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Constraint-Induced Language Therapy for Chronic Post-Stroke Aphasia: A District-Wide Pre–Post Effectiveness Study from Sialkot

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ABSTRACT

Background: Aphasia remains a major cause of long-term communication disability after stroke, substantially impairing participation, psychosocial wellbeing, and quality of life. Evidence supports intensive behavioral therapies for promoting neuroplasticity, yet real-world data on Constraint-Induced Language Therapy (CILT) in chronic post-stroke aphasia (PSA) from low- and middle-income settings remain scarce. Objective: To evaluate the district-level effectiveness of a standardized two-month CILT program in improving language outcomes among adults with chronic PSA in Sialkot, Pakistan. Methods: A prospective pre–post cohort study was conducted across five rehabilitation centers. Adults ≥1 month post-stroke with limited verbal output received CILT (three sessions/week, 60–90 minutes) for eight weeks. Primary outcome was change in Western Aphasia Battery Aphasia Quotient (WAB-AQ); secondary outcomes included domain scores for Spontaneous Speech, Naming+Reading, Repetition+Writing, and Comprehension. Paired t-tests and effect sizes (Cohen's dz) quantified change. Results: Eighty participants (mean age 56.8±15.0 years; 55% male) completed therapy. Mean WAB-AQ improved from 24.51±5.92 to 77.38±8.48 (Δ=+52.86, 95% CI 50.80–54.92, t=51.02, dz=5.71, p<0.001). All domain scores showed significant gains (p<0.001). Aphasia severity migrated from 48 very severe and 32 severe cases pre-therapy to 36 moderate and 44 mild post-therapy. Conclusion: Intensive, short-cycle CILT yielded transformative improvements in chronic PSA, supporting its integration into district-level speech-language rehabilitation pathways.

Keywords
Aphasia, Constraint-Induced Language Therapy, Stroke Rehabilitation, Neuroplasticity, Speech Therapy, Low-Resource Settings

INTRODUCTION

Aphasia is a complex neurogenic communication disorder that impairs the ability to process language, affecting both expressive and receptive functions following damage to the dominant cerebral hemisphere, most commonly from a cerebrovascular accident. It represents one of the most disabling sequelae of stroke, with reported global prevalence ranging from 21% to 38% among survivors (1). The impairment extends beyond linguistic deficits, profoundly influencing an individual's psychosocial adjustment, independence, and overall quality of life (2). In low- and middle-income countries (LMICs) such as Pakistan, post-stroke aphasia (PSA) contributes substantially to the rehabilitation burden due to delayed access to speech-language therapy, resource scarcity, and lack of structured community-based rehabilitation services (3). Persistent communication deficits impede reintegration into family and community roles, aggravating depression and caregiver strain while diminishing return-to-work potential (4).

Advances in neurorehabilitation over the last two decades have emphasized the brain's capacity for experience-dependent reorganization even in chronic stages of stroke recovery. Intensive behavioral interventions that exploit this neuroplastic potential have demonstrated measurable improvement in functional language outcomes long after the traditional "spontaneous recovery" window (5). Among these, Constraint-Induced Language Therapy (CILT)—an adaptation of the motor rehabilitation principle of constraint-induced movement therapy—has emerged as a leading evidence-based approach. CILT compels verbal output by restricting compensatory non-verbal modalities such as gesturing or writing, forcing the patient to engage language networks through massed, task-oriented, and communicative game-based interactions (6).

Multiple controlled studies from high-income settings have validated the efficacy of CILT. Pulvermüller et al. first demonstrated substantial gains in verbal communication after short, intensive CILT blocks (7). Subsequent trials and meta-analyses confirmed significant improvements in the Western Aphasia Battery (WAB) Aphasia Quotient (AQ) and related communicative indices when compared to conventional or low-intensity therapies (8,9). However, these findings largely stem from small-scale or laboratory-controlled cohorts within specialized research facilities. Real-world implementation in chronic PSA—particularly in LMIC contexts characterized by low literacy, variable stroke chronicity, and resource constraints—remains insufficiently studied. Evidence from such settings is essential to establish external validity and inform health-service integration strategies (10).

The knowledge gap therefore lies in understanding how CILT performs as a scalable, district-wide intervention under pragmatic conditions, outside controlled trials. Most existing literature addresses early or subacute aphasia rehabilitation, whereas chronic cases in resource-limited regions often remain untreated or receive sporadic speech therapy with limited outcomes (11). Moreover, no prior district-level program evaluation from Pakistan or neighboring South Asian countries has reported comprehensive pre–post language gains using standardized measures such as WAB-AQ and its domain subcomponents. The absence of such evidence impedes advocacy for speech-language therapy inclusion in provincial rehabilitation frameworks and limits clinician confidence in delivering CILT at community level (12).

Given these gaps, the present study was conceptualized as a district-wide, pragmatic evaluation of a standardized two-month CILT program among adults with chronic PSA in Sialkot, Pakistan. The study aimed to quantify real-world improvement in overall language function, expressed through changes in WAB-AQ and specific domain scores (Spontaneous Speech, Naming and Reading, Repetition and Writing, Comprehension). By focusing on chronic-stage patients and analyzing severity migration across standardized AQ categories, the investigation sought to determine whether clinically meaningful gains could be achieved under routine clinical conditions.

Objective: To evaluate the effectiveness of a two-month, standardized CILT program in improving language outcomes among adults with chronic post-stroke aphasia in District Sialkot, as measured by pre–post changes in the Western Aphasia Battery Aphasia Quotient and related language domain scores.

MATERIAL AND METHODS

This investigation was designed as a prospective pre–post effectiveness cohort evaluating a standardized block of Constraint-Induced Language Therapy (CILT) for adults with chronic post-stroke aphasia (PSA) under routine clinical conditions. The rationale for a single-arm pre–post design was twofold: first, to quantify real-world change attributable to an intensive, speech-first program delivered at district scale; and second, to generate implementation evidence where randomized delivery is often impractical due to service constraints and ethical obligations to treat. The study was conducted across five healthcare facilities in District Sialkot, Pakistan, which routinely manage stroke rehabilitation and speech-language therapy (SLT). Participants were enrolled consecutively from SLT caseloads and completed a two-month intervention; outcome assessments were performed immediately before the first session and immediately after the final session to capture program-level change while minimizing intercurrent clinical variation.

Eligible participants were adults residing in District Sialkot with aphasia secondary to a prior stroke and limited verbal communication at baseline, at least one month post-event to ensure entry in the chronic phase. Exclusion criteria were severe cognitive impairment precluding valid testing, concomitant neurological disease unrelated to the index stroke, or physical limitations expected to prevent adherence to the prescribed therapy schedule. Potentially eligible cases were identified from clinic schedules and inpatient/outpatient referral logs; treating clinicians screened against criteria and invited consecutive patients until the cohort was complete. Recruitment followed a standardized script describing the program, risks, and benefits. Written informed consent was obtained from all participants or, where appropriate, from a legally authorized representative after capacity assessment in line with local law and international ethical standards. No incentives were offered, and participation did not alter access to usual medical care.

Data collection used pre-specified case-report forms and a fixed measurement battery. Demographic and clinical variables included age (years), sex (male/female), education (none/primary/middle/matric/secondary/graduate), time since stroke (months), stroke type (ischemic/hemorrhagic) abstracted from medical records and imaging reports where available, and comorbidities recorded as hypertension, diabetes mellitus, combined hypertension-diabetes, coronary artery disease, or none. The primary outcome was the Western Aphasia Battery (WAB) Aphasia Quotient (AQ), computed from four language domains scored according to the test manual (Spontaneous Speech, Naming+Reading, Repetition+Writing, and Comprehension), with the AQ treated as a 0–100 continuous variable (13). Domain composites were prespecified secondary outcomes to profile differential response across expressive and receptive language skills. Operational definitions for aphasia severity categories followed AQ thresholds: 0–25 very severe, 26–50 severe, 51–75 moderate, and ≥76 mild. "Chronic" PSA was defined operationally as ≥1 month post-stroke at enrollment. All assessments were administered by SLTs trained to criterion on WAB administration and scoring, using standardized prompts and scoring sheets; the same instrument and scoring rubric were applied at both time points to reduce instrumentation bias (13). To minimize expectancy and session fatigue, language testing was separated from therapy sessions and conducted in a quiet clinical room using the same seating arrangement and cueing policy at both time points.

The intervention comprised a standardized two-month CILT block delivered three times per week in 60–90-minute sessions. Therapy emphasized forced verbal communication through graded language-action games and barrier tasks that constrained non-verbal compensations (e.g., gesturing, writing), promoted massed practice of verbal output, and progressively increased linguistic complexity (e.g., single-word requests to phrase and sentence-level exchanges). Task difficulty was titrated session-by-session using pre-specified lists and picture sets to maintain a high success rate while preventing ceiling effects. Attendance was monitored, and any missed sessions were rescheduled within the same week when feasible to maintain intensity. Fidelity was supported by session checklists capturing task mix, number of elicited utterances, and use of constraints.

Several steps were taken to address potential biases and confounding inherent to pre–post program evaluations. Selection bias was mitigated by consecutive recruitment from routine caseloads across multiple facilities and by applying uniform inclusion/exclusion criteria. Performance and measurement biases were minimized by using a fixed, manualized therapy protocol, standard administration of outcome tests by trained SLTs, and identical scoring rules at both time points (13). Regression to the mean and spontaneous recovery were attenuated by limiting enrollment to the chronic phase (≥1 month post-stroke), where spontaneous gains are typically smaller than in the acute/subacute phases, and by using a sensitive, continuous primary endpoint. To reduce confounding by case-mix, the analysis plan prespecified exploratory models adjusting for age, sex, stroke type, months since stroke, education, and comorbidity strata; these variables were defined a priori as potential prognostic factors based on clinical plausibility and service data.

The sample size reflected a pragmatic census of all eligible, consenting patients during the recruitment window across the five facilities, targeting maximal precision for the primary effect estimate in a district-scale service evaluation. With n=80, and the observed paired standard deviation of differences estimated from the data, the two-sided 95% confidence interval (CI) for the mean AQ change achieved a precision of approximately ±2 points, which is narrower than typical minimally important differences reported for language scales in post-stroke rehabilitation. This level of precision was deemed adequate for program decision-making and for planning future comparative studies.

The statistical analysis plan was finalized before data cleaning. All analyses were conducted in R (v4.x) using two-sided tests with $\alpha=0.05$. Descriptive statistics summarized baseline characteristics and comorbidity frequencies. The primary analysis estimated the mean paired difference

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in AQ with its 95% CI using a paired t-test; the standardized within-subject effect size (Cohen's d_z) was computed as the mean change divided by the standard deviation of paired differences. Because repeated measures on the same participants are correlated, the reported paired correlation (r=0.210) informed calculation of the test statistic and variance estimates for precision reporting. Secondary analyses summarized mean paired changes for each domain composite and the severity migration across AQ categories from pre- to post-therapy. Pre-specified exploratory regressions (linear models for continuous change scores and ordinal logistic models for post-therapy severity bands) adjusted for age, sex, stroke type, months since stroke, education, and comorbidity categories to examine whether gains varied by case-mix; model diagnostics evaluated linearity (component-plus-residual plots), homoscedasticity (studentized residuals), and leverage/influence (Cook's distance). Missing data were handled as follows: participants with both pre- and post-therapy WAB measurements were included in paired analyses; where item-level WAB data were partially missing within a domain, scores were derived per instrument guidance when allowable; otherwise, the domain was set missing without imputation to avoid biasing variance estimates (13). Sensitivity analyses compared results with and without any prorated domain scores to assess robustness. Outliers were inspected visually and by influence diagnostics; no change analyses were excluded solely on the basis of magnitude unless accompanied by documented scoring error.

Ethical approval for conduct at all participating facilities was obtained from the relevant institutional ethics committee, and the study adhered to the principles of the Declaration of Helsinki. All participants (or legal representatives) provided written informed consent before any study procedures. Data protection procedures included assignment of unique study identifiers, storage of paper forms in locked cabinets within restricted-access offices, and maintenance of electronic datasets on encrypted, password-protected systems with role-based access. To ensure reproducibility and data integrity, standard operating procedures governed screening, consent, therapy delivery, and outcome testing; SLTs underwent competency checks before data collection; double data entry with cross-validation was performed for all WAB scores; an audit trail logged all corrections with date, reason, and author; and a version-controlled analysis script implemented the full statistical pipeline from raw export to tables. The complete variable dictionary, scoring algorithms, and analysis code were archived with time stamps to facilitate independent replication (13).

RESULTS

A total of 80 participants completed the study and were included in the final analysis. The mean age of the cohort was 56.8 ± 15.0 years, with 55% males (n = 44) and 45% females (n = 36). The majority of cases were due to ischemic stroke (82.5%), while the remainder had hemorrhagic stroke (17.5%). Comorbidities were common, with hypertension (36.3%) and combined hypertension with diabetes (22.5%) being most frequent. Participants had a broad educational background, ranging from no formal education to graduate-level attainment.

Table 1. Baseline Characteristics of Participants (n = 80)

Variable	Category / Statistic	Value
Age (years)	Mean ± SD	56.78 ± 15.04
Gender	Male, n (%)	44 (55.0)
	Female, n (%)	36 (45.0)
Stroke Type	Ischemic, n (%)	66 (82.5)
	Hemorrhagic, n (%)	14 (17.5)
Comorbidities	Hypertension	29 (36.3)
	Diabetes Mellitus	13 (16.3)
	Hypertension + Diabetes	18 (22.5)
	Coronary Artery Disease	4 (5.1)
	None	16 (20.0)
Education Level	No formal education	11 (13.8)
	Primary	19 (23.8)
	Middle/Matric	27 (33.8)
	Graduate	23 (28.8)
Duration since Stroke (months)	Median (IQR)	8 (4–14)

The primary analysis revealed a statistically significant and clinically large improvement in the Western Aphasia Battery Aphasia Quotient (WAB-AQ) following the two-month CILT program. Mean AQ increased from 24.51 ± 5.92 at baseline to 77.38 ± 8.48 post-intervention. The mean paired difference of +52.86 points (95% CI 50.80–54.92) corresponded to t(79) = 51.02 and a Cohen's dz = 5.71, indicating a very large within-subject effect (p < 0.001).

Substantial improvements were also observed across all language domains of the WAB. The largest absolute gain was seen in Spontaneous Speech (+12.60), representing a 63% improvement relative to the domain scale, followed by Naming + Reading (+10.04) and Repetition + Writing (+9.88), each improving by approximately half of their total scale range. Comprehension also improved significantly (+4.50 on a 10-point scale; 45% of scale range). All within-domain changes were statistically significant (p < 0.001) and corresponded to large effect sizes (dz > 1.5).

Table 2. Change in Primary Outcome (Western Aphasia Battery – Aphasia Quotient)

Measure	Pre-therapy (Mean ± SD)	Post-therapy (Mean ± SD)	Mean Difference (Δ)	95% CI for Δ	t (df)	Cohen's dz	p-value
Aphasia Quotient (AQ)	24.51 ± 5.92	77.38 ± 8.48	+52.86	50.80 – 54.92	51.02 (79)	5.71	<0.001

Table 3. Domain-Wise Changes in Western Aphasia Battery Scores (n = 80)

Domain (Scale Range)	Pre-therapy (Mean ± SD)	Post-therapy (Mean ± SD)	Mean Difference (Δ)	% of Scale Gained	95% CI for Δ	t (df)	Cohen's dz	p-value
Spontaneous Speech (0–20)	4.29 ± 1.94	16.89 ± 2.10	+12.60	63.0 %	12.14 – 13.06	40.71 (79)	4.55	<0.001
Naming + Reading (0–20)	4.81 ± 2.22	14.85 ± 2.37	+10.04	50.2 %	9.61 – 10.47	38.19 (79)	4.27	<0.001
Repetition + Writing (0–20)	4.84 ± 2.19	14.71 ± 2.34	+9.88	49.4 %	9.45 – 10.31	37.22 (79)	4.17	<0.001
Comprehension (0–10)	3.50 ± 1.74	8.00 ± 1.63	+4.50	45.0 %	4.15 – 4.85	26.47 (79)	2.96	<0.001

Severity category migration demonstrated a clinically transformative shift. Before therapy, 60% (n = 48) of participants were classified as very severe and 40% (n = 32) as severe; no participant fell into moderate or mild categories. After therapy, no individual remained in either severe category; 44 participants (55%) achieved mild aphasia and 36 (45%) achieved moderate aphasia. The within-participant shift was significant on the Wilcoxon signed-rank test (Z = –7.86, p < 0.001).

Table 4. Aphasia Severity Category Migration Before and After CILT

Severity Category (AQ Range)	Pre-therapy (n, %)	Post-therapy (n, %)	Absolute Change (n)	Test Statistic	p-value
Very Severe (0–25)	48 (60.0 %)	0 (0.0 %)	−48		
Severe (26–50)	32 (40.0 %)	0 (0.0 %)	−32		
Moderate (51–75)	0 (0.0 %)	36 (45.0 %)	+36		
Mild (≥76)	0 (0.0 %)	44 (55.0 %)	+44	Z = –7.86	<0.001

Exploratory analyses examined whether demographic or clinical variables moderated the magnitude of AQ change. Mean improvements were consistent across subgroups of age, sex, stroke type, and comorbidity (all p > 0.05), suggesting that the large language gains observed were robust across case-mix factors.

Table 5. Subgroup Analysis of Mean Change in Aphasia Quotient (Δ AQ) by Clinical Characteristics

Subgroup Variable	Category	Mean Δ AQ (Mean ± SD)	95% CI for Δ	t (df)	p-value	Interpretation
Age Group	≤ 55 years (n = 39)	53.10 ± 9.12	50.24–55.96	30.18 (38)	0.76	No age effect
	> 55 years (n = 41)	52.63 ± 8.81	49.86–55.40	29.44 (40)		
Gender	Male (n = 44)	53.22 ± 8.97	50.52–55.92	32.01 (43)	0.68	No sex effect
	Female (n = 36)	52.41 ± 9.04	49.31–55.51	29.82 (35)		
Stroke Type	Ischemic (n = 66)	52.75 ± 9.01	50.33–55.17	36.77 (65)	0.71	Effect consistent
	Hemorrhagic (n = 14)	53.34 ± 8.55	48.38–58.30	21.28 (13)		
Comorbidity	None (n = 16)	52.94 ± 8.99	48.25–57.63	19.64 (15)	0.84	No comorbidity bias
	Any (n = 64)	52.83 ± 8.93	50.47–55.19	38.45 (63)		

Collectively, these findings demonstrate that participation in the standardized, district-level CILT program produced highly significant improvements in all measured domains of language function, with a very large overall effect size and uniform benefit across subgroups. The complete elimination of severe aphasia categories and the consistency of improvement across demographic and clinical characteristics confirm the program's robust clinical impact and scalability for real-world speech-language therapy services.

DISCUSSION

The present district-wide pre–post effectiveness study demonstrated a marked improvement in linguistic outcomes among adults with chronic post-stroke aphasia (PSA) following a two-month, standardized program of Constraint-Induced Language Therapy (CILT). The magnitude of change observed—a mean increase of over fifty points in the Western Aphasia Battery Aphasia Quotient (WAB-AQ) and universal migration from severe to moderate or mild categories—represents one of the most substantial real-world responses reported for any behavioral speech-language intervention in the chronic recovery phase. These findings affirm that even after the traditionally accepted window of spontaneous neurorecovery, structured, high-intensity language interventions can unlock dormant neuroplastic potential and lead to meaningful functional restoration.

Previous randomized controlled trials have consistently shown that CILT yields clinically significant gains compared with conventional or low-intensity therapies, though most such studies have been conducted in small, highly controlled environments (14). Pulvermüller and colleagues first introduced CILT's principles of massed practice and communicative constraint, demonstrating superior gains in verbal fluency compared with conventional stimulation approaches (15). Later, Maher et al. reinforced these findings, reporting significant post-intervention gains in spontaneous speech and repetition after 10 consecutive therapy days (16). Meta-analyses of language rehabilitation trials similarly emphasize that treatment intensity—rather than duration alone—is a critical determinant of outcome magnitude (17). The current study extends this evidence base by confirming that such gains can be replicated under real-world, resource-constrained district settings, outside controlled research laboratories. The large effect size (dz = 5.71) surpasses those reported in most prior CILT trials, likely reflecting the standardized program delivery, high adherence, and strict maintenance of verbal constraint across all sessions.

The mechanisms underlying the observed improvements can be interpreted through neuroplasticity models of cortical reorganization. Intensive verbal engagement in CILT is thought to enhance perilesional activation in the left hemisphere while recruiting homologous regions in the right frontal and temporal cortices, resulting in strengthened interhemispheric balance and functional network connectivity (18). Functional neuroimaging studies have demonstrated that post-stroke patients undergoing constraint-based therapy show increased activation in language-relevant cortical areas such as the left inferior frontal gyrus and superior temporal regions, paralleling behavioral recovery (19). These mechanisms align with Hebbian principles of "use-dependent" plasticity, whereby forced-use paradigms drive cortical reallocation through repeated activation of residual linguistic circuits (20). The present results thus provide applied evidence that these theoretical models remain valid even for chronic aphasia, where neural systems retain capacity for reorganization despite prolonged injury chronicity.

Compared with previous LMIC studies of aphasia rehabilitation, the present work offers distinct advancements. Prior Pakistani or South Asian studies have often involved heterogeneous, low-intensity interventions or focused primarily on early post-stroke rehabilitation, with variable adherence and limited quantitative outcome reporting (21). The district-level implementation across five centers, adherence to a standardized CILT regimen, and the use of a validated, comprehensive measure such as the WAB-AQ provide methodological rigor rarely achieved in similar contexts. Moreover, the inclusion of chronic-stage participants (>1 month post-stroke) expands the evidence base for late-phase intervention, challenging the pervasive assumption that chronic aphasia is refractory to therapy. The uniform improvement across subgroups—irrespective of age, sex, stroke type, or comorbidity—also underscores the generalizability of the CILT model to diverse patient profiles.

Clinically, these findings hold important implications for the organization of speech-language therapy (SLT) services in resource-limited districts. The observed wholesale migration from severe to mild aphasia indicates not only statistical but also functional recovery, with likely downstream effects on communication participation, psychosocial integration, and caregiver burden. Embedding CILT blocks into district rehabilitation programs could therefore represent a high-yield strategy for maximizing language recovery and reintegration at low marginal cost. Given the feasibility of training SLTs in a structured, game-based CILT protocol and the absence of adverse events, such programs could be sustainably scaled through existing public-sector rehabilitation networks.

While the results are compelling, several limitations must be acknowledged to contextualize interpretation. The study's single-arm, pre–post design precludes definitive causal attribution, as improvement could, in theory, include residual natural recovery or test–retest effects, though these are minimal beyond the subacute phase (22). The absence of a parallel control group limits comparison with spontaneous recovery or alternative therapy modalities. The sample, although large for a district program, was drawn from a single geographic region, which may constrain external generalizability to populations with different sociolinguistic or healthcare access profiles. The follow-up period was limited to immediate post-therapy assessment, precluding evaluation of long-term retention or decay of gains—a critical issue in chronic rehabilitation. Additionally, although WAB-AQ offers a robust measure of linguistic ability, broader participation metrics such as communication effectiveness or quality-of-life indices were not captured, which would have enriched the functional interpretation of recovery (23).

Nevertheless, several methodological strengths mitigate these limitations. Consecutive recruitment across multiple facilities reduced selection bias, standardized intervention delivery minimized performance variability, and adherence monitoring ensured intensity fidelity. The exceptionally large within-subject effect size and uniform improvement across case-mix strata further argue against regression artifacts. Double-entry validation, predefined analytic code, and reproducibility safeguards enhance data reliability and transparency.

Future research should build upon these findings through controlled, multi-arm studies comparing CILT with conventional or hybrid approaches, incorporating follow-up assessments at 6–12 months to evaluate durability. Neuroimaging and electrophysiological correlates could be integrated to elucidate cortical mechanisms of recovery, while economic evaluations should assess cost-effectiveness for district-level health planning. Furthermore, pragmatic trials exploring the integration of CILT with telerehabilitation or caregiver-assisted modules could extend accessibility in underserved regions.

In conclusion, this study provides compelling real-world evidence that a structured, intensive CILT program can produce transformative improvements in chronic PSA, even in resource-limited district settings. The results affirm the principle that intensity and forced verbal engagement remain central to neurorehabilitation efficacy, offering a scalable, high-value intervention model for language recovery after stroke. These findings support the incorporation of standardized CILT into national rehabilitation frameworks and justify future comparative and longitudinal trials to consolidate its role in long-term post-stroke care.

CONCLUSION

This district-wide effectiveness study demonstrated that a standardized two-month program of Constraint-Induced Language Therapy (CILT) produced exceptionally large and clinically meaningful improvements in language function among adults with chronic post-stroke aphasia. The mean gain of more than fifty points in the Western Aphasia Battery Aphasia Quotient (WAB-AQ), accompanied by complete elimination of severe aphasia categories, reflects not only statistically significant but functionally transformative recovery. These results confirm that intensive, verbally constrained, and task-oriented interventions can drive substantial neuroplastic change even in the chronic phase, long after spontaneous recovery has plateaued.

The findings highlight that structured, high-intensity speech therapy can be effectively implemented at the district level in low- and middle-income settings, producing benefits comparable to or exceeding those seen in specialized research centers. Integration of CILT into routine speech-language therapy services could thus offer a scalable, low-cost pathway for restoring communication independence, improving psychosocial outcomes, and reducing caregiver burden among stroke survivors. Future research should include randomized or matched-control designs with longer follow-up to evaluate durability, cost-effectiveness, and generalizability, as well as exploration of hybrid or tele-delivered CILT models. In summary, the present study provides compelling evidence that with appropriate structure, intensity, and therapist training, CILT can transform chronic aphasia management from a largely supportive approach into a robust, restorative therapeutic framework applicable across diverse healthcare contexts.

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