and colleagues et al., 1997; Shaker Li, Ren, Townsend, and Dodds et al., 1992) [58,59]. The varying definitions of total swallowing length, or the beginning and end of a swallowing signal duration, that have been utilised are the cause of the varied DAS found in the research. Other duration variables DPI varied and lacked a clear pattern of change with ageing, and volume alterations. Additionally, a novel investigation on the duration of the glottal release sound verified that it increases with age. We also discovered that peak intensity locations undergo temporal displacement and that the latency between the swallowing sound and the glottal release sound increases with age.

Intensity Variables:

Not much studies investigated the intensity variables in much depth like the duration variables, and it makes sense as the PI showed inconsistency in its findings which makes their interpretation difficult, just like the DPI it results varied which can be because Intensity could certainly be affected by the relative differences in neck tissue from different samples. But certainly, increased pressure could result in higher peak intensities, but it is unlikely that older persons produced more pressure during swallowing than younger persons. Articles also came to the conclusion that the mean or CV of the intensity measures (PI or SDI) did not significantly change with age, demonstrating that these acoustic measures are not responsive to the maturation of neuromotor control of swallowing.

Frequency Variables:

Just like Intensity variables, this was less of an explored territory but these showed particular results i.e., Peak frequency (PF) is low frequency that is more or else consistent across ages, but elderly people have much greater peak frequencies than younger people. These findings appear to be attributable to the fact that louder signals contain more of the less intense higher frequencies that are lost in a less intense signal.

The IDS (Initial Discrete Sounds) waveform of low-risk preterm newborns becomes more uniform with increasing PMA, which is our final unique finding. Postmenstrual age) and as the infants get closer to the "term" PMA, the waveform's overall stability gets closer to that of healthy adults.

Overall, we may agree that some of the acoustic metrics explored appear to be more valuable than others. The duration of the auditory swallowing signal appears to be a relevant parameter that is consistently associated with longer durations with increasing age. However, contradictory results persist about whether a gender or volume difference exists. The duration to peak intensity appears to be a less significant statistic and, based on our assessment, may be more of an indirect indication of the duration of the acoustic swallow. The between-subject peak intensity variable is difficult to understand, most likely because to anatomical variances; nevertheless, within-subject differences, such as less viscous and larger boluses being produced more loudly, may be significant and potentially valuable in data interpretation.

These findings may prove to be somewhat useful for future studies that are required to consider a uniform study on an informed definition of specific initial and final swallowing signals with uniform volumes and consistencies with distinct age groups and considering all relevant variables, to lower discrepancies and improve the effectiveness of classifying the swallowing sounds. But in addition to invasive procedures and radiographic approaches for evaluating swallowing abnormalities, the two

variables DAS and PF, as well as to some extent PI, are helpful to diagnose swallowing disorders. Studies that combine both sorts of approaches can help to make physiological and anatomical changes more distinct and apparent, rather than just discernible. Additionally, the outcomes when paired with variations in swallowing noises caused by various bolus consistencies might aid in the creation of an appropriate procedure for acoustic analysis of swallowing noises, which is a crucial step in the clinical examination of swallowing disorders.

References:

1. McCoy, Y. M., & Varindani Desai, R. (2018). Presbyphagia versus dysphagia: identifying age-related changes in swallow function. *Perspectives of the ASHA Special Interest Groups*, *3*(15), 15-21.
2. Sasegbon, A., & Hamdy, S. (2017). The anatomy and physiology of normal and abnormal swallowing in oropharyngeal dysphagia. *Neurogastroenterology & Motility*, *29*(11), e13100.
3. Sporns, P. B., Muhle, P., Hanning, U., Suntrup-Krueger, S., Schwindt, W., Eversmann, J., ... & Dziewas, R. (2017). Atrophy of swallowing muscles is associated with severity of dysphagia and age in patients with acute stroke. *Journal of the American Medical Directors Association*, *18*(7), 635-e1.
4. Aronson, A.E. Clinical Voice Disorders: An Interdisciplinary Approach, 2nd ed.; Thieme: New York, NY,USA, 1985.
5. Tracy, J. F., Logemann, J. A., Kahrilas, P. J., Jacob, P., Kobara, M., & Krugler, C. (1989). Preliminary observations on the effects of age on oropharyngeal deglutition. *Dysphagia*, *4*, 90-94.
6. Rademaker, A. W., Pauloski, B. R., Colangelo, L. A., & Logemann, J. A. (1998). Age and volume effects on liquid swallowing function in normal women. *Journal of Speech, Language, and Hearing Research*, *41*(2), 275-284.
7. Pelletier, C. A. (2007). Chemosenses, aging, and oropharyngeal dysphagia: A review. *Topics in Geriatric Rehabilitation*, *23*(3), 249-268.
8. Namasivayam-MacDonald, A. M., & Riquelme, L. F. (2019, June). Presbyphagia to dysphagia: multiple perspectives and strategies for quality care of older adults. In *Seminars in speech and language* (Vol. 40, No. 03, pp. 227-242). Thieme Medical Publishers.
9. Sasegbon, A., & Hamdy, S. (2017). The anatomy and physiology of normal and abnormal swallowing in oropharyngeal dysphagia. *Neurogastroenterology & Motility*, *29*(11), e13100.
10. Feng, X., Todd, T., Hu, Y., Lintzenich, C. R., Carr, J. J., Browne, J. D., ... & Butler, S. G. (2014). Age−related changes of hyoid bone position in healthy older adults with aspiration. *The Laryngoscope*, *124*(6), E231-E236.
11. Logemann, J. A., Curro, F. A., Pauloski, B., & Gensler, G. (2013). Aging effects on oropharyngeal swallow and the role of dental care in oropharyngeal dysphagia. *Oral diseases*, *19*(8), 733-737.
12. Matsuo, K., & Palmer, J. B. (2008). Anatomy and physiology of feeding and swallowing: normal and abnormal. *Physical medicine and rehabilitation clinics of North America*, *19*(4), 691-707.

13. Bawa, P. (1981). Neural development in children: a neurophysiological study. *Electroencephalography and Clinical Neurophysiology*, *52*(4), 249-256.

14. Kent, R. D. (1976). Anatomical and neuromuscular maturation of the speech mechanism: Evidence from acoustic studies. *Journal of speech and hearing Research*, *19*(3), 421-447.

15. Vignon, C., Pellissier, J. F., & Serratrice, G. (1980). Further histochemical studies on masticatory muscles. *Journal of the Neurological Sciences*, *45*(2-3), 157-176.

16. Kramer, S. S., & Monahan Eicher, P. (1993). The evaluation of pediatric feeding abnormalities. *Dysphagia*, *8*, 215-224.

17. Hamlet, S., Nelson, R., & Patterson, R. (1988). Sounds of swallowing. *The Journal of the Acoustical Society of America*, *83*(S1), S23-S23.

18. Hamlet, S. L., Nelson, R. J., & Patterson, R. L. (1990). Interpreting the sounds of swallowing: fluid flow through the cricopharyngeus. *Annals of Otology, Rhinology & Laryngology*, *99*(9), 749-752.

Challenges in profiling and diagnosing Mild Cognitive Impairment

Author Details: *[1]Geetha JK; [1]Hiba KM; [1]Hema HP; [1]Jaifar Saik Ullah & [2]Abhishek BP*

1-Under-graduate student, All India Institute of Speech and Hearing

2-Assistant Professor, Centre of Speech-Language Sciences, All India Institute of Speech and Hearing

ABSTRACT:

Mild Cognitive Impairment is considered as a precursor to dementia. The severity of mild cognitive impairment is more compared to normal aging but less severe compared to dementia. The process of diagnosing MCI is quite challenging as the profile is quite heterogenous. It became further challenging when the neuroimaging results are not available. We present a 68-year-old case with the main symptom of forgetting. A battery of neuro-psychological tests was administered on the client and the diagnosis of MCI was given to reflect the cognitive linguistic deficits in the case. As stated earlier, neuro-imaging was not done due to financial constraints. However, a battery of tests enabled proper diagnosis and rehabilitation

Key Words: *Profiling, Neuro-imaging, cognitive linguistic profiling, cognitive reserve, deficit-based approach.*

Introduction:

Cognitive-communication disorders (CCD) are problems with communication, which have an underlying cause in a cognitive deficit rather than a primary language or speech deficit. Ex. Communication issues arose as a consequence of Mild cognitive impairment (MCI), Traumatic Brain Injury (TBI), Dementia, etc. Cognitive decline is a common phenomenon associated with normal ageing and is getting a lot of attention among clinicians.

Cognitive communication disorders have devastating effects on family life and social life. Cognitive deficits like difficulty paying attention to the conversation, staying on topic, remembering information, recalling, understanding jokes, and metaphors, Following directions, etc. Cognitive deficits can be seen in isolation or combination, Symptoms vary in severity. The decline in cognitive performance with aging is due to several cognitive processes, including a reduction in the speed of processing, working memory capacity, and loss of sensory input. These disorders can comprise language comprehension, language production, and pragmatic language use. If these problems are not recognized and addressed in time the condition might deteriorate (ex. An MCI condition might develop into dementia). These processes result in deficits in encoding, storing, and retrieving information , but the cognitive capability is unaffected '(Williams & Kemper, 2010). These effects are seen while retrieving information from the long term and short term memory storage, where the retrieval of information is slower in the former and amount of information which can be stored is decreased in the latter '(Jorm, Christensen, Korten, Henderson, Jacomb, & Mackinnon,1997).

Recently the label 'Mild Cognitive Impairment' (MCI)is being practiced to signify the intermediate condition between dementia and normal ageing (Anand, Chapman, Zientz, & Toussaint, 2005).Cases with the following signs and symptoms are recommended to use this label:(i) informant-corroborated history of memory symptoms, (ii) impairment in memory when measured objectively (usually < 1.5 standard deviations on a verbal memory test), (iii) spared general cognition, (iv) activities of daily living (ADL) well preserved, and (v) no dementia Gauthier & Touchon,, 2005). Evidence suggests that cognitive decline in MCI has no adverse effect on activities of daily living in comparison to dementia

(McKhann et al., 2011) and this is consistent with the definition of "Mild Neurocognitive Decline"(NCD) from DSM-V (Edition, 2013). Cognitive decline was studied in individuals with Alzheimer's disease (AD), Mild cognitive impairment, and normal cognition for eleven years and it was concluded that cognitive capacity in normal declined slower than in MCI group and that of MCI group declined slower than the sub-group of Alzheimer's disease(Ritchie, & Touchon, 2000). All cases with MCI do not progress to dementia, as reported by studies. We present a patient with CCD and discuss the assessment, differential diagnosis, intervention, and the challenges faced in the process.

Aim:

To profile the cognitive linguistic deficits in a case diagnosed with MCI

Method:

A 68-year-old, Male, Multilingual (Kannada, English, and Urdu) Client reported with a complaint of dysfluent speech. So SSI-4 (Stuttering severity index) was administered initially in the outpatient department which indicated Mild stuttering and highly natural-sounding speech however, it was observed during testing that stuttering behavior was mainly because of word retrieval difficulty. Western Aphasia Battery (WAB) was done to address this issue, which indicated the presence of Anomic aphasia but cognitive issues in the client was pronounced which was unusual for an Anomic aphasia patient. To address cognitive issues MoCA (Montreal cognitive assessment) a rapid screening instrument for cognitive dysfunction was administered which indicated the presence of Mild cognitive impairment (MCI). Further CLQT (Cognitive linguistic quick test) a diagnostic tool was assessed which confirmed the presence of MCI. A recommendation to a neurologist was made, who confirmed the same. Further analysis of word retrieval and naming difficulty was done by administering ANT (Action naming test), BNT (Boston naming test), and generative naming (WAB). FDA (Franchay dysarthria assessment) was also done to rule out Dysarthria. As a speech-language pathologist we consider the communication aspects affected in any kind of cognitive related disorders (MCI, TBI, Dementia, etc) and label it as a cognitive communication disorder. Hence, the client was provisionally diagnosed as Cognitive communication disorder. The client attended 11 sessions of speech-language therapy

Result and Discussion:

The case report word finding difficulty and the condition was initially misinterpreted and neurogenic stuttering was suspected by the allied professional and SSI-4 was administered and it was clear that there was no evident dysfluency and the dysfluency was attributed to word finding difficulty. Following this, Western Aphasia Battery (WAB) was administered on the client and the findings of the test revealed Anomic Aphasia however the amount of cognitive deficit what the client exhibited did not correspond to Anomic aphasia, in other words the cognitive linguistic deficits did not match with the quantum of cognitive deficits, following this Montreal Cognitive Assessment was administered on the client and the scores on MOCA was reduced suspecting Mild Cognitive Impairment. The cognitive linguistic profiling was carried out using Cognitive Linguistic Quick test, the test revealed that the client exhibited deficits pertaining to attention, memory and reasoning confirming MCI. The basic constraint in this client was that the scanning results was unavailable imposing challenges to diagnosis. The number of deficits exhibited by the client was more than the senescent changes exhibited in normal aging for instance the client exhibited difficulty in following directions, had difficulty in retrieving words in a conversation task. He also exhibited problems on judgment based tasks showing the possibility of MCI in the client. The client exhibited more f=difficulty in time constrained task and on generative naming task, he exhibited difficulty and need constant prompts to name pictures on

confrontation naming task too. The client started intervention at the time of the conduct of the current study. Deficit based approach was used in the intervention as the cognitive decline/deficit was mild in nature. He reciprocated well to therapy. The outcomes of therapy was not profiled in detail as the number of sessions were less for a detailed profiling and comparing pre and post therapy details.

Conclusion:

Mild Cognitive Impairment is a precursor to Dementia, if the condition is not identified earlier, there is high vulnerability/risk of such client developing dementia. The diagnosis would be difficult if neuro-imaging details are not availability as the client could not afford, neuro imaging was not done in this client. A detailed cognitive linguistic profiling enabled the proper diagnosis and timely intervention facilitated cognitive reserve.

References:

1. Anand, R., Chapman, S. B., Zientz, J., & Toussaint, K. J. P. o. G. (2005). Mild cognitive impairment: A clinical perspective. *10*(2), 10-14.
2. Jorm, A. F., Christensen, H., Korten, A., Henderson, A., Jacomb, P., & Mackinnon, A. J. P. m. (1997). Do cognitive complaints either predict future cognitive decline or reflect past cognitive decline? A longitudinal study of an elderly community sample. *27*(1), 91-98
3. Ritchie, K., & Touchon, J. J. T. L. (2000). Mild cognitive impairment: conceptual basis and current nosological status. *355*(9199), 225-228.
4. Gauthier, S., & Touchon, J. J. A. o. n. (2005). Mild cognitive impairment is not a clinical entity and should not be treated. *62*(7), 1164-1166.

Harmonizing Voices: A Comprehensive Systematic Review of Voice Hygiene Programs' Impact on Teachers' Well-being and Performance

Author Details: *[1]Ms Deepti Pradhan; [2]Mr. Vivek Kumar*

1-BASLP Intern, Institute of Health Sciences

2-Assistant Professor in the Department of Speech, Language, Cognition and Swallowing Disorders

Introduction:

In the intricate symphony of education, teachers wield their voices as instruments of inspiration and knowledge, guiding the melodies of countless young minds. However, the cadence of their vocation can sometimes take a toll on their vocal health, affecting not only their personal well-being but also the resonance of their educational orchestration. This confluence of challenges brings into focus the harmonizing potential of "voice hygiene programs" – a harmonious blend of techniques, practices, and interventions designed to nurture and restore teachers' vocal vitality.

The multifaceted role of educators extends far beyond mere classroom instruction; their voices hold the power to captivate, inspire, and lead. Yet, the rigorous demands of teaching often subject their voices to strain, fatigue, and even injury. As educators face the reality of these vocal challenges, the need for effective interventions becomes apparent. Voice hygiene programs emerge as a harmonious solution, offering a diverse range of strategies to safeguard and enhance teachers' vocal health.

In the pursuit of educational excellence, the interplay between educators' vocal well-being and their performance becomes increasingly relevant. This comprehensive systematic review endeavors to illuminate the impact of voice hygiene programs on both the personal well-being of teachers and their professional effectiveness. By orchestrating an array of studies, methodologies, and insights, this review seeks to harmonize the diverse voices of research into a coherent chorus of understanding.

As the curtain rises on this exploration, we delve into a journey through the pages of studies, each note contributing to the crescendo of knowledge. By deciphering the harmonies of evidence, we aim to assess whether voice hygiene programs truly resonate as transformative measures. As we navigate the symphony of findings, let us uncover whether these interventions have the potential to harmonize teachers' well-being and performance, ultimately weaving a more melodious tapestry of education.

Method:

A meticulous study selection process was undertaken to ensure the inclusion of relevant and high-quality research. Initial searches were conducted including Elsevier, PubMed, NIH, and google scholar in which out of 20 articles 7 were included in the inclusion criteria. The search strategy employed a combination of keywords such as "voice hygiene programs," "teacher vocal health," and "intervention effectiveness." The timeframe for inclusion was set from the inception of the databases to.

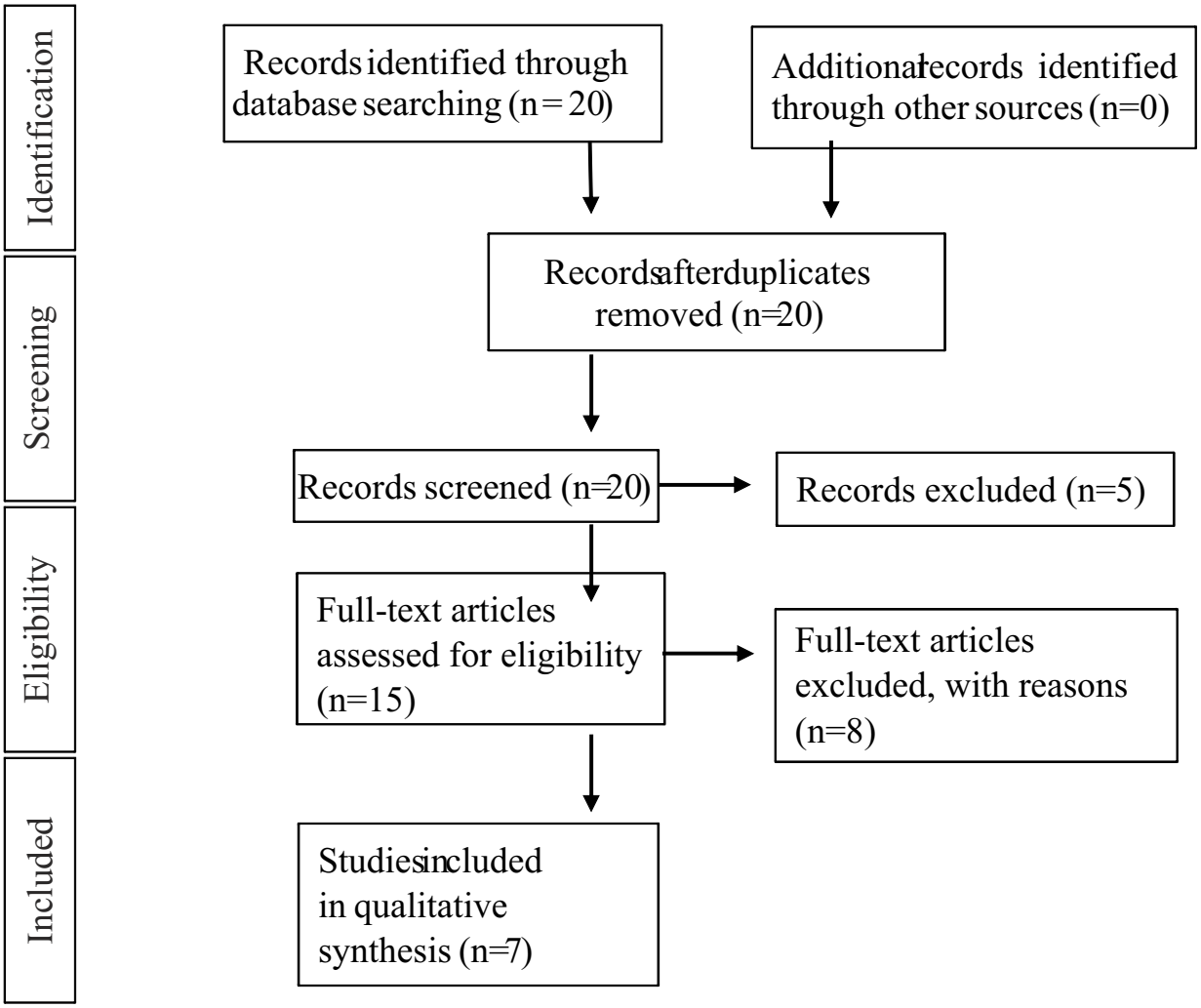
Studies considered for inclusion were required to be published in peer-reviewed journals and focus on investigating the impact of voice hygiene programs on teachers' well-being and performance. The selected articles for inclusion in this overview were sourced from a range of studies conducted between 2016 and 2021.The scope encompassed both qualitative and quantitative research designs conducted within educational settings.

Studies that did not directly examine voice hygiene interventions for teachers or were conducted outside educational contexts were excluded. Additionally, conference abstracts, editorials, and non-English publications were not included in the final selection.

Data extraction was carried out using a standardized form to capture essential details from the selected studies. Information extracted included study characteristics, participant demographics, intervention specifics, outcome measures, and key findings.

To enhance reliability, two independent reviewers participated in the study selection, data extraction, and quality assessment processes. Disagreements were resolved through discussion and consensus.

To ensure transparency and adherence to PRISMA guidelines, a flow diagram was constructed detailing the number of records identified, screened, assessed for eligibility, and ultimately included in the systematic review.



By meticulously adhering to this comprehensive study selection process, this systematic review guarantees the incorporation of robust and relevant research, yielding reliable insights into the impact of voice hygiene programs on teachers' well-being and performance.

Result:

In the study by Nallamuthu A. (1), The Vocal Hygiene Program (VHP) was delivered through in-person sessions to seventeen female teachers experiencing voice issues. Prior to and four weeks after the program, all participants underwent a thorough assessment of their voice, including subjective, objective, and self-perceptual vocal measures.

The teachers' vocal habits underwent notable changes after the Vocal Hygiene Program (VHP). The frequency of throat clearing and coughing decreased for 64.7% of teachers. Whispering habits saw mixed results, with 35.2% reducing it, while 17.6% increased. All teachers practicing mimicry at baseline stopped after the program. Additionally, the habit of screaming improved for 94.1% of teachers. (1)

Concerning nonvocal habits, 52.9% consumed 2-5 cups of caffeinated drinks daily at baseline. Post-VHP, coffee intake reduced in 5 out of 9 teachers. 17% stopped soda intake. Alcohol and smoking were not reported. Improved meal-sleep intervals ($\geqslant$ 2 hours) were noted by 76.4% of teachers. Oily/spicy food intake reduced. 58.8% quit throat lozenge chewing. Water intake improved, with 47% having 6-8 glasses, and 53% exceeding 8 glasses daily. Vapor/steam inhalation increased among all teachers who coupled it with water intake. (1)

Vocal symptoms significantly improved, including throat discomfort (P=0.008), better breath control (P=0.016), and reduced heartburn (P=0.031). These changes positively affected well-being, reducing irritability (P=0.031) and upset (P=0.031). Teachers with activity limitations reported better voice use in conversations (P=0.031) and telephone calls (P=0.016). (1)

Environmental barriers persisted, including noise (82.35%) and chalk dust (47.05%). However, communication device use improved (P=0.004), consistent voice use throughout the day increased (P=0.008), and adapting to weather changes improved (P=0.002). (1)

Teachers perceived more support from family (94.11%), colleagues (88.23%), and doctors (100%) post-VHP. However, school policies (70.58%) remained a hurdle. Challenges such as noise, chalk dust, and class size persisted. Most teachers (94%) faced limitations on medical leave for voice issues. (1)

In the preliminary study by López, J. M., (2) included a total of 116 teachers, with 85 of them being women. Their ages ranged from 25 to 55 years, with an average age of 40.6 years and a standard deviation of 7.8. The findings of the study revealed a notable improvement in the voice performance of the teachers after undergoing 25 hours of training.

The vocal training appears to offer protective benefits for laryngeal organs, countering fatigue experienced by teachers. Positive changes were observed in self-perceived voice quality and acoustic measurements. These acoustic changes stem from improved micro-instability in vocal cord vibrations and a better balance of vocal cord properties, reducing fatigue. While some improvements were seen in self-perception and physical subscales of the Voice Handicap Index (VHI), significance wasn't consistent across all VHI-10 scales. The study's tools proved sensitive to short-term changes over 8 weeks, and the cost-effective methodology achieved several objectives quickly. However, the study has limitations that warrant addressing in future research. (2)

In a study by Bolbol, S.A, (3) included 156 teachers from Sharkia governorate and 180 administrative staff from Zagazig University. Most were married, non-smoking women aged $\geqslant$40 with $\geqslant$15 years on the job. Over 80% in both groups consumed caffeinated drinks. Teachers teaching Science/Math constituted 28%, and 71.8% taught Languages/Arts. Many (58.3%) used a loud teaching voice. Teachers reported significantly more voice issues than controls, confirmed by higher VHI scores. Factors affecting voices were work duration, class frequency, and voice loudness. Post a health program, teachers' vocal hygiene knowledge improved and maintained for three months. Laryngo-video-stroboscopy revealed pathologies like nodules, polyps, and cysts in some examined teachers.

In a study (by Porcaro, C. K., (4)) participants had diverse teaching experience (1 to 30+ years) and reported using their voices for varying durations (1 to 15+ hours per day). Of 26 participants, 16 had previously faced voice issues, and only five sought medical help. A t-test of Dependent Means

indicated a significant increase ($P < 0.001$) in willingness to adopt vocal hygiene behaviors post-training. The training's impact was considered substantial ($d \geqslant 0.80$), with around 90% of targeted behaviors showing improvement. Notably, avoiding whispering (+0.85) and using nonverbal signs ($d = 0.82$) displayed the most significant changes. Predictive modelling using Multiple Linear Regression revealed that demographic factors like age, class size, and years of teaching influenced participants' responses. The first-stage model explained 46.8% of the variance, and the second-stage model, including age and class size, accounted for 24.5% of the variance. Class size emerged as a stronger predictor than age.

The study by Sundram, E. R., (5) evaluated the effectiveness of a voice care program for primary school teachers in northeastern Malaysia. The program incorporated voice amplification and vocal hygiene instruction. Participants with scores of five and above on the M-VHI-10 self-perceived outcome-based measure were included. The intervention group showed significant improvement over eight weeks, considering confounding factors. Another study with a similar approach reported reduced voice handicap index scores among teachers. Voice amplification was found effective, reducing voicing effort and promoting vocal recovery. Combining vocal hygiene with amplification enhanced awareness and education. Compliance with amplifiers was high, and technical training played a role. The workplace-based, group approach likely contributed to the program's success, fostering support and accessibility. The cost of the intervention was relatively low compared to other methods.

In a study conducted by Munier, C., & Farrell, R. (6) established a connection between class size and voice issues. Teachers handling larger class sizes (>30 pupils) experienced more voice problems compared to those with smaller class sizes (<30 pupils). The relationship was statistically significant at a 99.97% confidence level. This outcome aligns with similar findings in the literature. The research underscores the importance of recognizing the impact of working conditions, especially on vocal health for primary school teachers. Addressing risk factors is crucial to enhance occupational safety and health in voice-related professions. The study's results indicate that the current working conditions for primary school teachers may not fully align with recommended guidelines from the World Health Organization.

Another study by Pomaville, F., (7) investigated the impact of a Voice Health Education (VHE) program on vocal performers' knowledge and at-risk vocal behaviors. Using a pretest-posttest design, survey data were analyzed. The program increased participants' knowledge of voice production and vocal hygiene, evidenced by significant changes in responses to knowledge-based questions. Positive behavioral changes were observed, including increased water intake and decreased caffeine/alcohol consumption. Participants adopted healthier reactions to vocal symptoms, notably laryngeal irritation. While negative symptoms decreased, the change wasn't statistically significant, potentially due to the short follow-up period. The study supports the effectiveness of VHE programs in enhancing vocal knowledge and reducing at-risk behaviors. Limitations include potential recall bias, participant attrition, and a small sample size, mainly consisting of students. Future research should involve a more diverse sample and consider longer follow-up periods.

Conclusion:

In conclusion, the mentioned studies collectively shed light on various aspects of voice care and its impact on different populations, particularly teachers and vocal performers. The studies demonstrate the effectiveness of interventions such as Vocal Hygiene Programs (VHP) and Voice Health Education (VHE) in improving vocal knowledge, reducing at-risk behaviors, and enhancing overall vocal health. Notable improvements were observed in vocal habits, behaviors, and self-perception, as well as reductions in vocal symptoms and related discomfort. The studies underscore the importance of

addressing environmental and behavioral factors that contribute to vocal issues, as well as the significance of workplace-based interventions and group support.

However, these studies also acknowledge certain limitations, including small sample sizes, potential recall bias, and the need for longer-term follow-up to assess sustained effects. Despite these limitations, the research provides valuable insights into the multifaceted nature of vocal health and the potential benefits of targeted interventions. Collectively, these findings emphasize the importance of incorporating vocal care programs and awareness initiatives to promote healthy vocal practices among teachers, vocal performers, and other individuals with high vocal demands. Further research with larger and more diverse samples is warranted to validate and expand upon these findings, ultimately contributing to the betterment of vocal health and well-being in these populations.

Reference:

1. Nallamuthu, A., Boominathan, P., Arunachalam, R., & Mariswamy, P. (2021). Outcomes of vocal hygiene program in facilitating vocal health in female school teachers with voice problems. *Journal of Voice*.
2. López, J. M., Catena, A., Montes, A., & Castillo, M. E. (2017). Effectiveness of a short voice training program for teachers: a preliminary study. *Journal of Voice*, *31*(6), 697-706.
3. Bolbol, S. A., Zalat, M. M., Hammam, R. A., & Elnakeb, N. L. (2017). Risk factors of voice disorders and impact of vocal hygiene awareness program among teachers in public schools in Egypt. *Journal of Voice*, *31*(2), 251-e9.
4. Porcaro, C. K., Howery, S., Suhandron, A., & Gollery, T. (2021). Impact of vocal hygiene training on teachers' willingness to change vocal behaviors. *Journal of Voice*, *35*(3), 499-e1.
5. Sundram, E. R., Norsa'adah, B., Mohamad, H., Moy, F. M., Husain, N. R. N., & Shafei, M. N. (2019). The effectiveness of a voice care program among primary school teachers in Northeastern Malaysia. *Oman medical journal*, *34*(1), 49.
6. Munier, C., & Farrell, R. (2016). Working conditions and workplace barriers to vocal health in primary school teachers. *Journal of Voice*, *30*(1), 127-e31.
7. Pomaville, F., Tekerlek, K., & Radford, A. (2020). The effectiveness of vocal hygiene education for decreasing at-risk vocal behaviors in vocal performers. *Journal of Voice*, *34*(5), 709-719.
8. Vermeulen, R., Du Toit, M., van Lierde, K., & Van der Linde, J. (2022). The effect of vocal hygiene education programs on voice quality in professional voice users: a systematic review. *Journal of Speech, Language, and Hearing Research*, *65*(12), 4700-4713.
9. Nusseck, M., Immerz, A., Spahn, C., Echternach, M., & Richter, B. (2021). Long-term effects of a voice training program for teachers on vocal and mental health. *Journal of Voice*, *35*(3), 438-446.
10. Richter, B., Nusseck, M., Spahn, C., & Echternach, M. (2016). Effectiveness of a voice training program for student teachers on vocal health. *Journal of Voice*, *30*(4), 452-459.
11. Pizolato, R. A., Rehder, M. I. B. C., dos Santos Dias, C. T., de Castro Meneghim, M., Ambrosano, G. M. B., Mialhe, F. L., & Pereira, A. C. (2013). Evaluation of the effectiveness of a voice training program for teachers. *Journal of voice*, *27*(5), 603-610.
12. Zangeneh, A. M., Izadi, F., & Ghelichi, L. (2018). Vocal hygiene as a treatment for teachers: a

review. *www. mjltm. com info@ mjltm. org*, 10.

13. Bovo, R., Trevisi, P., Emanuelli, E., & Martini, A. (2013). Voice amplification for primary school teachers with voice disorders: a randomized clinical trial. *International journal of occupational medicine and environmental health*, *26*, 363-372.

14. Van Houtte, E., Claeys, S., Wuyts, F., & Van Lierde, K. (2011). The impact of voice disorders among teachers: vocal complaints, treatment-seeking behavior, knowledge of vocal care, and voice-related absenteeism. *Journal of voice*, *25*(5), 570-575.

15. Rodríguez-Parra, M. J., Adrián, J. A., & Casado, J. C. (2011). Comparing voice-therapy and vocal-hygiene treatments in dysphonia using a limited multidimensional evaluation protocol. *Journal of communication disorders*, *44*(6), 615-630.

PUBLISHED BY:

Autonomous Institute of Health Sciences

Chandaka Village, Bhubaneswar- 751024

(+91) 9867758589

www.isamworld.in