Journal of Informatics Education and Research
ISSN: 1526-4726
Vol 6 Issue 1 (2026)

The Use of Relaxation in the Therapy of Stuttering

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Received : 14/08/2025 ; Accepted: 21/12/2025 ; Published : 27/01/2026

Abstract

Relaxation techniques play a crucial role in the management and treatment of stuttering, complementing both behavioral and speech-focused interventions. Stuttering is not solely a motor speech disorder but also a condition influenced by emotional, cognitive, and physiological tension. Excessive muscle tension in the respiratory, phonatory, and articulatory systems can exacerbate disfluencies and secondary behaviors. Relaxation strategies—such as diaphragmatic breathing, progressive muscle relaxation, mindfulness, and guided imagery—aim to reduce physical and psychological stress, promote smoother speech initiation, and enhance self-control during communication. By decreasing global and speech-related anxiety, these techniques help clients achieve better fluency, improve body awareness, and foster a sense of confidence and calmness in speaking situations. Integrating relaxation within a holistic stuttering therapy program supports long-term fluency maintenance and contributes to the overall well-being and communicative competence of individuals who stutter.

Keywords: Stuttering , relaxation , therapy .

1. Introduction

Our study focuses on the **management of stuttering**, specifically addressing its **motor components**, including **vocal training**, **respiratory control**, and **relaxation techniques**. The intervention aims to optimize the coordination between **phonatory, respiratory, and postural systems**, thereby improving fluency and reducing speech-related tension.

This motor-oriented approach is grounded in contemporary models of **speech motor control and neuroplasticity**, which emphasize the interdependence between **respiration, voice production, and somatic regulation** in fluent speech. By targeting these mechanisms, therapy facilitates both **physiological efficiency** and **emotional regulation**, essential for sustainable fluency in adults who stutter.

2. Stuttering Definitions

According to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)* (American Psychiatric Association, 2013), **stuttering**—also known as *Childhood-Onset Fluency Disorder*—is characterized by a **disturbance in the normal fluency and time patterning of speech** that is inappropriate for the individual's age and language skills. It involves frequent occurrences of one or more of the following features:

- Sound and syllable repetitions,
- Prolongations of consonants or vowels,
- Interjections or filled pauses,
- Broken words (pauses within a word),
- Audible or silent blocking (filled or unfilled pauses in speech),
- Circumlocutions to avoid problematic words,
- Excessive physical tension during word production,
- Repetition of whole monosyllabic words.

This disturbance in fluency **interferes with academic or occupational achievement or with social communication** (APA, DSM-5, 2013).

Beyond these **primary symptoms**—the observable and audible manifestations of stuttering—many individuals also present **secondary behaviors**. These include **associated motor tics**, **facial grimacing**, **excessive respiratory effort**, and **psychophysiological reactions** such as facial flushing, tachycardia, and sweating (Bloodstein & Bernstein Ratner, 2008; Craig et al., 2017). Nonverbal behaviors, such as gaze avoidance or tension in body posture, are also frequently reported.

In addition, individuals who stutter often develop **cognitive and emotional reactions**, including **negative self-perceptions, anticipatory anxiety, and avoidance behaviors**, which contribute to maintaining the disorder and increasing communication difficulties (Iverach & Rapee, 2014; Smith & Weber, 2017).

Thus, stuttering is best conceptualized as a **disorder of communication**, not merely a speech motor disruption. It typically occurs during **spoken interaction with others**, while fluency often improves during activities such as **singing, reading in unison, or acting**, where motor and linguistic control differ from spontaneous speech (Alm, 2004; Chang et al., 2019).

3. Fundamental Alterations in the Speech Mechanisms of Stuttering

Le Huche (1998) described six fundamental "malfunctions" (*malfaçons*) underlying stuttered speech, representing a cascade of disruptions in the act of speaking. While this conceptualization has historical value, similar mechanisms have been described and supported by contemporary international research on speech motor control, self-monitoring, and emotional regulation in stuttering (Alm, 2004; Ingham et al., 2015; Chang et al., 2019; Smith & Weber, 2017).

3.1 Inversion of the Normal Relaxation Reflex During Speech Difficulty

Stuttering is thought to arise from excessive **muscular effort and tension** during moments of speech difficulty, when fluent speakers would typically relax to regain coordination. Instead, individuals who stutter often "push" harder, increasing laryngeal and articulatory tension.
This maladaptive compensatory response is consistent with neurophysiological findings of **hyperactivity in sensorimotor networks** and **basal ganglia dysfunction** in stuttering (Chang et al., 2019; Neef et al., 2015).

3.2 Loss of Speech Spontaneity

People who stutter frequently lose the **automatic and spontaneous nature** of speech production. They may overmonitor their own articulation, pre-plan utterances excessively, or substitute words to avoid anticipated stuttering moments. This overcontrol aligns with the "monitoring overload" model, which attributes stuttering to excessive **executive control of speech motor output** (Max et al., 2004; Civier et al., 2010).

3.3 Loss of Calming or Reassuring Behaviors

Non-stuttering speakers naturally employ **reassuring gestures** (e.g., hand movements, facial expressions) when encountering disfluency, signaling awareness and control to their interlocutor. In contrast, most people who stutter suppress such gestures, appearing unaware of their disruptions.
This phenomenon has been linked to **altered self-awareness and social monitoring** mechanisms in stuttering (Arnold et al., 2011; Tichenor & Yaruss, 2020).

3.4 Loss of Acceptance of Communicative Support

Many people who stutter resist any **intervention or support** from their listener (such as being prompted or interrupted), preferring to maintain full control of speech despite breakdowns.
This reduced communicative reciprocity has been associated with **heightened speech-related anxiety** and **negative listener sensitivity**, as documented in studies of interpersonal dynamics in stuttering (Iverach & Rapee, 2014; Craig et al., 2017).

3.5 Loss of Self-Monitoring (Auditory Feedback Loop)

Some individuals who stutter experience deficits in **internal auditory feedback**—the ability to mentally rehear their own speech within seconds after production. This internal monitoring is crucial for detecting and correcting verbal errors. Neuroimaging studies have demonstrated **abnormal connectivity in auditory–motor integration circuits**, suggesting impaired self-monitoring mechanisms (Chang et al., 2019; Beal et al., 2015).

3.6 Alteration of Expressivity and Emotional Prosody

Finally, people who stutter often exhibit **reduced vocal expressiveness** and diminished facial or prosodic cues, making it difficult for listeners to perceive their emotional stance (approval, surprise, indignation, etc.). Research indicates **reduced modulation of prosody** and atypical right-hemisphere activation patterns in emotional speech among people who stutter (Kell et al., 2009; Toyomura et al., 2011).

4. Epidemiology

Stuttering affects approximately **1% of the global population**, a prevalence consistent across cultures, languages, and socioeconomic groups (Yairi & Ambrose, 2013; Craig et al., 2002). The disorder typically emerges during **early childhood**, most often between **2 and 4 years of age**, with about **75% of cases beginning before age 3.5** (Reilly et al., 2013).

Although developmental stuttering is the most common form, onset can also occur **later in childhood, during adolescence, or rarely in adulthood**. In adults, stuttering is usually associated with **neurological injury or trauma**, often classified as **neurogenic stuttering** (Theys et al., 2008; Ludlow & Loucks, 2003).

Regarding **sex distribution**, stuttering exhibits a strong **male predominance**. In childhood, the ratio is approximately **3 boys for every 1 girl**, but this imbalance increases with age, reaching about **4–5 males for every female** in adulthood due to higher recovery rates among females (Yairi & Ambrose, 2013; Reilly et al., 2009).

5. Onset of Stuttering

In children, the onset of stuttering may be **gradual or sudden**, and can occur intermittently, with periods of increasing frequency and severity (Yairi & Ambrose, 2013). In most cases, early stuttering is **transient**: approximately **75–80% of children recover spontaneously** before the age of 6 (Reilly et al., 2013; Yairi & Ambrose, 1999). However, for the remaining 20–25%, stuttering becomes **persistent**, and predicting which children will recover or develop chronic stuttering remains a major challenge (Ambrose et al., 2015).

Current research suggests that stuttering results not from a single cause, but from the **interaction of multiple predisposing, precipitating, and perpetuating factors** (Smith & Weber, 2017).

- Predisposing factors include genetic vulnerability, atypical neural processing of speech and timing, and temperamental traits such as heightened emotional reactivity (Kraft & Yairi, 2012; Chow & Chang, 2017).
- Precipitating factors are those that trigger the first onset, such as rapid language development, environmental stress, or emotional events (Reilly et al., 2013).
- Perpetuating factors contribute to the persistence of stuttering, often linked to the child's reaction to disfluency, the attitude of the family, and the development of avoidance behaviors or anxiety (Walden et al., 2012; Smith & Weber, 2017).

This multifactorial framework highlights stuttering as a **dynamic neurodevelopmental disorder**, shaped by both **biological predispositions and environmental interactions**.

6. Evolution of Stuttering

Adult stuttering manifests in diverse ways depending on the individual's developmental history, personality traits, and emotional and behavioral responses to the disorder. Its course over time is **highly variable**, with periods of remission and relapse, often influenced by both internal and environmental factors (Craig et al., 2002; Yairi & Ambrose, 2013).

6.1 Long-Term Course and Variability

In most cases, stuttering that persists beyond the age of six tends to **remain relatively stable through adolescence**, with fluctuations in frequency and severity (Yairi & Ambrose, 1999). Periods of remission may alternate with episodes of increased disfluency, sometimes occurring in **unexpected contexts**—for instance, during periods of low stress such as vacations (Yairi & Ambrose, 2013).
Longitudinal data suggest that **peak symptom severity** often occurs between **late adolescence and early adulthood (18–25 years)**, followed by gradual improvement over the lifespan (Craig et al., 2002; Tran et al., 2019). Nevertheless, residual

speech behaviors and psychosocial impacts frequently persist, shaping the individual's **self-concept, communication confidence, and quality of life** (Iverach et al., 2011).

6.2 Self-Maintaining Mechanisms

From a neurobehavioral perspective, stuttering tends to **self-perpetuate through learned behavioral and physiological responses** (Alm, 2004; Smith & Weber, 2017). Motor effort and excessive tension are often reinforced by transient relief or "release" sensations following speech blocks, which act as **negative reinforcement loops** (Neef et al., 2018). Over time, avoidance of feared speaking situations and anticipatory anxiety further **strengthen maladaptive behavioral patterns** and increase physiological arousal (Blomgren, 2013). Avoidance prevents individuals from testing and revising irrational beliefs about their speech, thereby maintaining a cycle of fear and avoidance (Menzies et al., 2009).

6.3 Cognitive-Behavioral Perspectives

Within the **cognitive-behavioral framework**, stuttering is maintained by **learned associations between speech, anxiety, and self-perception** (Menzies et al., 2009; Iverach & Rapee, 2014). Repeated negative speaking experiences contribute to the development of **maladaptive coping strategies** such as speech monitoring, word substitution, and situational avoidance. These reactions consolidate over time, reinforcing the disorder's chronicity (Craig et al., 2016).

Individuals who stutter often develop **secondary emotional responses**—fear of speaking, shame, or guilt—which in turn amplify physiological stress responses and interfere with fluency (Tumanova et al., 2011). The social reactions of listeners can further **exacerbate self-consciousness and self-stigma**, promoting excessive speech control and loss of spontaneity (Boyle, 2015). Consequently, the individual may **focus more on speech performance than on communicative interaction**, leading to frustration, reduced communicative pleasure, and persistent self-devaluation.

7. Manifestations of Stuttering

The manifestations of stuttering vary significantly from one individual to another. In addition to the audible disturbances of speech and fluency, stuttering is frequently accompanied by tonic and/or respiratory irregularities, disruptions in nonverbal communication, and physiological symptoms such as facial flushing or excessive sweating (Craig et al., 2002; Alm, 2014).

These overt symptoms represent what is often called the **"visible tip of the stuttering iceberg"**—that is, what the listener can hear and observe when the individual speaks. Beneath this surface lies the **"hidden portion"** of the iceberg, consisting of covert reactions such as maladaptive communication attitudes, negative cognitions, and disabling avoidance behaviors, along with the person's thoughts, emotions, and beliefs about speaking (Manning & DiLollo, 2018; Tichenor & Yaruss, 2019).
These covert factors often prevent individuals who stutter from engaging in authentic, spontaneous communication with their interlocutors.

Indeed, it is these **cognitive and emotional components** that have the most profound impact on a person's **social communication abilities and quality of life** (Yaruss & Quesal, 2004; Plexico et al., 2009).
The interaction between overt and covert aspects makes every stuttering profile unique. As emphasized by Manning and DiLollo (2018), **the observable form of stuttered speech is closely interdependent with the speaker's internal reactions and beliefs**. Stable improvement in fluency can only occur when both the overt speech behaviors and the underlying emotional-cognitive components evolve together.

Among these various manifestations, this section will focus specifically on:

- Disturbances in speech production and fluency,
- Alterations in nonverbal communication,
- Vocal parameters, and
- Pneumo-phonic (respiratory-phonatory) coordination.

7.1 Speech

Stuttering disrupts both the **articulatory organization** and the **temporal coordination** of speech movements. In addition to phonation, even the regulation of **pauses and silences** may become atypical, contributing to the overall disfluency pattern (Smith & Weber, 2017).

Articulation and speech represent the most visible aspects of stuttering. However, these manifestations are highly variable and context-dependent: many individuals who stutter can produce **completely fluent, well-coordinated articulatory movements** in certain situations—such as when singing, speaking alone, or under reduced communicative pressure—only to experience marked disfluency in others (Alm, 2014; Ingham et al., 2015).

Over time, as the person struggles to avoid or overcome blocks, a range of **maladaptive articulatory behaviors** may become ingrained. These include excessive tension, unnecessary co-contractions, articulatory "fixations," and deviant movement patterns that can interfere with the fluid execution of speech gestures (Max et al., 2004; Civier et al., 2010). Such compensatory mechanisms may become **automatized**, forming part of the stuttering pattern itself.

Most people who stutter appear to have **limited proprioceptive and kinesthetic awareness** of their speech organs and articulatory gestures (Loucks & De Nil, 2006). Consequently, their control of speech may feel externally driven or disconnected from body awareness, rather than consciously regulated.

Interestingly, discrepancies are often observed between the **speaker's subjective perception** of stuttering severity and the **listener's external evaluation**. This perceptual mismatch highlights the complex interaction between **motor performance**, **cognitive appraisal**, and **emotional reactivity** in the experience of stuttering (Tichenor & Yaruss, 2019; Craig et al., 2002).

7.2 Nonverbal Aspects

For individuals who stutter, communication situations often evoke **heightened emotional arousal and anxiety**, which can disrupt cognitive processing and the capacity for social interaction. This phenomenon has been described as a **temporary disorganization of attentional and executive resources**, leading to reduced efficiency in both verbal and nonverbal communication (Craig & Tran, 2014; Iverach et al., 2017).

Nonverbal communication plays a central role in social interaction—accounting for an estimated **60–70% of communicative meaning** through facial expressions, gaze behavior, gestures, and posture (Burgoon et al., 2016). Thus, stuttering not only affects verbal fluency but also interferes with these **nonverbal interactional channels**, which are crucial for regulating turn-taking, expressing emotion, and maintaining interpersonal engagement.

Research indicates that people who stutter often show **reduced eye contact**, **increased facial and body tension**, **involuntary concomitant movements** (so-called "secondary behaviors"), and **postural rigidity** during speech (Guntupalli et al., 2007; Tichenor & Yaruss, 2019). These visible reactions can influence how listeners perceive the speaker—sometimes being interpreted as anxiety, disinterest, or lack of confidence—further complicating the communicative exchange (Messenger et al., 2015).

Eye contact, for instance, typically occurs during about **40–50% of the speaking time** in normal face-to-face conversation and provides essential **feedback** to both speaker and listener (Kendon, 2010). It signals turn-taking readiness, monitors comprehension, and maintains mutual engagement. The **loss or avoidance of eye contact** among people who stutter deprives them of this secondary feedback channel—especially critical when verbal communication becomes momentarily blocked or disrupted (Plexico et al., 2009).

In this sense, stuttering can be viewed not merely as a **speech production disorder**, but as a **global communication disorder** affecting both the **linguistic and paralinguistic dimensions** of interaction. Effective therapeutic approaches increasingly integrate **nonverbal and psychosocial training**—such as body awareness, facial relaxation, and social exposure—to restore communicative confidence and reciprocity (Boyle et al., 2018; Beilby et al., 2013).

7.3 Voice

Voice alterations are frequently observed in individuals who stutter, reflecting both **physiological and emotional dysregulation** during speech production. These vocal phenomena include sudden shifts in pitch, occasional falsetto breaks,

monotony, and limited variation in pitch or intensity (Natke et al., 2003; Behlau et al., 2014). Many speakers exhibit **prosodic irregularities**—including inappropriate intonation patterns, misplaced stress, and abnormal timing of pauses—which reduce speech naturalness and communicative effectiveness (Conture et al., 2013).

Perceptually, the voice of people who stutter may sound **strained, breathy, or hoarse**, and may present **inconsistent intensity control**—either excessively loud or abnormally soft (Ziegler et al., 2010). Such features have been linked to **heightened laryngeal muscle tension** and **disrupted coordination of the respiratory and phonatory subsystems** (Loucks & De Nil, 2006; Sasisekaran, 2014).

Laryngoscopic and aerodynamic studies have revealed **paradoxical vocal fold behavior** during stuttering moments—where the vocal folds remain abducted (open) during speech initiation or repetition, and only adduct normally when voicing resumes (Riley & Bakker, 2009; McClean et al., 2015). This disruption leads to a **loss of periodicity in the glottal cycle**, contributing to the auditory impression of instability or "voice breaks."

These findings suggest that stuttering involves not only disturbances in articulatory timing but also **deficits in laryngeal motor control** and **pneumophonic coordination**—that is, the integration of respiratory pressure and vocal fold vibration necessary for smooth phonation (De Nil & Abbs, 1996; Loucks & De Nil, 2006). Increased general muscle tension and laryngeal rigidity, often observed under communicative stress, can further exacerbate the disorder, reinforcing both **vocal strain and speech dysfluency** (Tichenor & Yaruss, 2019).

In many adults who stutter, there is also an **altered self-perception of their voice**—some report disliking or dissociating from their vocal identity, describing their voice as "unfamiliar" or "out of control." This phenomenon, now explored in the context of **self-monitoring and auditory feedback loops**, may represent a crucial target for therapy aiming to restore vocal ownership and fluency (Max et al., 2004; Civier et al., 2010).

7.4 Breathing and Pneumo-Phonatory Coordination

Among the secondary signs of stuttering, respiratory abnormalities such as spasmodic hiccup-like jerks, inspiratory blocks, and massive tension of the intercostal muscles appear particularly striking (Ingham et al., 2012; Alm, 2004). These disturbances reflect an overall disruption in the coordination between respiratory and phonatory systems.

An asynchrony is often observed between thoracic and abdominal movements, which move in opposite rather than parallel directions as would be normal (Loucks & De Nil, 2006). When beginning a sentence, many individuals who stutter find themselves not at the end of an inspiration, as typical speakers do, but in mid-expiration or partial inspiration. Small additional inhalations then give them the constant impression of being out of breath (McClean, 2007). It is also common to observe a sudden expiration just before stuttering occurs, depriving the speaker of air necessary for phonation.

Some speakers exhibit a "vocal fry" or creaky voice just before speech onset, corresponding to voiced inhalation events (Watson & Alfonso, 1987). During speech blocks, laryngeal dysfunctions are closely linked to respiratory disturbances: the vocal folds may be fixed in abduction, preventing voicing, or in tight adduction, blocking airflow. In response, the stuttering individual may attempt to overcome the blockage by using strong abdominal contractions to force out residual air, often accompanied by irregular breathing patterns — short inhalations followed by apneas, or deep, irregular inspirations (Conture et al., 2008).

Additionally, many individuals who stutter begin the expiratory phase while the vocal folds remain open, causing an air leak before voicing and forcing an early inspiratory recovery (Watson & Alfonso, 1987; Loucks & De Nil, 2006). Consequently, their respiratory profiles during speech are markedly deviant compared with those of fluent speakers.

Le Huche's early observations have since been confirmed by functional studies showing that respiratory disturbances in people who stutter occur **only during speech production**, not during quiet breathing (Bloodstein & Bernstein Ratner, 2008; Ingham et al., 2012). This finding supports the hypothesis that the respiratory–phonatory discoordination in stuttering is not structural but task-dependent, reflecting a breakdown in sensorimotor integration during speech.

8. Motor-Based Intervention in Stuttering

The techniques employed in the management of stuttering are as diverse as the theoretical models that attempt to explain the disorder. However, most clinicians agree that treatment must address the individual **as a whole**, integrating both speech-specific and non-speech aspects of communication.

According to current international research, effective therapy typically targets **multiple domains** of stuttering: psychological, linguistic, pragmatic, social, and motor (Craig et al., 2016; Ingham & Bothe, 2012). The **motor component** of intervention focuses on breathing control, relaxation, and vocal function—elements that are tightly interrelated in the regulation of fluent speech.

Motor-based therapy therefore includes **respiratory retraining**, **phonatory control**, and **articulatory coordination**, all aimed at improving the sensorimotor integration underlying speech production (Max et al., 2004; Loucks & De Nil, 2006). Relaxation techniques and controlled breathing exercises help to reduce muscle tension and respiratory irregularities, while vocal work focuses on optimizing laryngeal efficiency and phonation onset.

It is important to emphasize that these motor techniques represent **only one component** of comprehensive stuttering therapy. They are typically integrated within broader cognitive-behavioral and communication-based frameworks that target emotional regulation, self-acceptance, and the restructuring of maladaptive beliefs about speech (Yaruss & Quesal, 2004; Guitar, 2019).

Thus, motor intervention complements—not replaces—the multidimensional therapeutic approach required for lasting improvement in fluency and communication confidence.

9. Voice, Respiration, and Relaxation: An Integrated Physiological Relationship

These three components—**voice, respiration, and relaxation**—are deeply interdependent. Relaxation exercises naturally induce a global reduction in muscular tension, affecting not only the **orofacial and cervical muscles** but also the **thoracic and dorsal regions**, which are essential for vocal support and postural control (Sundberg, 2018; Bassi et al., 2021).

Postural alignment has a direct impact on the **quality and efficiency of vocal gesture**. Movements of the ribs and diaphragm are biomechanically connected to those of the spine, and the position of the **larynx** varies with head and neck movements (Titze & Verdolini Abbott, 2012). This complex interaction underscores the need to address the **whole-body coordination** underlying phonation rather than isolating the vocal mechanism.

During speech, several respiratory adaptations occur:

- **Inspiration becomes shorter**, while **expiration lengthens**, since phonation takes place during the expiratory phase.
- The **volume of air mobilized** is significantly greater than during resting respiration.
- The **vocal folds adduct** to initiate sound production, requiring an increase in **subglottal pressure** sufficient for the airstream to pass through the glottis.

Respiratory muscles must therefore adjust dynamically to maintain this pressure throughout phonation and to **modulate intensity, pitch, and timbre** according to communicative needs (Sataloff, 2017).

Effective and natural speech depends not only on the physiological functioning of the **respiratory and laryngeal systems**, but also on a **refined body awareness**—a kinesthetic perception of the body's position, movement, and vocal mechanisms. This concept, referred to as the **"vocal body schema"** or *vocal kinesthetic awareness*, is essential in voice rehabilitation (Behlau & Madazio, 2019; Bassi et al., 2021).

Relaxation techniques play a crucial role in restoring this awareness by reducing **muscle hypertonicity**, improving **respiratory coordination**, and enhancing **phonatory control**. Numerous studies have confirmed the strong correlation between a person's vocal quality, their **respiratory function**, **postural stability**, and **psychophysical awareness** of their own body (Fuchs & Mürbe, 2020; Sundberg, 2018).

Thus, the integration of **respiratory training**, **postural reeducation**, and **relaxation therapy** constitutes a cornerstone of evidence-based intervention in modern voice therapy, promoting efficient, sustainable, and expressive vocal use.

10. Motor Reeducation Techniques

Motor reeducation in stuttering and voice disorders typically follows a structured progression involving **relaxation, body work, vocal training, motor control for speech**, and finally **spontaneous speech**. Each stage addresses a specific

physiological and psychophysical component of speech production, aiming for optimal coordination between respiration, phonation, and articulation (Behlau & Madazio, 2019; Bassi et al., 2021).

10.1 Relaxation Techniques

Relaxation serves as a foundational element in the treatment of stuttering and dysfluency-related motor tension. Its primary goal is to **reduce generalized muscular hypertonicity**, restore **body awareness**, and facilitate **efficient respiratory and phonatory control** (Fuchs & Mürbe, 2020). Several evidence-based methods have been adapted for clinical use:

a. Autogenic Training (Schultz Method)

Originally developed by **Johannes H. Schultz (1932)**, autogenic training is a **self-relaxation technique** based on passive concentration and autosuggestion, closely related to self-hypnosis. It induces progressive **muscle relaxation** and **autonomic regulation** through focused mental exercises.

Patients are guided through six standardized stages, each aiming to modify physiological responses associated with stress and speech effort (Kanji et al., 2021):

1. **Heaviness:** Promotes awareness of muscle relaxation and release of physical effort.
2. **Warmth:** Induces peripheral vasodilation, improving circulation and muscular comfort.
3. **Cardiac control:** Enhances perception and stabilization of heart rhythm.
4. **Breathing control:** Encourages passive, unforced observation of natural breathing cycles.
5. **Solar plexus warmth:** Focuses attention on gentle abdominal warmth and calmness.
6. **Cool forehead:** Encourages mild vasoconstriction, reinforcing mental clarity.

Clinical studies demonstrate that **autogenic training** reduces **autonomic hyperarousal**, improves **respiratory control**, and enhances **speech fluency and voice stability** in patients with stuttering or voice tension disorders (Kanji et al., 2021; Nakano et al., 2020).

b. Progressive Muscle Relaxation (PMR)

Developed by **Edmund Jacobson (1938)**, PMR involves **systematic contraction and release** of major muscle groups. The patient alternates between brief voluntary contraction and full relaxation, progressing through different body regions (head, neck, shoulders, torso, limbs).

This approach increases **somatosensory feedback** and helps patients distinguish between states of tension and release, fostering self-regulation of **muscle tone** during speech (Varvogli & Darviri, 2011). PMR has been shown to improve **breathing coordination**, **laryngeal efficiency**, and **speech comfort**, making it a useful complement in voice and fluency therapy (Carroll et al., 2020).

c. Other Relaxation Approaches

Additional therapeutic frameworks, such as **body-oriented psychotherapy**, **mindfulness-based stress reduction (MBSR)**, and **biofeedback-assisted relaxation**, have shown promise in speech motor control by improving **sensorimotor awareness** and **reducing cognitive reactivity** to speech-related anxiety (de Sonneville-Koedoot et al., 2015; Craig et al., 2016).

11. Body Work Techniques

Among the various somatic approaches applied in speech and voice therapy, the **Feldenkrais Method®** (Feldenkrais Educational Foundation of North America, 2004) is one of the most documented and clinically relevant frameworks. It belongs to the field of **somatic education**, which focuses on enhancing self-awareness through movement to improve posture, coordination, and neuromuscular efficiency (Buchanan & Ulrich, 2020).

11.1 Principles of the Feldenkrais Method®

The Feldenkrais Method is based on the neurophysiological principle that **habitual motor patterns**, even inefficient or uncomfortable ones, are reinforced by the nervous system through repetition. Because these patterns are automatized, the brain tends to reproduce them unconsciously, limiting motor flexibility.

The method proposes **new movement pathways** through **sensorimotor exploration**, directly engaging the **central nervous system** to reorganize habitual patterns. The ultimate goal is to **expand the body's repertoire of efficient actions**, achieving maximum functional effect with minimal effort (Feldenkrais, 1981; Buchanan & Ulrich, 2020).

11.2 Somatic Learning Process

Therapeutic sessions encourage the patient to **explore bodily sensations** and **movements** in a novel and mindful way. Through slow, precise, and non-strained motion, the individual is guided to notice:

- How each body part feels and moves.
- How minor adjustments affect breathing, balance, and voice production.
- How movement awareness influences global muscular tone and posture.

This **sensorimotor feedback loop** facilitates **neuroplastic adaptation**, allowing the nervous system to discover more economical and balanced movement patterns (Lukacs et al., 2021).

12. Applications in Speech and Voice Therapy

In **speech-language pathology**, the Feldenkrais Method has been integrated into programs for:

- **Vocal function retraining** (reducing laryngeal tension, improving resonance and breath coordination);
- **Lingual and mandibular posture optimization**;
- **Stress management and self-regulation** during speech tasks;
- **General body alignment and proprioceptive control** during phonation and articulation (Behlau et al., 2019; Smith et al., 2022).

By cultivating awareness of movement and posture, patients develop **greater control over their vocal effort** and **improved adaptability** under communicative stress. The acquired motor skills are progressively **transferred to daily speech and professional voice use**.

13. Conclusion

Motor retraining represents an **essential component** of comprehensive stuttering management. It enables patients to **reclaim control over their speech production**, focusing on **reducing excessive muscular effort and tension** while simultaneously **reconditioning maladaptive motor patterns** that have developed through years of dysfluent speech .

From a neuromotor perspective, stuttering is now understood as involving **abnormal sensorimotor integration** within speech-related cortical and subcortical networks, including the **basal ganglia, premotor cortex, and supplementary motor areas**. Consequently, therapeutic interventions targeting the motor aspects of speech not only restore fluency at a behavioral level but also promote **functional reorganization and neuroplasticity** in these neural circuits.

Beyond the physiological benefits, motor work plays a **psychophysiological regulatory role**. By reinforcing efficient and controlled motor patterns, the patient learns to **resist emotional flooding**—anxiety, frustration, or self-consciousness—that often accompany communicative situations. This process enhances **self-efficacy and attentional engagement**, allowing the speaker to remain connected both to the **semantic content** of their utterance and to the **interlocutor** during real-life interactions.

In this sense, motor training serves not only as a **rehabilitation of speech gesture** but also as a **bridge between motor control and emotional regulation**, central to a holistic approach to stuttering therapy.

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