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Assessment and Treatment of Acquired Neurogenic Stuttering: A Single Subject Study

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Case Report

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Abstract

Neurogenic stuttering is a subtype of acquired stuttering characterized by speech disfluencies following acquired brain damage. Despite advances, research on neurogenic stuttering remains limited, particularly concerning its pathophysiology and therapy. This study aimed to explore the clinical profile of neurogenic stuttering post cerebrovascular accident (CVA) and document the outcomes of speech-language intervention. The participant, a 51-year-old Malayalam-speaking male sales manager from Calicut, experienced speech difficulties after a left parieto-temporal infarct, presenting with right-sided weakness and heart failure, alongside a history of type 2 diabetes and hypertension. Assessment revealed reduced verbal output, poor clarity, disfluencies, articulatory errors, intact comprehension, but mild deficits in naming and morphosyntax; standardized tests indicated a non-aphasic profile with mild dysarthria and mild stuttering (SSI-4: 23). The therapeutic intervention comprised three phases: Establishment (including gentle onset, continuous phonation, Melodic Intonation Therapy, voluntary stuttering, language/vocal modulation, and relaxation), Transfer (generalization via role-play and self-monitoring), and Maintenance (long-term support). Therapy resulted in reduced disfluencies, enhanced intelligibility, and improved communication attitude, with the client maintaining fluency strategies despite setbacks following a seizure. This case underscores the efficacy of individualized, evidence-based intervention incorporating fluency shaping, prosodic training, counseling, and family involvement in managing neurogenic stuttering post-CVA, while highlighting the need for further holistic research to advance clinical practice and evidence-based care.

Introduction

Stuttering is defined as an interruption in the natural flow of speech, characterized by sound and syllable repetitions, prolongations, monosyllabic word repetitions, and blocks (ASHA, 2021). These core disfluencies are often accompanied by secondary behaviors such as visible struggle, physical tension, and avoidance of speaking situations (Majic, 2021). The emotional consequences may include embarrassment, anxiety, and reduced self-confidence, often leading to social withdrawal and diminished quality of life (Craig et al., 2009; Iverach & Rapee, 2014).

Stuttering is broadly classified into developmental and acquired types. Acquired stuttering, emerging after early childhood, includes psychogenic and neurogenic forms (Theys et al., 2008). While psychogenic stuttering stems from emotional trauma, neurogenic stuttering follows neurological events such as stroke, TBI, brain tumors, Parkinson's disease, seizures, or dialysis (DeVries, 2022). It typically involves sound repetitions, prolongations, and blocks, often occurring at word endings and on content words, with minimal visible tension and variability based on context and communication partners. Differential diagnosis is crucial due to overlapping symptoms among stuttering types, but remains challenging (DeVries, 2022). Lesions in the basal ganglia, thalamus, frontal lobe, and white matter tracts —excluding the occipital lobe—are commonly linked to neurogenic stuttering (Helm-Estabrooks, 1999; Alm, 2004; Theys et al., 2013; De Nil, 2019).

Despite its clinical relevance, neurogenic stuttering remains largely underdiagnosed and underrepresented in research. Prevalence data are limited, and there is a notable absence of standardized intervention protocols (Cruz et al., 2018). The available research mainly consists of single case reports or small case series (Cruz et al., 2018; Tani et al., 2011), resulting in a fragmented understanding of the condition.

This context underscores a critical need for comprehensive, detailed examinations of individual cases, which can deepen our understanding of the clinical profile, functional impact, and management of neurogenic Stuttering.

Need for the Study

Despite important advances, research on neurogenic stuttering is still at an early stage compared to developmental stuttering, with significant gaps in the understanding of its pathophysiology, diagnosis, treatment, psychosocial impact, and epidemiology. These gaps highlight the value of single case studies, which provide detailed clinical insights and help bridge the current lack of broader data in neurogenic stuttering research. This case study details a case of acquired stuttering following a Cerebrovascular Accident (CVA), highlighting core features and underscoring the value of exploring the clinical profile of neurogenic stuttering. It also demonstrates the effectiveness of client-centered, targeted intervention, contributing to the evidence base for timely diagnosis and effective management of this condition.

Aim

To explore the clinical profile of neurogenic stuttering resulting from a CVA and to document the outcomes of speech-language intervention.

Objectives

1. To describe the clinical features and symptomatology of neurogenic stuttering in an individual CVA.
2. To explore the outcomes of speech-language therapy in managing neurogenic stuttering following a CVA.

Method

Participant details: A 51-year-old Malayalam-speaking male from Calicut, Kerala, with a postgraduate degree in Business Administration and over ten years of experience as a sales manager, presented with speech difficulties following a CVA. He had no history of smoking or alcohol use and had been managing type 2 diabetes mellitus for 15 years and systemic hypertension for the past 3 years. On 11/10/2024, he experienced an acute infarct in the left parieto-temporal region, with right-sided weakness and signs of heart failure. Neuroimaging confirmed an infarct in the left frontoparietal region, with no haemorrhagic transformation. Following initial hospital-based care, he received two months of home-based speech

therapy, which was later discontinued due to the unavailability of services. Subsequently, he was referred to the Association for the Welfare of the Handicapped (AWH) Special College in Calicut for a comprehensive evaluation and therapy.

The study utilised a single-subject case design that included a pre- & post-assessment phase and an intervention phase.

Consent: Written informed consent was obtained from the patient for publication of this case report

Assessment procedure: Pre-assessment phase starts with systematic data collection, focusing on gathering a comprehensive case history analysis and evaluating key communication skills. This phase serves as the foundation for clinical decision-making and intervention planning.

Following a comprehensive case history, which included both medical and non-medical background information, revealing that the client was on medications such as Clopilet A, Storvas 40 mg, Monit GNT 2.6 mg, Glimy M2, and Januvia 100mg - prescribed for the management of diabetes, cholesterol, and cardiac conditions and he is also attending physiotherapy from October 2024 as part of ongoing rehabilitation, further an in-depth assessment of the client's speech and language skills was conducted.

The following assessment tools were administered to evaluate different aspects of the client's communication

- Western Aphasia Battery- Malayalam (Philip J E, 1992)
- Frenchay Dysarthria Assessment-2 (Enderby, 2008)
- Stuttering Severity Instrument–4 (Riley, 2009)
- GRBASI Scale (Hirano, 1981)
- Speech Intelligibility Rating Scale (AYJNIHH, 1984)
- Modified Erickson Scale of Communication Attitudes – S-24 (Erickson, 1969).

A range of standardized assessment tools was administered to evaluate specific aspects of the client's communication profile. The WAB-M was used to assess overall language function and to rule out the presence of aphasia (Philip J E, 1992). FDA-2 evaluated the structure and function of the speech musculature to determine the presence and severity of dysarthria (Enderby, 2008). SSI-4 was employed to quantify the severity of stuttering and identify specific patterns of dysfluency (Riley, 2009). To assess voice quality, the GRBASI scale was used, which analyses six perceptual parameters: Grade, Roughness, Breathiness, Asthenia, Strain, and Instability (Hirano, 1981). The Speech Intelligibility Rating Scale measured the intelligibility of connected speech (AYJNIHH, 1984), while the Modified Erickson Scale of Communication Attitudes (S-24) assessed the client's attitude towards communication and stuttering (Erickson, 1969). In this case, the absence of an apraxia component was inferred from the patient's consistent ability to respond spontaneously, comply with voluntary commands, and provide appropriate answers to questions,, while the lack of speech discrepancies was further corroborated by multiple

sources, including caregiver reports and analysis of earlier audio recordings The pre- and post-assessment measures of the above tests are discussed in the results and discussion section.

Statistical analysis

Data are presented based on behavioural observations, test results, and treatment outcomes were analysed qualitatively through detailed narrative description and interpretation.

Ethics approval:

Ethics approval was obtained from the institution's ethical committee

Result and Discussion

A comprehensive overview of the speech and language assessments administered to the client, the clinical findings, and the treatment interventions implemented is provided below.

Clinical Features and Symptoms of Neurogenic Stuttering Following CVA

Speech Assessment Findings: The client exhibited dysfluencies such as initial syllable and word repetitions, interjections, filled and unfilled pauses, and effortless blocks in all word positions. Articulatory errors—including substitution, distortion, and omission—were observed during both conversational and reading tasks. Speech intelligibility was reduced, and the client demonstrated an increased rate of speech and impaired prosody. Although many reports suggest that individuals with neurogenic stuttering typically do not exhibit an adaptation effect, here the client demonstrated a clear presence of this phenomenon. This finding is consistent with Tani and Sakai (2011), who also reported positive adaptation effects in patients with neurogenic stuttering following basal ganglia lesions, thereby supporting the notion that adaptation can indeed be observed in some cases of neurogenic stuttering.

Although neurogenic stuttering has classically been described as resistant to fluency-enhancing conditions such as singing, choral reading, or repeated reading (Helm-Estabrooks, 1999), more recent evidence suggests that this is not always the case. Theys, van Wieringen, and De Nil (2008) reported that while many patients with neurogenic stuttering showed consistent disfluencies across tasks, a subset demonstrated variability. For example, several stroke and brain-surgery patients exhibited a positive adaptation effect during successive readings, and some were more fluent in tasks such as automatic speech or reading compared to spontaneous speech. These findings highlight that, contrary to earlier assumptions, a minority of individuals with neurogenic stuttering may experience task-related fluency benefits similar to those observed in developmental stuttering

Speech Subsystems: Evaluation of the speech subsystems revealed reduced articulatory coordination and sequencing. This impairment results in difficulty transitioning smoothly between sounds or syllables,

which likely contributes to dysfluencies such as repetitions and blocks. The client also exhibits challenges in producing rapid sequences of sounds, especially during complex or multisyllabic words, further reducing intelligibility, particularly at higher speech rates, as observed in the present case.

In addition, inadequate phonatory and respiratory sufficiency was noted, which results in fluctuations in voice quality, pitch, and loudness control, potentially impacting overall vocal effectiveness and prosody. Also, insufficient or poorly coordinated breath support makes it difficult to sustain speech during longer utterances or reading tasks. These respiratory deficits often compound difficulties with coordination and fluency, as speech may be forced or interrupted by the need to take breaths at inappropriate times.

Furthermore, an increased rate of speech combined with impaired prosody (including the melody, rhythm, and stress patterns of speech) can lead to monotonous, rushed, or unnatural-sounding speech, making communication less effective and expressive, as seen in this case.

Language Assessment Findings: The client demonstrated adequate comprehension of auditory verbal commands, yes/no questions, and connected passages. He participated in spontaneous, automatic, and responsive speech with only minimal difficulty. However, mild impairments were observed in generative naming and morphosyntactic skills. A detailed summary of test results is presented in Table 1 below.

To confirm the diagnosis, the assessment results from various measures were compared with findings reported in existing literature (Table 2 below). The current case was provisionally diagnosed as neurogenic stuttering (Speech fluency disorder secondary to CVA) with mild dysarthria. The client demonstrated a non-aphasic language profile, mild dysarthria, and mild stuttering with an SSI-4 score of 23. GRBASI ratings indicated mild hoarseness and roughness, without signs of strain or instability. Intelligibility, as measured by the Speech Intelligibility rating scale, was rated at 2, reflecting mostly intelligible speech with occasional repetitions.

Table 1

Scores of each test in the test batteries described below

Test	Finding/score	Interpretation
WAB-M	Non-aphasic. Aphasia Quotient – 95.2	Language function is within normal limits, but a very mild difficulty is observed in morphosyntactic aspects of language.
FDA-2	Mild Dysarthria Results – reflexes, palate, and respiration ratings of 9 in all conditions, laryngeal, lip, tongue rated 8, intelligibility rated 6.	Mild impairment in speech musculature and coordination resulting in poor speech intelligibility and inappropriate prosody. Articulatory errors are observed, which include substitutions, distortions, and omissions seen in conversation and reading tasks.
SSI- 4	Total Score – 23 Percentile rank – 24 to 40, Severity Equivalent: Mild	Individuals present with Mild stuttering, characterized by initial syllable and word repetition, interjections, filled pauses, blocks, which are present in both content and function words in all word positions.
GRBASI	$G_1R_1B_1A_0S_0I_0$	Mild hoarseness and roughness; no asthenia, strain or instability
Speech Intelligibility Rating Scale	Score – 2 (Speech is understood with a little effort, repetitions needed occasionally)	Mild to moderate difficulty in intelligibility is present.
S24 Scale	Score – 14, Suggest the range between no stuttering to stuttering	Mildly negative attitude towards communication. While the individual exhibits overt avoidance or fear, there is evidence of reduced confidence and occasional negative self-perceptions related to speaking situations. Functionally, this suggests a moderate impact on communicative participation, which may influence their willingness to engage in certain social contexts.

Speech-Language Therapy and Outcomes in Neurogenic Stuttering Following CVA

Therapy Procedure: Therapy was delivered in three phases—Establishment, Transfer, and Maintenance—through an individualized, evidence-based plan focused on enhancing fluency, articulatory coordination, prosody, intelligibility, and communicative confidence. Initially, the clinician provided an overview of the treatment procedure.

The client has attended a total of 40 therapy sessions. These sessions were distributed as follows: 13 sessions during the establishment phase, 15 sessions during the generalization phase, and 12 sessions during the maintenance phase, which remains ongoing. Session frequency was approximately three times per week, with each session lasting 40 minutes.

Table 2

Comparison of clinical features between the present case and reported cases in the literature

Clinical feature	Present case	Reported in literature	Sources
Onset	Sudden onset following a neurological event	Neurogenic stuttering has a sudden onset following brain insult (stroke, TBI, Tumour)	Helm-Estabrooks (1999); Jokel et al. (2007); Theys, van Wieringen, and De Nil (2008);
Disfluencies	Initial syllable repetition, blocks, pauses, and interjections.	Characteristics of neurogenic stuttering: repetitions, blocks across all parts of words, and lack of adaptation effect	Helm-Estabrooks (1999); Jokel et al. (2007); Rosenbek et al. (1978)
Articulatory errors	Substitution, distortion, omission, and rapid rate of speech	Clinical survey noted articulatory and increased rate of speech for neurogenic stuttering	Theys et al. (2008)
Findings	Mild dysarthria and mild stuttering	Acquired stuttering frequently co-occurs with dysarthria and motor speech disorders	Duffy (2005)
Imaging finding	Acute infarct on the left parietal-temporal region	Lesions in various locations of CNS including basal ganglia, cerebellum, cortex linked to neurogenic stuttering	Grant et al. (1999); Ludlow et al. (1987)
Treatment given	Fluency shaping, stuttering modification, DAF, MIT, articulation training.	DAF and fluency shaping strategies used in neurogenic stuttering	Van Borsel and Taillieu (2001), Albert, M. L., Sparks, R. W., & Helm, N., 1973, Yates, A. J., 1963

During the Establishment Phase, the therapy targeted awareness and physiological ease using techniques such as gentle onset, light articulatory contacts, and continuous phonation to reduce speech tension. Prolonged Speech (O'Brian et al, 2003) and reduced speech rate were introduced to promote smooth transitions and improved speech timing. Melodic Intonation Therapy (MIT) (Albert et al., 1973) was incorporated to engage alternative neural networks through rhythmic and melodic speech. Delayed Auditory Feedback (Yates, A. J., 1963) was used to alter auditory feedback and reduce habitual disfluencies. Voluntary stuttering and pullout (Van Riper, C., 1973) strategies were taught to improve control and reduce fear and avoidance behaviours. Research supports that combining stuttering modification and fluency shaping techniques is effective for adults who stutter, as this integrated approach improves speech fluency while also addressing the emotional and physical aspects of stuttering, leading to better overall communication outcomes (Langevin et al, 2006; Blomgren M, 2013). Articulatory training was also provided by guiding the patient to practise phonemes across various word positions and levels, to enhance speech clarity and production. In parallel, language components such

as naming and morphosyntactic formulation were targeted, along with vocal modulation technique (Boone, D. R., 2013) to improve pitch and loudness control. Relaxation exercises and anxiety reduction strategies (Guitar, B., 2014) were also integrated to support the emotional aspects of communication.

A significant element of this therapy is the use of Stuttering Severity Scale, which is used to rate stuttering severity, it's a 9 point Stuttering Severity Scale where: 0 = no stuttering, 1 = minimal stuttering (not noticed by casual listener), 2–3 = mildly noticeable, 4–5 = moderately noticeable, some communication interferences, 6–7 = severely noticeable, struggling to communicate, 8 = extremely severe, stuttering dominates communication (O'Brian, S., Onslow, M., Cream, A., & Packman, A., 2003). We have adapted this rating scale to our therapy from the Camperdown Program is a behavioural fluency shaping treatment specifically developed for adults. It was developed in the 1980s at the University of Sydney by a team of researchers at the Australian Stuttering Research Centre, University of Technology Sydney (UTS).

Severity ratings (SRs) provide a simple and effective way to measure a client's stuttering both in and outside the clinic. Their simplicity allows clinicians, clients, and caregivers to quickly and clearly communicate about stuttering severity. SRs also enable ongoing evaluation of progress toward treatment goals. If progress is not satisfactory, changes in SR scores will alert the clinician so any issues can be addressed promptly. Problem-solving and decision-making based on SRs are a routine part of treatment (Cullinan, & Prather 1968). These ratings help both clients and clinicians quantify stuttering before, during, and after treatment, and provide a shared language for discussing progress. The client was trained to use the SR rating in the establishment phase. The session-wise SR rating scores are given in Table 3 below.

In the Transfer Phase, the focus shifted toward generalization of fluency techniques into real-world contexts through guided role-plays, semi-structured dialogues, and monitored conversational exchanges. Real time feedback and playback enabled self-monitoring and error correction (Li, J., Wu, S., & Leshed, G., 2024), while structured exposure to high pressure speaking contexts (Tichenor SE, Herring C, Yaruss JS, 2022) helped build confidence. Clinician support was gradually reduced, and emphasis was placed on independent strategy use and acceptance of occasional disfluencies.

The Maintenance Phase focused on sustaining fluency gains and preventing relapse. The client continued applying techniques in diverse speaking situations and began developing a personalized fluency toolkit consisting of recovery strategies such as mental rehearsal, relaxation cues, and fluency anchors. Family members were actively involved to create a supportive environment and to reinforce generalization outside the clinical setting. During the maintenance phase, session frequency was gradually reduced: initially to two sessions per week, then to once weekly, followed by twice monthly. The plan is to gradually decrease sessions further to monthly once, then once every three months, and finally once every six months for ongoing follow-up to monitor the maintenance of fluency.

A post-therapy evaluation was conducted to measure changes in fluency, intelligibility, emotional response, and speech control.

Table 3

Session-Wise Details of Therapy Phases and SRs

Session no.	Phase of Therapy	SR score	Remarks/Stuttering Rating
1 to 5	Establishment Phase	6–7	Techniques introduced, disfluencies present. Severe level
6 to 13	Establishment Phase	4–5	Techniques established, Improvement in naming, loudness is better, and pauses are reduced. Moderate level
14 to 22	Transfer Phase	3–4	Iterations reduced to 1 to 2, interjections used appropriately. Mild to Moderate level.
23 to 27	Transfer Phase	3	Follows the technique independently. Initial syllable repetition decreased between 1 to 2 iterations. Mild level.
28 to 30	Maintenance Phase	6	Post-stroke seizure attack occurred. Motivation decreased, leading to an increase in disfluencies and a decrease in MPD. Severe level
31 to 35	Maintenance Phase	3–4	Difficulty using the technique, but pitch and loudness are improving. Mild to Moderate level
35+	Maintenance Phase	1–2	Fluency improved, with speech sounding more natural and minimal disfluencies. The client was motivated and more confident in speaking situations, showed reduced avoidance behaviors, and successfully transferred fluency strategies into everyday life. Extremely Mild level.

Therapy yielded significant improvements in fluency, as evidenced by a reduction in the SSI 4 score from 23 to 17, within the very mild range, which reflects a reduction in the frequency and severity of disfluencies, including initial syllable repetitions, word repetition, interjections, and blocks. This quantitative improvement was further supported by spontaneous speech observations during therapy, where the client used pull-out techniques and self-correction more effectively, especially in semi-structured conversations and reading aloud. According to GRBASI ratings, both roughness and breathiness decreased to score 0 from 1, reflecting better overall voice quality. On the speech intelligibility rating scale, the level of the client improved from 2 to 1, with the client being mostly understood by listeners and exhibiting markedly fewer repetitions. Emotional adaptation was noted, with the S-24 score dropping to 10, and qualitative observations indicated increased speech initiation and reduced observable anxiety during communication. MPD for /a/ improved from 12 seconds pre-therapy to 20 seconds post-therapy, /i/ improved from 12 seconds to 22 seconds and /u/ improved from 12 seconds to 23 seconds, indicating enhanced breath support and control. Articulatory errors was also diminished. The patient also showed improvements in naming, morphosyntactic accuracy, and effective use of compensatory strategies in both spontaneous speech and structured tasks. Although a gliotic seizure temporarily led to reduced motivation and a decline in MPD, continued therapy facilitated the recovery of fluency gains and fostered increased confidence.

Table 4

Comparison of Baseline (Pre-Intervention) and Post-Intervention Treatment Outcomes

Test	Pre-Intervention	Post-Intervention
WAB -M	Non-aphasic; AQ = 95.2	Non-aphasic; No regression after seizure
FDA-2	Mild dysarthria; poor articulatory coordination	Mild dysarthria; Improved intelligibility and oral movements were observed, with all areas receiving a rating of 9—equivalent to an 'a' (normal) on the FDA scale—except for intelligibility in sentences and conversation, which was rated 8.
SSI-4	Score 23 – Mild; 2–3 repetitions; frequent pauses/interjections	Score 17 – Very Mild; 1–2 repetitions
GRBASI	G_1 R_1 B_1 A_0 S_0 I_0	G_1 R_0 B_0 A_0 S_0 I_0; improved roughness and breathiness
Speech Intelligibility Rating scale	Level 2 – Understood with effort; repetitions needed occasionally	Level 1–2 – Mostly understood; fewer repetitions needed
S-24	Score: 14 – Moderate concern about communication	Score: 10 – Positive communication attitude
Emotional/Behavioural Response using Desensitization Activities Inventory (DAI)	Reported anxiety, situational avoidance, and physical tension	Reduced anxiety; active participation; improved social interaction
MPD	/a/: 12s; /i/: 12s; /u/: 12s	/a/: 20s; /i/: 22s; /u/: 23s – a significant improvement in respiratory-phonatory function
Naming and Sentence Structure	Difficulty with generative naming; poor morphosyntactic accuracy	Improved naming; better use of linking words in structured tasks
Prosody	Flat pitch, increased rate, poor volume regulation	Controlled pitch/loudness; better rate management via tapping and MIT
Real-life Communication	Avoidance in spontaneous speech; limited self-monitoring	Active use of techniques in conversations, phone calls, and debates
Client Motivation & Engagement	Variable, reduced post-seizure	Improved, actively participating and practicing techniques, and generalizing it to work settings.

Figure 1 below compares the client's MPD and SR scores across therapy sessions. A clear upward trend is observed in MPD and reduction in SR scores, with a temporary decline post seizure and steady recovery thereafter, which indicates improvement in overall speech motor control.

Session-wise data revealed a gradual improvement in technique use and spontaneous speech, with some variability noted following the seizure. Additionally, counselling and relaxation interventions contributed to emotional resilience, while family involvement was instrumental in supporting the maintenance of gains and the generalization of skills. Intensive therapy has resulted in notable improvements, with structured approaches facilitating positive changes that are consistent with neuroplasticity following treatment (Lundgren, Helm-Estabrooks, & Klein, 2010).

Summary and Conclusion

This case study illustrates that neurogenic stuttering following CVA can benefit from an intensive speech-language intervention, combining fluency, articulation, voice, prosody and language skills along with counselling. Tailored therapy reduced disfluencies, improved intelligibility, and fostered positive communication attitudes. The patient's seizure episode highlighted the need for continuous support and adaptive strategies to sustain fluency. Findings emphasize the importance of holistic, individualized therapy in addressing speech-motor, linguistic, and emotional dimensions of neurogenic stuttering. Larger studies are warranted to refine intervention protocols and support evidence-based care.

Unique intervention successes or failures in a single patient can serve as pilot data, highlighting the potential of new therapeutic approaches that could later be tested systematically. Case studies can bring unique clinical details, symptom profiles, and treatment outcomes of unusual or underreported manifestations into the scientific literature.

It is suggested that this study be expanded upon in future research by expanding the sample size to include more people with neurogenic stuttering. Future investigations should also examine the effectiveness of various therapeutic approaches tailored to neurogenic stuttering, with careful consideration of targeted areas of change - such as speech motor control, cognitive-linguistic factors, and emotional regulation - to attaining long term results (Baxter et al., 2016) Moreover, it is advisable that subsequent studies incorporate communication partners of individuals with neurogenic stuttering to gain a comprehensive understanding of how the disorder impacts core speech behaviours, emotional responses, and overall participation. This broader perspective can enhance the evaluation of comprehensive intervention strategies designed for neurogenic stuttering and improve treatment efficacy.

Declarations

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Author Contribution

The second author (P. S. S) conceptualised the study and designed the methodology. The first author (R. M.) conducted the assessment and treatment. The original draft of the manuscript was prepared by the first author (R. M.), while the second author (P. S. S) critically reviewed and approved the final version.

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Figures

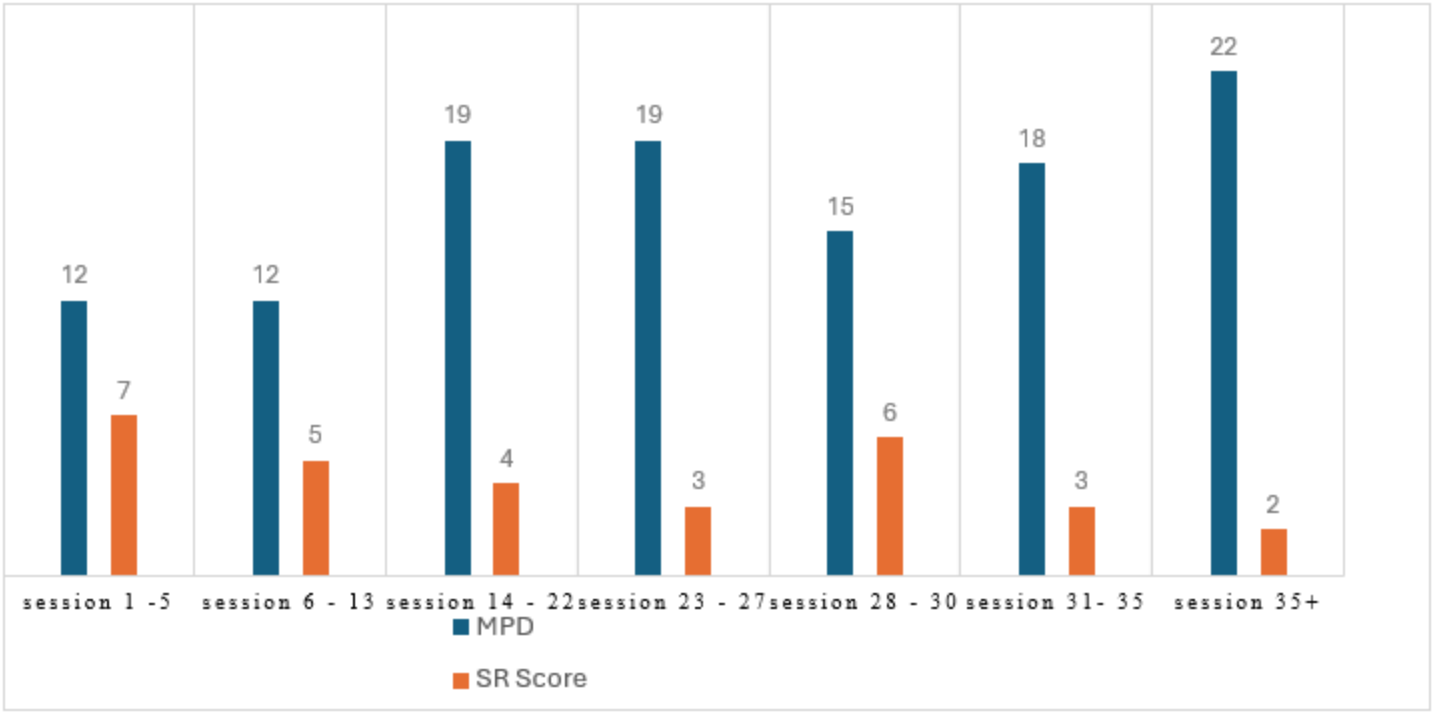


Figure 1

MPD and Stuttering Rating Score across therapy sessions