14

Aphasia and Apraxia

Evidence Tables

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### 14.3 Therapies for Aphasia

#### 14.3.2 Individual Studies of Language Therapy for Aphasia after Stroke.

**Table 14.3.2 Effects of Language Therapy on Aphasia Post-Stroke**

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<th>Author, Year</th>
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<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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<tr>
<td><strong>Lincoln et al.</strong> (1982)</td>
<td>UK</td>
<td>RCT</td>
<td>PEDro=4</td>
<td>TPS=NA</td>
<td>N=24</td>
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<td><strong>Intervention:</strong> 24 stroke patients receiving inpatient stroke rehabilitation were randomly assigned to one of four groups: i) speech therapy + non-specific treatment (control condition), ii) non-specific treatment + speech therapy, iii) speech therapy + operant training and iv) operant training + speech therapy. Each group received two, 4wk interventions (e.g. group 1 received speech therapy for 4wk followed by non-specific therapy for 4wk). All treatments were provided in 12, 30min sessions. Speech therapy was conventional speech therapy, operant training followed a specific verbal conditioning procedure and non-specific treatment provided a conversation session about a series of predetermined topics with a therapist. Assessments were conducted at baseline and after each intervention condition.</td>
<td><strong>Outcomes:</strong> Porch Index of Communicative Ability (PICA); Raven’s Progressive Matrices; Speech questionnaire.</td>
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<td>1.</td>
<td>For all groups, there was a significant improvement demonstrated over time on the majority of assessments including the overall PICA (p&lt;0.001).</td>
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<td>2.</td>
<td>However, there were no significant differences between treatments on any assessments with the exception of Raven’s Progressive Matrices, on which speech therapy produced greater improvement than non-specific treatment (p&lt;0.01).</td>
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<td>3.</td>
<td>In addition, non-specific treatment was associated with significantly greater improvement in communication as rated on the Speech Questionnaire (p&lt;0.01); however, the authors note that test re-test and inter-rater reliability for this assessment was poor.</td>
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<td>4.</td>
<td>When “treated patients” (n=24) were compared to “untreated” (n=9) patients (who received only 1/wk session of SLT) there were no significant differences noted on any assessment.</td>
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<tr>
<td><strong>Lincoln et al.</strong> (1984)</td>
<td>UK</td>
<td>RCT</td>
<td>PEDro=6</td>
<td>TPS=NA</td>
<td>N=211</td>
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<td><strong>Intervention:</strong> 211 aphasic stroke patients who were able to cope with language testing assessment were randomised at 10wk post-stroke to receive two, 1h therapy sessions per week at either a hospital or at home for 34wk or to receive no treatment.</td>
<td><strong>Outcomes:</strong> Porch Index of Communicative Ability (PICA); Functional Communication Profile (FCP); Boston Diagnostic Aphasia Examination (BDAE).</td>
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<tr>
<td>1.</td>
<td>Patients in both groups demonstrated improvement; however, no significant differences in language recovery were noted between the groups on the PICA, FCP, and the BDAE.</td>
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<tr>
<td><strong>Shewan &amp; Kertesz</strong> (1984)</td>
<td>Canada</td>
<td>RCT</td>
<td>PEDro=5</td>
<td>TPS=NA</td>
<td>N=100</td>
</tr>
<tr>
<td><strong>Intervention:</strong> 100 aphasic stroke patients who were unable to recover their language skills within the first 2-4wk post-stroke were randomised to one of three treatments: (1) language oriented therapy (LOT) provided by a speech-language pathologist (SLP), (2) stimulation facilitation therapy (ST) provided by a SLP and (3) unstructured settings therapy (UNST) provided by nurses. Patients who did not want/were unable to participate formed a control group (CG). Patients in each of the 3</td>
<td>1. No difference in WAB scores, its subsets AQ and CQ scores and ACSTS scores between the groups.</td>
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<td>2.</td>
<td>The AQ scores of patients in the treatment groups were significantly higher compared to the control groups. Individually, LOT and ST patients significantly improved compared to the control patients, but no significant differences were observed between the UNST and the CG.</td>
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<td>3.</td>
<td>The CQ scores of the treatment groups</td>
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<tr>
<td>Study (Year)</td>
<td>Location</td>
<td>Design</td>
<td>PEDro</td>
<td>Time Period</td>
<td>N</td>
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<tr>
<td>Hartman (1987)</td>
<td>USA</td>
<td>RCT</td>
<td>6</td>
<td>Acute</td>
<td>60</td>
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<tr>
<td>Prins et al. (1989)</td>
<td>Netherlands</td>
<td>RCT</td>
<td>5</td>
<td>≥3mo</td>
<td>32</td>
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<tr>
<td>Poeck et al. (1989)</td>
<td>Germany</td>
<td>No Score RCT</td>
<td>7</td>
<td>Chronic</td>
<td>160</td>
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<td>Laska et al. (2011)</td>
<td>Sweden</td>
<td>RCT</td>
<td>7</td>
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<td><strong>TPS=acute</strong>&lt;br&gt;N=99</td>
<td>language therapy or no therapy. The treatment period was for 21d and consisted of 45min sessions of Language Enrichment Therapy (LET) every weekday. Baseline conditions were determined by the short adjusted version of NGA and the Amsterdam-Nijmegen everyday language test (ANELT). <strong>Outcomes</strong>: ANELT; aphasia coefficient (Coeff) from an adjusted version of the Norsk grunntest for afasi. (p=NS).</td>
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<td><strong>Bowen et. al.</strong>&lt;br&gt;(2012)&lt;br&gt;UK&lt;br&gt;RCT&lt;br&gt;PEDro=7&lt;br&gt;TPS=acute&lt;br&gt;N=170</td>
<td><strong>Intervention</strong>: 170 individuals were enrolled in this multicentre, parallel group randomized control trial which examined the efficacy of enhanced communication therapy within the first 4mo post-stroke, compared to attention control (AC) (natural recovery). The SL therapy was consensus-based, best practice guided, and was provided over a 13wk period. Assessments were completed at baseline and 6mos follow up. <strong>Outcomes</strong>: Therapy Outcome Measure (TOM) activity subscale. 1. The 81 individuals in the treatment group received an average of 22 visits (18hr) over the 13wk study period. 2. An overall improvement of 0.8 on the TOM was observed, indicating a clinically meaningful improvement from a baseline mean of 2.4 ('limited communication, relies on cues and context to make basic needs understood') to 3.6 ('consistently able to make needs known, communicates beyond here and now') at 6mo follow up, with similar gains seen in both study arms. 3. No significant differences were found between group means at 6mo follow up on mean TOM scores (mean difference=0.25 95% CI -0.19, 0.69; p=0.27). This observation was maintained even after adjusting through various sensitivity analyses.</td>
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<td><strong>Godecke et al.</strong>&lt;br&gt;(2012)&lt;br&gt;Australia&lt;br&gt;RCT&lt;br&gt;PEDro=7&lt;br&gt;TPS=NA&lt;br&gt;N=59</td>
<td><strong>Intervention</strong>: 59 aphasic stroke patients were randomized to receive either daily aphasia therapy or usual care (≤1 session/ wk). Individualized, daily aphasia therapy treatment was provided 5d/wk to a maximum of 20 sessions (30-80min sessions). Assessments were completed at discharge from hospital or at 4wk post randomization. <strong>Outcomes</strong>: Western Aphasia Battery; Aphasia Quotient (AQ); Functional Communication Profile (FCP). 1. Daily therapy participants received an average of 7.5 treatment sessions over the study period (mean 331min of training). 2. Controlling for baseline stroke severity, daily therapy treatment participants improved to a significantly greater degree on AQ and FCP scores compared with controls (p=0.01 and p=0.004 respectively). These improvements were maintained at 6mo follow up, however, between group differences were no longer significant.</td>
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<td><strong>Votruba et al.</strong>&lt;br&gt;(2013)&lt;br&gt;USA&lt;br&gt;Pre-Post&lt;br&gt;No Score&lt;br&gt;TPSmean=43.6±37.3mo&lt;br&gt;NStart=50&lt;br&gt;NEnd=50</td>
<td><strong>Population</strong>: Mean age=56.8±15.2yr; Gender: Males=28, Females=22. <strong>Intervention</strong>: Participants received speech-language therapy (SLT) that involved mainly individual sessions with adjunct group therapy. The SLT involved practicing exercises for expressive language skills, writing, comprehension, reading, naming, etc. All participants completed &gt;27hr of SLT (mean=31.8±4.2hr). <strong>Outcomes</strong>: Boston Naming Test (BNT); Boston Diagnostic Aphasia Examination: oral and written 1. Statistically significant improvements from baseline to post-intervention were observed on the repetition and written picture description subtests (p&lt;0.05 for both). 2. No significant differences from baseline to post-intervention were observed on the BNT, CIM and the oral picture description subtest.</td>
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picture description, repetition; Complex Ideational Material (CIM).

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<tr>
<th>Study</th>
<th>Location</th>
<th>Design</th>
<th>PEDro</th>
<th>TPS EG (Mean ± SD)</th>
<th>TPS CG (Mean ± SD)</th>
<th>N Start</th>
<th>N End</th>
<th>Population Details</th>
<th>Intervention Details</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>MacGregor et al. (2015)</td>
<td>UK</td>
<td>Pre-Post</td>
<td></td>
<td>81.6 ± 72.1mo</td>
<td></td>
<td>12</td>
<td>12</td>
<td>Mean age=57±15.6yr; Gender: Males=9, Females=3.</td>
<td>Participants received 2wk of intensive language-action therapy (ILAT) administered for 3-4hr/d on 10 consecutive days. Assessments were conducted before and after the therapy.</td>
<td>1. A significant improvement was found on the BNT (p=0.01) and on the TT (p=0.028) after therapy. 2. The BDAE subscales were not found to have significantly improved following therapy.</td>
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<tr>
<td>Takizawa et al. (2015)</td>
<td>Japan</td>
<td>Cross-over Case Series</td>
<td></td>
<td>23.2 ± 13.7mo</td>
<td></td>
<td>6</td>
<td>6</td>
<td>Mean age=53.8±9.3yr; Gender: Males=3, Females=3.</td>
<td>Participants received two types of treatment in a cross-over design; single-word therapy and sentence therapy. Therapy sessions were provided for 40min, 1-5 sessions/wk over 2-8mos. Assessments were conducted at baseline, post-treatment and 4wk follow-up.</td>
<td>1. Participants improved significantly from baseline to post-single-word therapy in terms of the number of grammatical sentences (p=0.049), the number of AS1 sentences (p=0.049) and in the number of verbs used (p=0.021). 2. Participants improved significantly from baseline to post-sentence therapy on neologisms (p=0.042). 3. No other significant differences in sentence production were observed from pre to post-treatment for single-word and sentence therapy. 4. Group analysis of participants revealed no significant difference in verb acquisition after sentence therapy compared to after single-word therapy. 5. All participants except for participant 1 showed significant improvements on trained and untrained verbs following single-word and sentence therapy (p&lt;0.05). 6. All participants maintained their performance in verb retrieval at the 4wk follow-up except for participant 4 who experienced a significant decline in the improvements observed post-sentence therapy (p=0.045) and approached significance for maintenance of the post-single-word therapy effect (p=0.077).</td>
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<tr>
<td>Whitworth et al. (2015)</td>
<td>Australia</td>
<td>RCT</td>
<td>7</td>
<td>20.9 ± 17.0mo</td>
<td>47.8 ± 16.6mo</td>
<td>14</td>
<td>14</td>
<td>Narrative Aphasia group (EG; n=8): Mean age=63.1±16.3yr; Gender: Males=5, Females=3. Usual Care group (CG; n=6): Mean age=54.7±11.5yr; Gender: Males=3, Females=3.</td>
<td>Participants were randomly allocated to receive Novel Approach to Real-life communication: Narrative Intervention in Aphasia (EG) or Usual Care (CG) 4x/wk over 5wk. Outcomes were assessed at baseline and 5wk.</td>
<td>1. There was no significant difference between groups in Single Word Comprehension of Verbs (p=0.868); however, the EG group did improve (p=0.048) over time as did the control group. 2. There was no significant difference between groups in Naming of Verbs (p=0.739), Objects (p=0.231), or Actions (p=0.603); however, EG group did improve</td>
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<tr>
<td>Study</td>
<td>Population</td>
<td>Intervention</td>
<td>Outcomes</td>
<td>Summary</td>
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<td><strong>Varley et al.</strong> (2016)</td>
<td>Speech-first group (EG; n=25): Mean age=63±17.2yr; Gender: Males=17, Females=8. Sham-first group (CG; n=25): Mean age=68±13.4yr; Gender: Males=12, Females=13.</td>
<td>Participants were randomly allocated to receive speech-first conditioning (EG) or sham-first condition (CG) once or twice a day for 20min over 6wk. Participants then completed the other protocol for an additional 6wk. Outcomes were assessed at baseline, 6wk, and 12wk.</td>
<td>Nend=24&lt;br&gt;TPS=21mo&lt;br&gt;NStart=27&lt;br&gt;NEnd=44</td>
<td>1. After the first 6wk, the EG group showed a significantly greater improvement naming and repetition (p&lt;0.05).&lt;br&gt;2. The CG group showed a significant improvement in naming and repetition following treatment at 12wk.</td>
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<td><strong>Van Der Meulen et al.</strong> (2016) #1053</td>
<td>Melodic Intonation Therapy group (EG; n=10): Mean age=58.1±15.2yr; Gender: Males=7, Females=3. Control group (CG; n=7): Mean age=63.6±12.7yr; Gender: Males=4, Females=3.</td>
<td>Participants were randomly allocated to receive melodic intonation therapy (EG) or control group (CG) for 6wk. Outcomes were assessed at baseline and 6wk.</td>
<td>Sabadel; Amsterdam-Nijmegen Everyday Language Test (ANELT); Aachen Aphasia Test (AAT); Melodic Intonation Therapy (MIT) tasks.</td>
<td>1. There were no significant improvements or between group differences in Sabadel, ANELT, AAT Naming, or AAT Comprehension (all p≥0.5).&lt;br&gt;2. CG group showed a significant improvement in AAT Repetition (p=0.046); however, this was no different from the EG group (p=0.61).&lt;br&gt;3. The EG group made significant improvements in the MIT task trained items (p&lt;0.01) and untrained items (p=0.03); however, only the trained items was significantly different from the CG group (p=0.02).</td>
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<td><strong>Stahl et al.</strong> (2016)</td>
<td>Intensive Language-Action Therapy group (EG; n=9): Mean age=47.8±10.2yr; Gender: Males=6, Females=3. Traditional Naming Therapy group (CG; n=9): Mean age=54.4±12yr; Gender: Males=5, Females=4.</td>
<td>Participants were randomly allocated to receive Intensive Language-Action Therapy (EG; a form of constraint-induced aphasia therapy) or traditional naming therapy (CG) 3.5hr/d for 6 consecutive days. Participants than complete the opposite therapy for another 6 consecutive days. Outcomes were assessed at baseline, post treatment 1 (T1) and post treatment 2 (T2).</td>
<td>Aachen Aphasia Test (AAT).</td>
<td>1. At T1, overall AAT scores were significantly more improved in the EG group from baseline compared to CG group (p&lt;0.05); however, between T1 and T2, the EG group showed a significantly greater improvement compared to the EG group (p&lt;0.05).&lt;br&gt;2. At T1, AAT production scores were significantly more improved in the EG group from baseline compared to CG group (p&lt;0.05); however, between T1 and T2, the CG group showed a significantly greater improvement compared to the EG group (p&lt;0.01).</td>
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<td><strong>Kurland et al.</strong> (2016)</td>
<td>Mean age=66.8yr; Gender: Males=15, Females=9.</td>
<td>Participants were randomly assigned to either the promoting aphasic communicative effectiveness (PACE) or the intensive language action therapy group for 10 treatment sessions.</td>
<td>Boston Diagnostic Aphasia</td>
<td>1. Both groups significantly improved on the Boston Aphasia Measure over time (p&lt;0.05), but were not significantly different from each other.&lt;br&gt;2. There were no significant differences in naming between groups, although both groups significantly improved over time (p&lt;0.001)</td>
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14.3.2.1 Effects of Intensity of speech and Language Therapy on Aphasia Post-Stroke

Table 14.3.2.1 Effects of Intensity of Speech and Language Therapy on Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
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<tbody>
<tr>
<td>Brindley et al. (1989)</td>
<td>UK</td>
<td>4 (ABA)</td>
<td>TPS=ch regions</td>
<td>Intervention: This study involved Broca’s aphasic patients defined by the Boston Diagnostic Aphasia Examination without predominate apraxia and who were 1yr post-stroke. Two groups of five patients each received 5hr of language therapy for 5d/wk for 12wk. Comparison was made during the intensive period of therapy with a 12wk non-intensive period pre-course and a similar 12wk non-intensive period post-stroke.</td>
<td>1. Significant improvement on FCP - details in movement, speech, reading, and overall score were noted during the intensive period. 2. There was a significant ratio of improvement on FCP between intensive period and second non-intensive period in movement, speech and overall score. 3. LARSP showed significant improvement in intensive period on sentence length increase, reduction in element omission, and increase in percentage of full utterances.</td>
</tr>
<tr>
<td>Denes et al. (1996)</td>
<td>Italy</td>
<td>RCT</td>
<td>PEDro=6</td>
<td>N=17</td>
<td>Intervention: 17 patients with global aphasia following left hemisphere stroke were randomly assigned to receive either standard treatment (n=9) or intensive treatment (n=8). Patients receiving standard treatment received an average of 60 therapy sessions over 6mos (approximately 3/wk). Intensive treatment consisted of 130 sessions over the same time period. Therapy was conducted using an “ecological” approach focusing on the restoration of language in a conversational setting.</td>
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<tr>
<td>Hinckley &amp; Craig (1998)</td>
<td>USA</td>
<td>No Score</td>
<td>TPS=NA</td>
<td>N=40</td>
<td>Intervention: In three small studies (n=15, 15, 10; total n=40), patients received a 6wk course of intensive speech/language therapy (15hr individual, 3hr group, 3hr computer lab) followed by a 6-8wk period of no therapy (study 1), &lt;3hr therapy (study 2) or 3-5 hr therapy (study 3) and a second 6wk period of intensive therapy. Assessments were conducted pre- and post-phase.</td>
</tr>
<tr>
<td>Hinckley &amp; Carr (2005)</td>
<td>USA</td>
<td>Outcomes: 13 individuals with moderately severe aphasia were assigned to receive either 20hr of</td>
<td>1. Eight patients received intensive, and five patients received non-intensive training.</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Population</td>
<td>Intervention</td>
<td>Outcomes</td>
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<tr>
<td>Bakheit et al. (2007)</td>
<td>UK RCT</td>
<td>Mean age=71.0±2.3yr; Gender: Males=38, Females=37.</td>
<td>Participants received individualized conventional speech and language therapy for 12wk. Assessments were conducted at 4wk, 8wk, 12wk and 24wk.</td>
<td>1. Significant improvements were made on the WAB from the previous assessment to the subsequent one for all time points (p&lt;0.05 for all); the largest improvement was observed from baseline to 4wk. 2. The median percentage increase in WAB scores at all assessment points was significantly different between aphasia subgroups (p&lt;0.001). 3. Broca’s aphasia participants had significantly greater median percentage increases in WAB scores when compared to global, anomic and conduction aphasia subgroups at all time points (p&lt;0.05). 4. Wernicke’s aphasia participants had</td>
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</table>

| | | individual context-based therapy + 5hr/wk of group treatment (intensive therapy) or 4hr/wk of individual, context-based therapy (non-intensive therapy). Context-based therapy included role-plays, self-generated strategies and context-specific cues. Assessments were conducted before and after intervention. | Criterion task (ordering items from a catalogue); Communicative abilities in daily living (CADL-2); Psycholinguistic assessment of language processing in aphasia (PALPA) subtests (oral and written picture naming). | 2. There were no significant between group differences reported at baseline. Both groups demonstrated significant improvement on the criterion task. There was no significant between group differences reported for the criterion task. 3. On the CADL-2, the non-intensive treatment group improved more than the intensive group (p<0.05). 4. There was no significant between group difference on the PALPA oral picture naming subtest, but the intensive group did demonstrate significantly more improvement than the non-intensive group in the written naming subtest (p<0.05). |

| Bakheit et al. (2007) | Pre-Post | 97 patients with aphasia post first-ever stroke were randomly assigned to receive either 5/wk 1hr long sessions of speech therapy (intensive therapy, n=46) or two 1hr long sessions (standard therapy, n=51). An additional 19 patients received therapy via National Health Service (NHS) therapists, but were not randomized to a treatment condition. Language function was assessed at 4wk, 8wk, 12wk and 24wk. | Western Aphasia Battery (WAB). | 1. Overall, there were no significant differences noted in performance on the WAB between standard and intensive therapies. 2. However, none of the patients assigned to the intensive therapy group received the full course of therapy – only 13/51 received 80% or more. Patients assigned to the intensive therapy group were often too ill or refused therapy during the first 4wk of the study. 3. When the subgroup of patients that received the most therapy was compared to the standard therapy group, no significant difference in WAB scores was noted at any assessment point. 4. The NHS group received the least amount of therapy (mean=6.9hr over 8.6 sessions vs. 19.3hr over 19.3 sessions). WAB scores were significantly higher in patients receiving standard therapy vs. NHS level therapy. |
significantly greater median percentage increases in WAB scores when compared to anomic and conduction aphasia subgroups at 12wk and 24wk and when compared to the global aphasia subgroup at 24wk (p<0.05 for all).

Martins et al. (2013) Portugal RCT PEDro=7 TPSExp=7.7wk TPSCon=7.5wk NStart=30 NEnd=14

**Population:** Experimental Group (EG; N=15); Mean age=58.3±12.3yr; Gender: Males=10, Females=5. Control Group (CG; N=15); Mean age=64.3±10.5yr; Gender: Males=9; Females=6.

**Intervention:** The EG received intensive speech and language therapy 2hr/d, 5/wk, for 10wk. The CG received regular speech language therapy 2hr/wk for 50wk. Assessments were conducted at baseline, 10wk, 50wk, and 62wk.

**Outcomes:** Functional Communication Profile (FCP); Western Aphasia Battery: Aphasia Quotient (AQ).

1. Per protocol and intention to treat analysis revealed no significant between group differences on any of the outcome measures between baseline and 50 or 62wk, or in the maintenance of therapeutic improvement between 50 and 62wk.
2. Intention to treat analysis of AQ scores revealed a significant improvement following treatment (p<0.001) with no significant interaction between AQ score and group.
3. Intention to treat analysis of FCP scores revealed a significant increase following treatment (p<0.001) with no significant interaction effect between FCP score and group and no significant effect of group.
4. Per protocol analysis of both groups revealed significant increases in AQ and FCP scores from baseline to re-evaluations (both p<0.001) with no EG effect (p=0.68).

Des Roches et al. (2015) Germany PCT No Score TPSExp=51.4±5mo TPSCon=98±129.7mo NStart=51 NEnd=51

**Population:** Experimental Group (EG; N=42); Mean age=63.6±10.8yr; Gender: NA. Control Group (CG; N=9); Mean age=67.1±10yr; Gender: NA.

**Intervention:** Language and cognitive tasks were assigned to both EG and CG. The therapy duration (11-11.5wk) and the number of clinical sessions (9.6-9.67) did not differ between the two groups, but the EG received additional home practice of tasks. The prescribed home practice depended on how the participant performed during clinical sessions.

**Outcomes:** Western Aphasia Battery (WAB): Aphasia Quotient (AQ), Cortical Quotient (CQ); Cognitive Linguistic Quick Test (CLQT): attention, executive function, visuospatial skills; Pyramids and Palm Trees (PAPT); Latency and accuracy of language tasks; Reading; Writing; Sentence planning; Auditory memory; Visuospatial memory; Visual processing; Analytical reasoning Arithmetic: addition, subtraction, multiplication, division; Quantitative reasoning: clock math, word problem; Executive skills: instruction sequencing.

**Task Effectiveness:**
1. Neither group showed a significant overall improvement on language and cognitive tasks in terms of latency and accuracy.
2. There were statistically significant differences between the two groups in terms of accuracy for the naming picture (CG>EG) and syllable Identification (EG>CG) domains on Naming test and word spelling on the Writing test (EG>CG) (p<0.05 for all); and in terms of latency for category matching on the Naming test (CG>EG) (p<0.05).

**Standardized Tests**
1. Significant improvements were observed in the EG on the WAB CQ subtest (p<0.05), WAB-AQ (p<0.01), Composite Severity score (p<0.01) and CLQT subtests of attention (p<0.05), executive function (p<0.01) and visuospatial skill (p<0.001).
2. The only statistically significant change that the control participants showed was an improvement on the PAPT (p<0.05).
### 14.3.2.2 Volunteer-Facilitates Speech and Language Therapy

Table 14.3.2.2 Volunteer-Facilitated Speech and Language Therapy on Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td><strong>Meikle et al.</strong> (1979)</td>
<td>UK</td>
<td>RCT</td>
<td>PEDro=4</td>
<td>TPS=acute</td>
<td>N=31</td>
</tr>
<tr>
<td><strong>David et al.</strong> (1982)</td>
<td>UK</td>
<td>RCT</td>
<td>PEDro=5</td>
<td>TPS=acute</td>
<td>N=155</td>
</tr>
<tr>
<td><strong>Wertz et al.</strong> (1986)</td>
<td>USA</td>
<td>RCT</td>
<td>PEDro=6</td>
<td>TPS=acute</td>
<td>N=121</td>
</tr>
<tr>
<td><strong>Marshall et al.</strong> (1989)</td>
<td>USA</td>
<td>RCT</td>
<td>PEDro=5</td>
<td>TPS=acute</td>
<td>N=121</td>
</tr>
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</table>
### 14.3.3 Group Therapy for Aphasia Post-Stroke

#### Table 14.3.3 Efficacy of Group Language Therapy on Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td><strong>Wertz et al.</strong> (1981) USA</td>
<td>RCT</td>
<td>PEDro=6</td>
<td>TPS=acute N=67</td>
<td><strong>Intervention:</strong> 67 male aphasic stroke patients with a stroke (left hemisphere and no worse than 20/100 vision in better eye, 4wk post onset and entry scores from the 15th to the 75th percentile on the Porch Index of Communicative Ability (PICA)) were randomly assigned to either group A or group B. Patients in group A received 4hr/wk of individual treatment with a therapist in traditional stimulus response type treatment. Patients in group B received group treatment designed to facilitate language use in a social setting. <strong>Outcomes:</strong> PICA.</td>
</tr>
<tr>
<td><strong>Aten et al.</strong> (1982) USA</td>
<td>No Score</td>
<td>TPS=NA N=7</td>
<td><strong>Intervention:</strong> Seven male patients received functional communication intervention consisting of group therapy in 1hr sessions 2/wk for 12wk. Topics included shopping, giving &amp; following directions, social greetings and exchanges, supplying personal information, reading signs and directories and gestural responding. <strong>Outcomes:</strong> Porch Index of Communicative Ability (PICA); Communicative Abilities of Daily Living (CADL).</td>
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<tr>
<td><strong>Bollinger et al.</strong> (1993) USA</td>
<td>No Score</td>
<td>TPS=chronic N=14</td>
<td><strong>Intervention:</strong> 14 patients at least 18mos since stroke onset and presenting with aphasia received Contemporary Group Treatment (CGT) involving a group interactive process with encouragement of multimodal stimulation and communication and Structured Television Viewing Group Treatment (STVGT). Patients were divided into two groups based on the Communicative Abilities of Daily Living results (CADL) (high vs. low) to ensure adequate communication proficiency within groups. Group therapy consisted of 1hr sessions, 3x/wk for 10wk, followed by 10wk of STVGT followed by a 10wk withdrawal period. After the withdrawal period, 10wk of STVGT was re-initiated followed by 10wk of CGT and concluded with another 10wk withdrawal period. <strong>Outcomes:</strong> Porch Index of Communicative Abilities (PICA); CADL; Auditory Comprehension for Sentences (ACS).</td>
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<td>1. Group A patients performed significantly better on the graphics sub-test of the PICA.</td>
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<td></td>
<td>1. Scores on the PICA did not differ significantly pre to post intervention.</td>
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<td>2. However, scores on the CADL scale were significantly improved (p&lt;0.01).</td>
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<td>1. 10 patients completed the study protocol. There were statistically significantly increases on the PICA and CADL after the first block of treatments with retention of skills during withdrawal.</td>
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<td>2. A significant increase in PICA scores was noted during the second block of treatments and withdrawal.</td>
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<td>3. There was no change in the ACS.</td>
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<tr>
<td>Reference</td>
<td>Location</td>
<td>Study Design</td>
<td>PEDro</td>
<td>TPS</td>
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<tr>
<td>Marshall et al. (1993)</td>
<td>USA</td>
<td>No Score</td>
<td>TPS=NA</td>
<td>N=25</td>
</tr>
<tr>
<td>Brumfitt &amp; Sheeran (1997)</td>
<td>UK</td>
<td>No Score</td>
<td>TPS=NA</td>
<td>N=6</td>
</tr>
<tr>
<td>Elman &amp; Berstein-Ellis (1999)</td>
<td>USA</td>
<td>RCT</td>
<td>PEDro=4</td>
<td>TPS=chronic</td>
</tr>
<tr>
<td>Hoover et al. (2014)</td>
<td>USA</td>
<td>Cross-over RCT</td>
<td>PEDro=6</td>
<td>TPS=mean=8.8yr</td>
</tr>
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</table>
Aphasia and Apraxia

14.3.4 Community-Based Treatment Programs

Table 14.3.4 Community-based Aphasia Programs

<table>
<thead>
<tr>
<th>Author, Year Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td><strong>Hoen et al.</strong> (1997) Canada No Score TPS=NA N=47</td>
<td></td>
<td></td>
<td>Intervention: Evaluation of the York-Durham Aphasia Centre’s community-based programme. Psychological well-being was evaluated for 35 patients and 12 family members.</td>
<td>1. Patients were observed to show positive significant change on five of six measures of well-being: self-acceptance, purpose of life, personal growth, autonomy and environmental mastery. 2. Family members showed significant positive changes on five of six measures as well: personal growth, positive relations with others, purpose of life, self-acceptance.</td>
</tr>
<tr>
<td><strong>Aftonomos et al.</strong> (1999) USA No Score TPS=NA N=60</td>
<td></td>
<td></td>
<td>Intervention: 60 patients with aphasia enrolled in two community-based, comparably managed and equipped therapy programs. The program incorporated specially designed computer-based tolls before and after treatment at the impairment (speech-language test performance) and disability levels (functional communication).</td>
<td>1. Patients’ mean performance scores improved significantly in response to treatment on the WAB and the CETI. 2. No significant difference between improvements in patients in acute versus chronic stage aphasia, between different impairment severity levels, different locations, at the level of function or of different diagnostic types.</td>
</tr>
<tr>
<td><strong>Worrall &amp; Yiu</strong> (2000) USA RCT PEDro=5 TPS=NA N=14</td>
<td></td>
<td></td>
<td>Intervention: 14 aphasic patients were randomly assigned to participate in either recreational activities or the Speaking Out program. The Speaking Out intervention consisted of 10 scripted modules addressing issues in everyday functional communication. Subjects participated in both conditions in a crossover design. Each 10wk intervention phase was separated from the next by a 10wk withdrawal phase. Group A participated in the Speaking Out Program first (1-2hr/wk for 10wk), then</td>
<td>1. There was a significant difference for both groups before and after the Speaking Out intervention on the WAB (group A p=0.046; group B p=0.036). 2. For group A, there was a significant difference in general health perception assessed on the SF36 before and after participation in Speaking Out (p=0.028). 3. For Group B, there was a significant difference in scores on the ASHA-FACS</td>
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withdrawal followed by recreational activities (crafts, cards & games). Group B participated in recreational activities first, then withdrawal and then the Speaking Out Program. Both recreational activities and the Speaking Out Program were conducted in the home by trained volunteers.

**Outcomes:** Western Aphasia Battery (WAB); Short Form (36) Health Survey (SF36); American Speech-Language-Hearing Association Functional Assessment of Communication Skills (ASHA-FACS).

4. When scores were analyzed to compare the Speaking Out intervention with just recreational activities, no significant between group differences were noted.

<table>
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<tr>
<th>Author, Year Country PEDro Score TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Lyon et al. (1997) USA No Score</td>
<td><strong>Intervention:</strong> 10 treatment triads (patient, caregiver and communication partner) enrolled over a 3yr period. Two thirds of triads were assigned to begin</td>
<td>1. No pre-post differences reached significance for scores on the BDAE, CADL or ABS measures. Patients in the deferred</td>
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treatment immediately; one third had treatment deferred for 2mos. Treatment consisted of two phases lasting for 5.5mos. Phase 1 consisted of 1-1.5hr sessions 2/wk for 6wk during which the volunteer learned specific strategies to promote communication together with the aphasic patient in his/her triad. Phase 2 consisted of 2/wk sessions. Session one was a review of the previous week’s activity and planning for the next session. Session two consisted of activities/tasks of interest chosen by the aphasic individual and planned out by the patient, communication partner and clinician. Independent, subjective ratings of outcome were made by speech-language clinicians familiar with the patients.  
**Outcomes:** Boston Diagnostic Aphasia Examination (BDAE); Communication Activities in Daily Living (CADL) scale; Affect Balance Scale (well-being) (ABS); Communication Readiness and Use Index (CRUI); Psychosocial Well-being Index (PWI).

Wilkinson et al.  
(1998)  
UK  
No Score  
TPS=NA  
N=2  

- **Intervention:** In this study, an aphasic woman and her husband were asked to videotape themselves during peak conversation times at home for 1wk. The camera was then returned to the speech language therapist (SLT) who transcribed and analyzed their conversations verbally and nonverbally to determine which aspects of conversation the couple may wish to change. Therapy (termed ‘interaction therapy’) consisted of 3 stages: observation, where the couple and the SLT watch the video together; discussion, where they discuss how they feel about certain patterns of conversation; and suggestions for change, where the SLT highlights the problem areas and suggests ways to improve the flow of conversation. After four, 2hr therapy sessions, the couple was asked to videotape themselves once again and the conversations were transcribed and analyzed to assess improvement.  
**Outcomes:** SLT analysis.

1. In the post-therapy assessment of conversation, the couple did not display the same ‘other-repair’ pattern that was causing disturbance in the prior assessment.  
2. Further research into this therapeutic approach is suggested.  
3. It is emphasized that language therapy must not neglect functional and psychosocial issues if it is to bring about meaningful change for aphasics and their conversational partners.

Booth & Swabey  
(1999)  
UK  
No Score  
TPS=chronic  
N=4  

- **Intervention:** Four individuals with aphasia at least 6mos post-stroke and an adult relative living with them participated in a communication skills program based on Conversation Analysis. A conversational analysis profile for people with aphasia (CAPPA) was created via a structured interview with carers to determine the carer’s perception of the patient’s language abilities and conversation as well as analysis of a 10min conversation between carers and patients with aphasia. The interview and conversation analysis were compared to derive a summary profile. After  
1. Carers’ perception of communication more closely matched results of conversation analysis following the communication skills intervention.  
2. Increased awareness, however, was not necessarily indicative of how well carers were able to manage communication problems arising during conversation.  
3. While there was a decrease in the rating of severity of problems following intervention, it was not significant.  
4. Carers expressed increasing distress with
this initial assessment, carers participated in a weekly communication skills group for a total of 6wk. The group program consisted of lectures, discussions, workshops as well as personalized information and management strategies based on the conversation analysis. The CAPPA was repeated following the intervention. 

**Outcomes:** CAPPA.

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<tr>
<th>Reference</th>
<th>Country</th>
<th>Study Design</th>
<th>PEDro</th>
<th>TPS</th>
<th>N</th>
<th>Intervention</th>
<th>Outcomes 1</th>
<th>Outcomes 2</th>
<th>Outcomes 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kagan et al. (2001)</td>
<td>Canada &amp; USA</td>
<td>RCT</td>
<td>6</td>
<td>NA</td>
<td>40</td>
<td>Study included 40 stroke patients with moderate-to-severe aphasia and volunteers at an aphasia centre. Volunteers were randomly assigned to either receive a workshop training session designed to teach them how to acknowledge and reveal the competence of adults with aphasia through supported conversation (SCA) or were assigned to be exposed to aphasia by watching a video that told stories of patients with aphasia and their families. They were also given opportunity to interact with aphasia patients. Patients were randomly assigned to volunteers. <strong>Outcomes:</strong> Ratings of acknowledging competence and revealing competence of their aphasic partners.</td>
<td>1. SCA trained volunteers scored higher than controls on rating of acknowledging competence and revealing competence of their aphasic partners.</td>
<td>2. Patients assigned to trained volunteers scored higher on social and message exchange skills than did patients assigned to control volunteers.</td>
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<tr>
<td>Hopper et al. (2002)</td>
<td>USA</td>
<td>No Score</td>
<td>Chronic</td>
<td>2</td>
<td>Intervention: Two patients with chronic aphasia post-stroke participated together with their spouses. Each couple participated in a baseline instruction session in which the aphasic partner’s ability to convey a story to the non-aphasic partner was assessed and used to generate personalized communication strategies. Specific strategies offered by therapists were chosen by the couples. Each couple then participated in 10 treatment sessions in which the aphasic individual watched a videotaped story and then attempted to convey it to the non-aphasic partner. A clinician was present and intervened in the process to provide information about how to use effective strategies in the event of communication breakdown or miscommunication (conversational coaching). Pre and post treatment probes were conducted. <strong>Outcomes:</strong> Number of main story concepts communicated successfully; Communicative Activities of Daily Living (CADL-2).</td>
<td>1. A trend toward improvement was identified in the number of main story concepts conveyed when baseline scores were compared to post-treatment scores.</td>
<td>2. One aphasic individual demonstrated improvement on CADL-2 scores while the other did not.</td>
<td>3. Naïve observers reported greater understanding of the conversation between both couples after treatment than at baseline.</td>
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<tr>
<td>Cunningham &amp; Ward (2003)</td>
<td>UK</td>
<td>No Score</td>
<td>NA</td>
<td>4</td>
<td>Intervention: Four individuals with aphasia post stroke and their spouses participated in a training program intended to improve conversation. Couples and researchers determined topics of conversation to be used in the study. Baseline evaluation consisted of three sessions (one week apart) in which conversations between patients and spouses</td>
<td>1. Conversational analysis revealed that post-intervention, three of four couples demonstrated an increase in successful conversational repairs. In addition, the number of trouble sources initiated by the aphasic partners decreased following intervention for three of four couples.</td>
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were videotaped and analysed via conversational analysis. The frequency and type of nonverbal communication was also recorded. Intervention consisted of five sessions (1.5hr for 5wk). Sessions one and two were educational/informative, session three included instruction/feedback based on the video recordings taken during baseline, sessions four and five included active roleplaying and practise of supported conversations. All assessments were conducted pre and post intervention. **Outcomes:** Conversational analysis; Visual Assessment of Self-Esteem Scale (VASES); Hospital Anxiety and Depression Scale (HADS).

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<tr>
<td><strong>Intervention:</strong> A training course, based on supported conversation (Kagan et al. 2001), was delivered to six volunteers at a social club for individuals with aphasia. Participants with aphasia were recruited from the same group. All aphasic participants had stable language functioning and were at least 1yr post-stroke. Training consisted of three, 3hr morning sessions. Session one consisted of education/information regarding theories of conversation and aphasia, session two focused on the Aphasia Centre Instructional Video and discussion of alternative means of communicating and session three consisted of clarification, review and the opportunity to practise new strategies. The course was evaluated by assessing videotaped conversations between aphasic individuals and trained volunteers. Tapes were evaluated using Kagan’s rating scales (Kagan et al. 2001). Two questionnaires were administered to volunteers before and after training to assess knowledge of aphasia and knowledge of communication strategies. <strong>Outcomes:</strong> Kagan’s rating scales; Volunteer questionnaires.</td>
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<tr>
<td><strong>Intervention:</strong> Five individuals with aphasia and their spouses participated in a communication training programme based on principles of conversation partner training and learner-centred adult education. The program was developed based on the experience, needs, learning styles and rhythms of the participants. Assessments were conducted pre and post intervention as well as 2mo follow-up. Verbal and nonverbal communication behaviours were transcribed from the videos and analysed qualitatively. <strong>Outcomes:</strong> Videotaped conversations between the couples; Couple Questionnaire (spouses’ attitudes toward partners and couple’s ability to</td>
</tr>
</tbody>
</table>
**Fox and Armstrong** (2009)  
Australia  
Case Study  
No Score  
TPSPWA=1yr  
NStart=1  
NEnd=1  

| Population: Person with Aphasia (PWA): Age=78r; Gender: Male=0, Female=1.  
**Intervention:** A dyad containing one PWA and one conversation partner (CP) received conversational treatment for 1hr/d, 2d/wk for 7wk. Conversational therapy consisted of engaging in 3min conversations within the dyad followed by self-reflection and clinician feedback. The dyad also completed home conversational therapy sessions for 15min/d.  
**Outcomes:** Dyad’s satisfaction with self-selected elements of conversation; Measure of Skill in Supported Conversation (MSC): ability to acknowledge and reveal competence of the PWA; Measure of Participation in Conversation (MPC): interaction and transaction of the PWA; Goal behaviours of the PWA: topic initiations, metalinguistic comments to indicate trouble, use of questions, speech rate; Goal behaviours of the CP: use of probe questions to resolve breakdowns, percentage of the PWA’s turns interrupted by the CP, duration of repair sequences; Number of contributed words. |  
| 1. In terms of satisfaction with self-selected elements of conversation, the PWA showed greater improvement compared to the CP post-intervention; the PWA’s greatest improvements were in the length and frequency of conversations and opinion-giving and debating; the CP’s greatest changes were in the length of conversations and enjoyment with conversations.  
2. MSC improved post-intervention in terms of both acknowledging competence and revealing competence of the PWA.  
3. MPC improved post-intervention in terms of both interaction and transaction of the PWA.  
4. Analysis of the change in goal behaviours of the PWA from pre-therapy to 1wk post-intervention showed an increase in all behaviours except for a decrease in the rate of speech; a decrease in all behaviours was observed from 1wk post-intervention to 1mo post-intervention except for in the rate of speech which increased to a level above pre-therapy.  
5. Analysis of the change in goal behaviours of the CP from pre-therapy to 1wk post-intervention showed a decrease in all behaviours except for an increase in the percentage of the PWA’s turns interrupted by the CP; an increase in all behaviours was observed from 1wk post-intervention to 1mo post-intervention except for in the percentage of the PWA’s turns interrupted by the CP which decreased to a level below pre-therapy.  
6. The PWA contributed more words at baseline while the CP contributed more words at 1wk post-intervention and 1mo post-intervention; an overall increase was seen in the words contributed by the CP compared to baseline and an overall decrease was seen in the PWA compared to baseline. |  

**Beeke et al.** (2011)  
UK  
Case Study  
No Score  
TPSPWA<3yr  
NStart=1  

| Population: Person with Aphasia (PWA): Age=Late 30s; Gender: Male=1, Females=0.  
**Intervention:** Conversations between the PWA and their conversation partner (CP) were recorded 8x pre-therapy, 2x during therapy and 8x following therapy. The therapy was administered for 1.5hr/d, 1.5hr/wk for 1yr.  
|  
| 1. Turns appear to be longer and more complete in the PWA post-therapy.  
2. The PWA showed a greater tendency to produce a sequence of turns relating to a topic post-therapy.  
3. Behaviour indicators of word searching by |
<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armstrong et al. (2013) Australia Case Study No Score TPS=1yr NStart=1 NEnd=1</td>
<td><strong>Population:</strong> Person with Aphasia (PWA): Age=78yr; Gender: Male=0, Female=1. <strong>Intervention:</strong> A dyad containing one PWA and one conversation partner (CP) received conversational treatment for 1hr/d, 2d/wk for 7wk. Conversational therapy consisted of 3min conversations within the dyad followed by self-reflection and clinician feedback. The dyad also completed home conversational therapy sessions for 15min/d. <strong>Outcomes:</strong> Qualitative analysis of the PWA's conversational ability: ability to construct a turn of conversation and completeness of conversation.</td>
<td>1. The PWA made 293 total semantic moves while the CP made 290. 2. The PWA and CP both used more sustaining moves compared to opening moves post-intervention. 3. The PWA made fewer continuing moves than the CP post-intervention. 4. The CP made more independent evaluative moves than the PWA but less co-constructed evaluative moves than the PWA post-intervention. 5. The PWA and CP both used an equal proportion of supporting and confronting moves post-intervention. 6. The CP initiated repair frequently following therapy by either overlapping the PWA or using a pause in the PWA's conversation to initiate repair.</td>
<td></td>
</tr>
<tr>
<td>Beckley et al. (2013) UK Case Study No Score TPS=1yr NStart=1 NEnd=1</td>
<td><strong>Population:</strong> Person with Aphasia (PWA): Age=55yr; Gender: Male=1, Females=0. <strong>Intervention:</strong> Conversations between the PWA and their conversation partner (CP) were recorded 8x pre-therapy, 2x during therapy and 8x following therapy. The therapy was administered for 1.5hr/d, 1d/wk for 8wk and involved discussions with a partner, video feedback of recorded conversations and practice of conversational strategies with feedback from a speech language pathologist. Clips of conversation barriers, facilitators and problematic exchanges observed during the pre-treatment period were also integrated into the therapy. <strong>Outcomes:</strong> Discourse semantics: opening and sustaining semantic moves; Number of independent and co-constructed moves containing an evaluation; Number of supporting and confronting moves; Conversation analysis: overlap and repair.</td>
<td>1. An increase in the use of writing and drawing strategies when the conversation broke down was observed post-therapy. 2. The episodes of frustration the PWA experienced towards the CP decreased post-therapy. 3. According to the CAPPA assessment measured at baseline and post-therapy, linguistic skill impairment decreased from 86% to 73.5%, linguistic skill level of perceived problem decreased from 71% to 49%, repair showed no change in impairment and problem ratings, initiation and turn taking impairment rating increased from 25% to 38.5%, initiation and turn taking problem rating remained at 25%, topic impairment rating increased from 37.5% to 66% and topic problem rating increased from 50% to 59.5%.</td>
<td></td>
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</table>
| Johansson et al. (2013) Sweden Case Series       | **Population:** Person with Aphasia (PWA): Mean Age=75.0yr; Gender: Male=1, Female=2. **Intervention:** Six weekly sessions of 45min were administered to three dyads of a conversation | 1. On the evaluation questionnaire following therapy, all participants reported an increase in their knowledge and understanding of aphasia and an
partner (CP) and a person with aphasia (PWA) where three sessions involved only the CP and the speech language pathologist (SLP) and three sessions involved the dyads and the SLP. The CP was trained to support conversation of the PWA by acknowledging and revealing competence. The CP also received emotional support and information on aphasia, stroke and communication.

**Outcomes:** Qualitative analysis of initial video recordings of conversations within the dyad; Support in conversation (SiK): ability to acknowledge competence and ability to reveal competence; Participation in conversation (PiK): interaction and transaction; Understanding of aphasia and communication self-assessment questionnaire (UAK); Estimation of conversational skills self-assessment questionnaire (SAS); Evaluation questionnaire CP; Evaluation questionnaire PWA.

1. Improvement in conversational ability; all participants reported an appreciation for the interventions and would recommend it to other PWAs and CPs; all CPs reported that they felt supported and helped during the intervention and valued the one on one CP and SLP sessions with no negative feelings concerning the one on one CP and SLP sessions.

2. Analysis of the SiK assessment from baseline to post-intervention revealed that two CPs had a decrease in their ability to acknowledge competence of the PWA and an overall decrease in SiK scores, one CP had an increase in their ability to acknowledge competence of the PWA and an overall increase in SiK scores and two CPs showed an increase in their ability to reveal competence of the PWA while one showed no change.

3. Analysis of SAS scores from baseline to post-intervention showed an increase in one CP, a decrease in one CP and no overall change in the remaining CP.

4. Analysis of PiK scores from baseline to post-intervention showed an increase in both the interaction and transaction domains in two CPs while the remaining CP had a slight increase in interaction scores, a decrease in transaction scores and a slight decrease in the overall PiK score.

**Population:** Person with Severe Aphasia (PWSA; N=34): Mean age=63.3±8.2yr; Gender: Males=30, Females=4. Conversation Partner (CP; N=34): Mean age=61.2±7.5yr; Gender: Males=4, Females=30.

**Intervention:** Both the PWSA and their CP received therapy as part of a functional communication program. The program involved practicing functional communication strategies in three conversational tasks. The program followed two 14d intensive rehabilitation periods at 6mo intervals, and a follow-up visit to the pair 6mo after the end of the second rehabilitation period.

**Outcomes:** Communication Effectiveness Index (CETI); Western Aphasia Battery (WAB): object naming, Aphasia Quotient (AQ), sequential commands, auditory word recognition, yes/no answers; Couple Communication Scale (CCS); Communication Skills Evaluation (CSE); Satisfaction with training programme.

1. PWSAs showed significant improvements in the WAB AQ and object naming subtests between baseline and the end of the second rehabilitation period (p<0.01; p=0.013); no other significant changes were observed on the WAB.

2. PWSAs showed significant improvement on the CSE from baseline to the end of the first rehabilitation period as well as from the end of the first rehabilitation period to the end of the second (p<0.001 for both); no change in CSE was noted in PWSAs from the end of the second rehabilitation period to the 6mo follow-up.

3. CPs also showed significant improvements in the CSE between baseline and the end of the first rehabilitation period (p<0.001), as well as from the end of the first rehabilitation period to the end of the second (p<0.001).

4. CETI scores improved significantly between
1. All three PWAs and two of the CPs reported a slight improvement in perceived functional communication.

2. There was a non-systemic variation in all three dyads for measures of word fluency and comprehension in the PWA.

3. Results from the GDS showed that two of the PWAs (dyads 2 and 3) and one of the CPs (dyad 2) were likely suffering from depression during the course of the study.

4. Psychological well-being was rated as better by five of the six participants after the intervention and at 12wk follow-up compared to before the intervention.

5. COAST and Carer-COAST scores at post-intervention compared to baseline showed that communication was rated higher in three participants while three participants rated it as lower to slightly lower.

6. COAST and Carer-COAST scores at 12wk follow-up compared to baseline showed that communication was rated higher in five participants while one participant that rated communication lower post-intervention also rated it lower at follow-up.

14. Aphasia and Apraxia

**Population:** Person With Aphasia (PWA; N=3): Mean age=60.3±14.1yr; Gender: Males=1, Females=2.

**Intervention:** Conversation Partner Training programme in Supporting Partners of People with Aphasia in Relationships and Conversations was offered to participants in a group setting for six sessions, 1.5hr/wk for 6wk. The training consisted of informing participants about communication with aphasia and discussing video-recorded examples of communication problems.

**Outcomes:** Communication Outcome after Stroke Scale (COAST); Carer Communication Outcome after Stroke Scale (Carer-COAST); Geriatric Depression Scale (GDS); Communicative interaction: comprehension, word fluency, and psychological well-being.

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**Saldert et al. (2013)**

Sweden

Case Series

Population: Person With Aphasia (PWA; N=3): Mean age=60.3±14.1yr; Gender: Males=1, Females=2.

Intervention: A Swedish adaptation of the Conversation Partner Training programme in Supporting Partners of People with Aphasia in Relationships and Conversations was offered to participants in a group setting for six sessions, 1.5hr/wk for 6wk. The training consisted of informing participants about communication with aphasia and discussing video-recorded examples of communication problems.

Outcomes: Communication Outcome after Stroke Scale (COAST); Carer Communication Outcome after Stroke Scale (Carer-COAST); Geriatric Depression Scale (GDS); Communicative interaction: comprehension, word fluency, and psychological well-being.

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**Beeke et al. (2015)**

UK

Case Series

Population: Person with Aphasia (PWA): Mean age=60yr; Gender: Male=2, Females=0.

Intervention: Conversations between the PWA and
their conversation partner (CP) were recorded 8x pre-therapy, 2x during therapy and 8x following therapy. The therapy was administered for 1.5hr/d, 1d/wk for 8wk and involved discussions with a partner, video feedback of recorded conversations and practice of conversational strategies with feedback from a speech language pathologist. Clips of conversation barriers, facilitators and problematic exchanges observed during the pre-treatment period were also integrated into the therapy.

Outcomes: Quantitative analysis of the instances of conversational facilitators and barriers selected by the dyads to work on.

1. PWA 1 showed no significant increases from baseline to post-intervention in the self-selected conversational facilitators of writing, gesture use and keyword use.
2. PWA 2 showed no significant increases from baseline to post-intervention in the self-selected conversational facilitators of writing, gesture use and keyword use.
3. The CP of PWA 1 showed no significant increases following therapy in the self-selected conversational facilitators “let the conversation continue”, “carry on if you have understood” and “comment”.
4. The CP of PWA 1 showed significant decreases following therapy in the self-selected conversational barrier of asking test questions (p<0.0001).
5. The CP of PWA 2 showed no significant increases following therapy in the self-selected conversational facilitators “let the conversation continue”, “carry on if you have understood” and “paraphrase”.
6. The CP of PWA 2 showed significant decreases following therapy in the self-selected conversational barrier of asking test questions (p<0.0001).

McMenamin et al. (2015) Ireland Case Series

Population: Mean age=73.2±10.5yr; Gender: Males=4, Females=1.

Intervention: Participants who had experience with a Conversation Partner Programme (CPP) took part in three, 1hr data generation sessions across 12mo using the Participatory Learning and Action (PLA) technique where the participant’s perspective of aphasia and the CPP were recorded.

Outcomes: Themes describing experience with aphasia.

1. The group experienced a high number of communication challenges and the need to re-learn everything from a very basic level.
2. There was a shared belief that their level of tiredness was directly connected to communication effort.
3. The experience of not being able to converse and live life in the same way as before aphasia created a shared sense of being in a prison.
4. Not being able to complete normal activities resulted in feelings of weariness and annoyance.
5. The group shared the frustration of word-finding difficulties and communication breakdown.
6. The noise level, cross-talking, and feelings of exclusion created a common desire to escape or avoid group situations.
7. The group felt that living with aphasia necessitated new ways of coping with normal tasks.
8. The group felt that they received more support from family than from friends.
9. The group varied in their preference of location to meet their conversational partner and found that conversations during the CPP were mostly enjoyable and
10. As CPP progressed participants grew in confidence regarding their ability/familiarity of conversing with their partners.
11. The participants felt the opportunity to help others through the CPP had improved their expectations of the CPP.

### 14.3.6 Patient and Caregiver Education

#### Table 14.3.6 Caregiver/Patient Education Programs

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinckley et al. (1995)</td>
<td>USA</td>
<td>No Score</td>
<td>TPS=NA</td>
<td>N=NA</td>
<td>Intervention: Adults with aphasia and their families/caregivers participated in a brief education program presented in a 2d conference format. Goals of the conference were to increase productivity, to learn about aphasia, to increase knowledge about therapy options and home practice and to learn coping skills and deal with psychological issues. Participants completed a Community Integration Questionnaire (CIQ) at the time of the seminar and then again at 6 month follow-up. <strong>Outcomes:</strong> Knowledge and skills for living with aphasia; CIQ.</td>
</tr>
<tr>
<td>Hinckley &amp; Packard (2001)</td>
<td>USA</td>
<td>No Score</td>
<td>TPS=NA</td>
<td>N=36</td>
<td>Intervention: Subjects in the participant group (n=21) were recruited from aphasic individuals and their caregivers who attended a 2d educational seminar about living with aphasia. A comparison group (n=15) was recruited from the seminar mailing list and was comprised of interested aphasic individuals and their caregivers who did not attend the seminar. This study is based on the same seminar format as the above study (Hinckley et al. 1995) but also includes a comparison group and assessment of additional outcomes. <strong>Outcomes:</strong> Knowledge of living with aphasia; Community Integration Questionnaire (CIQ); Frenchay Activities Index (FAI); McMaster Family Assessment Device (MFAD).</td>
</tr>
<tr>
<td>Draper et al. (2007)</td>
<td>Australia</td>
<td>RCT</td>
<td>PEDro=4</td>
<td>TPS=NA</td>
<td>N=39</td>
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<tr>
<td></td>
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<td></td>
<td>1. 6mo outcomes demonstrated that attendance was associated with improvements in aphasia knowledge, independence in the home and increased communication with family members.</td>
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<td>2. The majority of participants had located useful community resources within 6mo of attendance.</td>
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<td>3. There was significant improvement in community integration scores noted at 6mo follow-up.</td>
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<td></td>
<td></td>
<td>1. At 6mo follow-up, participating caregivers and aphasic individuals rated their level of knowledge higher than those individuals who did not participate (p&lt;0.05).</td>
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<td>2. There was no difference between pre and post seminar assessments on any of the measures for the non-participant group.</td>
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<td>3. The participant group’s scores on the CIQ did not change from pre to post seminar assessments, however, significant changes were noted on the MFAD and FAI (both p&lt;0.05).</td>
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<td>1. The treatment group demonstrated significant improvement in GHQ scores over the period of the intervention (p=0.006) whereas the waiting list group demonstrated no improvement.</td>
</tr>
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<td>2. There were no other significant within group changes reported at either the end of intervention or at the end of the 3mo follow-up period.</td>
</tr>
</tbody>
</table>
### Outcomes
- General Health Questionnaire (GHQ);
- Relatives’ Stress Scale;
- Use and effectiveness of eight functional communication strategies.

3. Improvements demonstrated on the GHQ for patients in the treatment group were not sustained at 3mo.
4. Between-group comparisons were not reported.

#### 14.3.7 Computer-Based Treatment in Aphasia

**Table 14.3.7 Computer-Based Treatments in Aphasia Post-Stroke**

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruce &amp; Howard (1987)</td>
<td>UK</td>
<td>No Score</td>
<td>TPS=chronic</td>
<td>N=5</td>
<td><strong>Intervention:</strong> This study involved five participants of a previous study that exhibited word-finding difficulties but could repeat single words, had Broca’s aphasia and were more than 6mos post-stroke. Patients were trained to use computer generated phonemic cues to assist with word retrieval. Two sets of pictures were presented. On each occasion the subject could use the aid with one of the two sets.</td>
</tr>
<tr>
<td>Petheram (1996)</td>
<td>UK</td>
<td>No Score</td>
<td>TPS=acute/chronic</td>
<td>N=10</td>
<td><strong>Intervention:</strong> 10 patients at least 5mos since single left stroke with Functional Communication Profile (FCP) score of 42-89 received a computer for their home. A speech language pathologist provided initial instruction and demonstration of computer-based tasks. Patients worked on their own on each computer task: 10 exercises or 20 questions with three levels based on a psycholinguistic approach. If patients answered five consecutive questions correctly, the material was advanced to a higher level. If three of the five answers were incorrect, the level of difficulty was lowered. Duration of treatment was 3wk.</td>
</tr>
<tr>
<td>Katz &amp; Wertz (1997)</td>
<td>USA</td>
<td>RCT</td>
<td>PEDro=5</td>
<td>TPS=chronic</td>
<td>N=55</td>
</tr>
<tr>
<td>Aftonomos et al.</td>
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</tbody>
</table>

1. Significant differences between the aid and control conditions in word retrieval was noted in four out of the five patients.
2. Willingness of patients to make unsupervised use of microcomputers was confirmed: 9 of 10 patients made some use and 6 of 10 used it for an average of 2hr or more per week.
3. Response time significantly decreased at the end of treatment compared to the beginning of treatment.
4. Post-FCP scores significantly improved.

1. The computer reading group did better on PICA “overall” and “verbal” sections and on the WAB AQ and repetition subtests than the other 2 groups.
2. The computer stimulation group improved only on the overall PICA score.
3. Computerized reading therapy demonstrated generalization to non-computer, non-written language.

1. Patients improved approximately 10
### Aphasia and Apraxia

#### (1997)
**USA**  
No Score  
TPS= chronic  
**N=23**

- Patients who had previously been treated with traditional methods 6mos to 15yr post onset.
- Assessed aphasic patients’ response to resumption of therapy using computer-based treatment. All subjects had 1hr clinical sessions by speech therapist using designated computer based system, Lingraphica. The Lingraphica system allows patients to build messages via a string of selected pictures, which may be read or reproduced digitally as speech. Mean length of therapy was 16.2wk.

**Outcomes:** Porch Index of Communicative Ability (PICA); Boston Naming Test (BNT); Western Aphasia Battery (WAB); Boston Diagnostic Aphasia Examination (BDAE).

1. Significant improvements were demonstrated on all subtests of the WAB (p≤0.0006).
2. The remaining 20 patients improved significantly from pre to post-treatment on the BNT (p=0.005).
3. Changes in the BNT were reported for most patients regardless of length of time between onset of aphasia and commencement of therapy.
4. Similar improvements were reported for performance on subtests of the WAB and BDAE.

#### Aftonomos et al. (1999)
**USA**  
No Score  
TPS=NA  
**N=60**

- Intervention: 60 aphasic patients with an assignment of 1 to 8 diagnostic categories through administration of WAB and who had completed at least 1mo in the community-based program were involved. Patients were enrolled in two community-based programs, which use a computer-based tool, (the Lingraphica System – see Aftonomos et al. 1997) as part of an extensive, detailed formal patient care system. Treatment consisted of 1hr sessions. Patients were also expected to complete prescribed activities at home. Mean number of sessions per patient was 41.7. The mean duration of treatment was 20.5wk.

**Outcomes:** Western Aphasia Battery (WAB); Communicative Effectiveness Index (CETI).

1. Significant improvements were demonstrated on all subtests of the WAB (p<0.0001). Ratings on the CETI were obtained from individuals close to the subject (spouse, adjust child, sibling, etc).

#### Doesborgh et al. (2004)
**Netherlands**  
**RCT**  
**PEDro=6**  
TPS=NA  
**N=18**

- Intervention: 18 people with aphasia post-stroke and who had received intensive impairment-based interventions for aphasia were randomly assigned to receive either 10-11hr therapy with Multicue (n=8) or no treatment. Multicue is a computer program for the improvement of word finding based on cueing therapy. Sessions lasted 30-45min and were conducted 2-3/wk for approximately 2mos. While patients were treated via the Multicue program, apart from assigned language therapy and group psychosocial therapy, no other interventions were given. Participation in the “no treatment” condition continued for 6-8wk.

**Outcomes:** Boston Naming Test (BNT); Amsterdam-Nijmegan Everyday Language Test (ANELT-A).

1. Mean improvement on the BNT and the ANELT-A did not differ between groups.
2. However, subjects who received treatment with Multicue improved their scores on the BNT significantly (p=0.02). Scores on the BNT did not improve for participants allocated to the control condition.
3. Improvement on the BNT did not generalise to improvement in everyday verbal communication as assessed by the ANELT-A.

#### Cherney (2008)
**USA**  
No Score  
TPS=chronic  
**N=3**

- Intervention: AphasiaScripts is software package developed to function as a “virtual therapist”. Scripts are recorded as per patient needs – the patient listens to these scripts and then may participate in word, sentence and conversation practice. Three individuals with chronic aphasia participated in a computer script training program (AphasiaScripts) for 15wk. Individualized scripts

1. Positive changes in content, grammatical productivity and rate of production were reportedly associated with training.
2. Two thirds of participants demonstrated more than a 5 point improvement on the WAB, but no changes in functional communication were noted.
3. Only one participant demonstrated...
were developed for each participant over the course of the first 5wk (1hr sessions, 1/wk). For weeks 6-15, scripts were practiced independently in the home (≥30 min/d). Weekly meetings were held to assess progress and monitor compliance. Standardized testing was conducted before and after 9wk of training.

**Outcomes**: Western Aphasia Battery (WAB); Communicative Activities of Daily Living (CADL-2); Quality of Communication Life Scale (QCLS).

| Fridriksson et al. (2009) | **Intervention**: 10 individuals with chronic, nonfluent aphasia (Broca’s) participated in self-administered, computer-based training. Each participant was provided with a laptop with an installed program, headphones and a set of large green and red response buttons. The programs consisted of two treatment phases 1) audio-visual (AV) and 2) audio-only (AO). Each included 18 colour pictures of high-frequency nouns each presented in a 3-level hierarchy. Pictures were presented on the screen for 2s, then the patient was presented with a spoken word through the headphones (AO). The patient’s task was to signal whether the word matched the picture (green button) or not (red button). In the AV condition, presentation of the spoken word was supplemented with a video of a man’s mouth pronouncing the word. Half of the participants started with the AO treatment and then changed to AV, the other half began with AV. There was a minimum of five sessions, 1/d. When the patient achieved 90% accuracy, they advanced to the next level – a minimum of 15 sessions per treatment phase. **Outcomes**: Naming task; Philadelphia Naming Test (PNT). |
| Manheim et al. (2009) | **Intervention**: 20 individuals with chronic aphasia participated in the AphasiaScripts training program. Participants developed three scripts with a speech language pathologist (SLP) over five sessions, then practiced each script for 3wk, in a consecutive fashion at home on a laptop computer (total of 9wk intervention). Participants maintained a log of practice times. Practice was also recorded by the computer via log-on/log-off times. Compliance was checked via meetings with the SLP 1/wk. Assessments were conducted at study entry, 6wk later (pretreatment), end of intervention (post-treatment) and 6wk follow-up. **Outcomes**: Communication difficulties (CD) subscale; Communication-Associated Psychological Distress (CAPD) subscale; Burden of Stroke Scale (BOSS): mobility subscale. |

1. Following AV treatment, participants could name significantly more of the trained nouns than at baseline (p<0.0001).
2. Although AO training was associated with improvement, it was not significant.
3. AV training was associated with more improvement in naming trained nouns compared to AO (p=0.0006).
4. On the PNT (untrained nouns), AV treatment was associated with improved performance compared to baseline (p<0.0001). Similarly, AO training was associated with non-significant improvement vs. baseline.
5. Although AV appeared to be associated with a greater treatment effect than AO, it was not statistically significant.

1. CD scores reflected no change from entry to pretreatment assessment. From pre- to post-treatment there was a significant decrease in scores (improvement) (p=0.38, ES = 0.43). From the end of the intervention to follow-up, there was a further, non-significant improvement in scores. Overall improvement from pre-treatment to follow-up was significant (p=0.003, ES = 0.67).
2. Changes in the CAPD scores reflected improvement from pretreatment through follow-up, but these did not reach statistical significance.
3. Mobility scores did not demonstrate change over time.
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Design</th>
<th>PEDro</th>
<th>Treatment Details</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherney et al. (2010)</td>
<td>USA</td>
<td>RCT</td>
<td>6</td>
<td>25 individuals with chronic, non-fluent aphasia were randomized to receive either Oral Reading for Language in Aphasia (ORLA) therapy delivered by a computer, or the same therapy delivered by a speech language pathologist (SLP) following a no-treatment period of 7-12wk. Each participant received 24, 1hr sessions of ORLA. Patients were assessed at baseline, after a no treatment period of 7-12wk, prior to the start of intervention, and post intervention. <strong>Outcomes:</strong> Western Aphasia Battery (WAB): Aphasia Quotient (AQ).</td>
<td>1. All 25 participants received all 24 sessions of therapy over an average of 12.62wk. 2. Computer delivered ORLA therapy resulted in improvements on the WAB-AQ from pre- to post treatment (mean change in test score = 3.29, SD = 6.16). This was compared with the change in WAB score between baseline and pre-treatment assessments (-0.4, SD = 3.44) which was equivalent to an effect size of $d=0.74$ ($CI$ -0.15-1.57) for change in WAB-AQ scores associated with treatment. 3. Change from pre-treatment to post-treatment between the computer delivered ORLA and SPL delivered ORLA groups showed no significant difference for any of the assessed outcomes.</td>
</tr>
<tr>
<td>Palmer et al. (2012)</td>
<td>UK</td>
<td>RCT</td>
<td>8</td>
<td>34 participants with aphasia were randomized to receive either computer-based therapy (20min, 3/wk) or usual care over a 5mo intervention period. The intervention consisted of speech and language therapy delivered through independent use of a computer therapy program (Step-by-Step) configured by a speech language pathologist (SLP) and supported by a volunteer. Assessment was administered at baseline, 5mo follow up, and 8mo follow up. <strong>Outcomes:</strong> Object and Action Naming Battery.</td>
<td>1. 10 of the 15 participants (66.7%) randomized to the computer therapy arm were able to complete the therapy with the recommended frequency. 2. The change in naming ability between groups from baseline to 5mo follow up was 19.8% (95% CI, 4.4 - 35.2; $P=0.014$), with the treatment group demonstrating a greater improvement in naming ability. The effect was greater in favour of the computer therapy treatment group by 23.2% (95% CI, 7.9%-41.3%; $p=0.006$). 3. There was no significant between group difference in percentage change of naming ability at 8mo follow-up.</td>
</tr>
<tr>
<td>Bronken et al. (2012)</td>
<td>Norway</td>
<td>Case Series</td>
<td>No Score</td>
<td>Population: Mean age=55.4yr; Gender: Male=6, Female=1. <strong>Intervention:</strong> Participants received instructions to complete a home-based computerized behavioural therapy focusing on phonological discrimination. Participants completed a mean of 20.8hr of training during the 4wk intervention period. <strong>Outcomes:</strong> Participant observation and qualitative assessment of interviews conducted 2wk, 6mo and 12mo post-intervention; Stroke Aphasia Quality of Life (SAQOL); physical, psychosocial, communication and energy; Cantril's Ladder Scale (CLS); Faces scale; Hopkins Symptom Check List (HSCL).</td>
<td>1. Through participant observation and the qualitative assessment of interviews, participants showed a great need to discuss their new life situation and their experiences post-stroke. They reported that sufficient time to talk and paying attention to the psychosocial consequences of stroke and aphasia were important to them. They also reported that having a person able to support them to express their thoughts and feelings was important. Lastly, participants expressed concerns when dealing with difficulties in the future and expressed uncertainty in the duration and outcome of rehabilitation. 2. Results of CLS showed an increase in life satisfaction from baseline to 2wk post-intervention, a decrease in life satisfaction from 2wk post-intervention to 1yr post-intervention and an overall decrease in life satisfaction from baseline to 1yr post-</td>
</tr>
</tbody>
</table>
3. Results of the Faces scale showed a decrease in happiness from baseline to 2wk post-intervention, an increase in happiness from 2wk post-intervention to 1yr post-intervention and an overall increase in happiness from baseline to 1yr post-intervention.

4. Results of the HSCL showed an increase in distress from baseline to 2wk post-intervention, a decrease in distress from 2wk post-intervention to 1yr post-intervention and an overall decrease in distress from baseline to 1yr post-intervention.

5. SAQOL total scores increased from baseline to 2wk post-intervention in four participants, decreased in one and showed little change in one; scores from 2wk post-intervention to 1yr post-intervention increased in two participants, decreased in three and showed little change in one; overall scores from baseline to 1yr post-intervention increased in five participants and decreased in one.

---

**Lee et al. (2013)**

**USA**

**Case Series**

**No Score**

**TPS**

Mean = 43mo

**N Start** = 4

**N End** = 4

**Population:** Mean age = 71yr; Gender: Males = 2, Females = 2.

**Intervention:** Participants received an 8wk intervention where they practised attention exercises using the computerized Attention Processing Training-3 (APT-3) program. Assessments were conducted before and after the intervention period.

**Outcomes:** Reading of maze passages; Conner’s Continuous Performance Test-II (CPT-II); Test of Everyday Attention (TEA); Gray Oral Reading Test Fourth Edition (GORT-4).

1. Two of the study’s participants demonstrated improvements in maze reading with small effect sizes.

2. All participants improved on the CPT-II, TEA, and on the GORT-4 at post-test.

---

**Marshall et al. (2013)**

**UK**

**Pre-Post**

**No Score**

**TPS Mean = 77.9 ± 81.0mo**

**N Start** = 9

**N End** = 9

**Population:** Mean age = 64.8 ± 16.0yr; Gender: Males = 6, Females = 3.

**Intervention:** Participants used a computer gesture therapy tool (GeST) for 6wk with treatment delivered in two phases. In the first phase, weekly visits with a speech language therapist were provided, while the GeST was provided without therapist support in the second phase. Outcomes were assessed before therapy, after phase one (GeST supported), after phase two (GeST independent), and after 3wk.

**Outcomes:** Gesture recognition and rating; Spoken naming score (SNS).

1. A two factor ANOVA analysis of time and group (GeST supported, GeST independent, familiarized but not practiced, and not familiarized or practiced) for Gesture recognition revealed no significant main effect but a significant interaction between factors (p<0.05).

2. Separate ANOVAs conducted on the individual groups for Gesture recognition revealed a significant effect of time only for GeST supported naming (p<0.05); scores were only significantly different between baseline and following phase one (p<0.005) and between baseline and the 3wk follow-up (p<0.05).

3. A two factor ANOVA analysis of time and group for Gesture rating revealed no
1. Analysis of the impact of session and condition on zRTs revealed that there was a statistically significant effect of condition \((p<0.001)\). However, there was no effect of session and no significant Session X Condition interaction effect \((p=0.17)\).

2. Post-hoc analysis revealed an effect of complexity: each selective attention condition was associated with significantly longer zRTs than the corresponding sustained attention condition \((p<0.05)\).

3. Post-hoc analysis revealed a modality effect: each auditory attention condition resulted in significantly longer zRTs than the corresponding visual attention condition \((p<0.05)\).

4. The INTEGRATIONAL A/V condition also resulted in significantly longer zRTs than each of the other four attention conditions \((p<0.05)\).

5. There was a statistically significant main effect of Condition on COV \((p=0.02)\); post-hoc analysis revealed that COVs were significantly higher for SELECTIVE-A than SUSTAINED-V \((p=0.03)\) and statistically significantly higher for INTEGRATIONAL A/V than for SUSTAINED-V \((p=0.02)\).

### Woolf et al. (2016)

UK

**RCT**

PEDro=4

TPS_{E1}=53.4±28.81mo

TPS_{E2}=31.8±14.11mo

TPS_{C1}=35.2±33.16mo

TPS_{C2}=20.2±10.64mo

\(N_{\text{Start}}=20\)

\(N_{\text{End}}=19\)

**Population:** Remote University group (E1; \(n=5\)): Mean age=67.2±6.98yr; Gender: Males=3, Females=2. Remote Clinical group (E2; \(n=5\)): Mean age=58.6±14.38yr; Gender: Males=4, Females=1. Face-to-Face group (C1; \(n=5\)): Mean age=57.8±15.14yr; Gender: Males=3, Females=2. Attention group (C2; \(n=5\)): Mean age=53.0±13.93yr; Gender: Males=4, Females=1.

**Intervention:** Participants were randomly allocated to receive word finding therapy either remotely from the university (E1) or clinic (E2), or in person (C1) and compared to an attentional therapy control (C2). Outcomes were assessed at baseline, 4wk, and 10wk follow-up.

**Outcomes:** Picture Naming Task.

6. The E1, E2, and C1 groups made significantly greater improvements in the Picture Naming Task compared to the C2 group \((all \ p<0.001)\).

### 14.3.8 Telerehabilitation and Speech and Language Therapy
<table>
<thead>
<tr>
<th>Author, Year Country PEDro Score TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duffy et al. (1997) USA No Score TPS=NA N=NA</td>
<td><strong>Intervention:</strong> This study compared the results of remote vs. face-to-face assessments. Remote assessments were performed via i) satellite (n=8, two stroke patients), ii) videotaped samples (n=24); iii) teleconferencing at the Mayo Clinic (n=150). For satellite assessments, a clinician was available onsite to perform simultaneous observation. Videotaped samples were sent to the “on-satellite” clinician for diagnosis. Previous reports of teleconferred assessment were reviewed. Time for examination, counselling and discussion with patient/caregiver was 20-45min. <strong>Outcomes:</strong> History and recording of symptoms; Oral mechanism and motor speech examination; Language assessments (simple &amp; complex commands, picture identification &amp; naming, sentence repetition, word definition, proverb explanation, storytelling, oral spelling, reading aloud and verbal comprehension).</td>
<td>1. For the n=8 satellite group, there were no disagreements between observer and remote pathologist. 2. For previously videotaped samples, agreement between the face-to-face and satellite observer was 96%. 3. Review of the Mayo teleconferencing sessions revealed a broad range of speech pathology diagnoses made using these techniques. 4. Only 13% of the sample yielded an uncertain diagnosis and a face-to-face assessment was required in only 4% of the cases reviewed.</td>
</tr>
<tr>
<td>Mortley et al. (2003) UK No Score TPS=chronic N=7</td>
<td><strong>Intervention:</strong> Case series to examine the feasibility of delivering and monitoring computer-based therapy with no face-to-face intervention. Seven patients with aphasia, at least 12mos post-stroke, received computer-based language therapy over a period of 6mos. All therapy was conducted using a computer (PC) in the patients’ own home. On a monthly basis, the therapist conducted a remote session (transferring completed computer exercises from the patient to the therapists’ computer, evaluation and telephone conference to discuss progress, difficulties and modification to the program of exercises). A second appointment was set to download new exercises from the therapies to the patients. INTACT software was used as the source for therapy exercises; PC anywhere was used as the communications platform. <strong>Outcomes:</strong> Number of exercises; Number of attempts; Total time spent; Number of successful and failed remote sessions; Reasons for failure.</td>
<td>1. Total number of hours spent doing computer-based language exercises ranged from 20-67hr. 2. Median number of hours spent per month per person was 7. 3. A median of 39 exercises were assigned per person and the number of attempts per exercise ranged from 5-40. 4. 6 remote updates per person were planned. One individual received all updates successfully – in all other cases there was at least one technological failure.</td>
</tr>
<tr>
<td>Mortley et al. (2004) UK Case Series ABA No Score TPS=chronic</td>
<td><strong>Intervention:</strong> Case series of seven patients (ABA design, where A represents no-treatment) with previous stroke (&gt;2yr post-onset). Initial assessments were conducted face-to-face in order to evaluate deficits and plan therapy. A home visit was conducted to install software (or</td>
<td>1. Total number of practice hours (mean) was 74hr, 20min (12hr, 23min per month and 2hr, 45min per week). 2. Number of exercises ranged from 16-70 and attempts per exercise from 6-44 reflecting the individualised nature of the</td>
</tr>
</tbody>
</table>
computer if needed) with the first set of exercises for independent practice. Patients were instructed to use the system as much as they would like. The system allowed patients to access results and monitor their own progress. When ready, they could forward results to the therapist who would review the results and provide feedback via telephone. The therapist would analyse results and select new exercises which were then transferred onto the secure website by an agreed upon time when they would be available for the patient to download. The treatment cycle continued for 3mos, followed by a single face-to-face assessment, then continued for another 3mos. Assessments were conducted at 1wk (baseline 1), 7wk (baseline 2), 36wk and 42wk.

**Outcomes:** Object and Action Naming Battery; Sentence Comprehension Assessment; Psycholinguistic Assessment of Language Processing in Aphasia (PALPA 47, 48); Oral reading; Patterns of response in word retrieval; Total time spent; Number of exercises; Number of attempts.

3. Remote sessions with the therapist lasted approximately 2hr (downloading patient results, telephoning the patient to discuss progress, analysing results and picking and configuring new exercises and putting these on the secure server).
4. Number of remote therapy sessions ranged from 3-6 over 27wk of therapy.
5. All patients were able to participate independently.
6. Language performance was stable between baseline 1 and 2.
7. All patients demonstrated significant improvement in object naming between baseline 2 and end of therapy.
8. Mid-term assessments demonstrated generalisation to untreated items for 3 of 7 participants.
9. 6 patients participated in interviews. All perceived participation as a positive experience. All reported perceived improvement in functional communication.

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**Brennan et al. (2004)**
USA
Prospective
No Score
TPS=NA
N=40

**Population:** Mean age=43.4±15.9yr; Gender: Males=23, Females=17.

**Intervention:** Participants were tested in their story retelling ability in both face-to-face and teleconference settings. As for Georgeadis et al. (Georgeadis et al. 2004), authors also examined the effect of age, education, technology experience and gender on variations in performance between settings. The order of assessment was randomised for each patient.

**Outcomes:** Story retelling performance.

1. There was no significant difference in storytelling performance between settings (p=0.49).
2. None of the descriptive variables were significantly associated with differences in performance between settings, although there was a non-significant trend identified such that youngest age group (18-35) tended to perform best in face to face assessment while the oldest patients (53-70) performed best in the telerehabilitation setting. This may have been, in part, explained by the fact that younger patients were primarily TBI patients who may not perform as well in teleconference settings vs. individuals with stroke (Georgeadis et al. 2004).

3. A random sample of 12 stories was used to examine inter-rater reliability. Inter-rater agreement for these 12 stories was 92.8%.
4. Overall, performance in the teleconference setting was somewhat better than in the face-to-face setting, although there were no significant differences in performance across settings (p=0.495).
5. Correlation between performances across settings was high (r=0.92).
6. Individuals with TBI tended toward worse
1. Percentage levels of agreement were highest in individuals with mild deficits.
2. When a Kruskal-Wallis test was applied to BDAE-3 subtest clusters, there was no significant difference between levels of severity for the majority of subtests.
3. However, significant differences were identified for naming and paraphasia suggesting that severity of aphasia may affect assessment of these two areas in the...
Hoffmann et al. (2010)  
Australia  
PCT  
PEDro=NA  
TPS=101.8d  
N_{Start}=287  
N_{End}=197  

**Population:** Patient Group (PG, N=11): Mean age= 69±12.5yr; Gender: Males=40, Females=7.  
Carer Group (CG, N=8): Mean age=56±11.6yr; Gender: Males=3, Females=5.  

**Intervention:** Participants were allocated either to the telephone administration group for outcome measures or to the face-to-face administration.  

**Outcomes:** Caregiver Strain Index (CSI); Stroke and Aphasia Quality of Life Scale (SAQOL-39); Hospital Anxiety and Depression Scale (HADS).  

1. There were no significant differences in outcomes that were measured from the telephone delivery method compared to the face-to-face administration of outcome measures.  

Agostini et al. (2014)  
Italy  
Cross-over PCT  
No Score  
TPS_{mean}=3.2yr±0.8yr  
N_{Start}=5  
N_{End}=5  

**Population:** Mean age=65.4yr; Gender: Male=4, Female=1.  

**Intervention:** Participants were non-randomly divided to start the intervention with either face-to-face or tele-naming treatment for 8d. After a washout period of 3wk, participants then received the other intervention for 8d. Each naming session consisted of naming coloured photos of concrete objects with increasing phonological cues for assistance. Tele treatment was provided by communicating with the therapist online.  

**Outcomes:** Picture naming performance on treated and untreated items.  

1. A two factor ANOVA analysis of treatment type and time for treated items showed a main effect of time (p=0.0004), but no significant main effect of treatment type and no interaction between treatment and time (p=0.98).  
2. A significant improvement in picture naming performance was observed with treated items from baseline to post-intervention (p<0.01); no notable decline in performance was observed at the 3wk follow-up.  
3. ANOVA analysis of treatment type and time for untreated items showed no main effects of time (p=0.613) or treatment type (p=0.947), and no interaction between factors (p=0.98).  
4. A two factor ANOVA analysis of treated and untreated items and treatment type showed a significant main effect of item type post-intervention (p=0.02) with participants having a better performance on treated items; no main effects and no interaction effect was observed at 3wk follow-up.  

Woolf et al. (2016)  
Australia  
Quasi-experimental  
TPS=NA  
N_{Start}=20  
N_{End}=19  

**Intervention:** Four intervention groups: 1) Remote therapy delivered from a University lab; 2) remote therapy delivered from a clinical site; 3) face-to-face therapy; 4) an attention control condition. Participants who received therapy received eight 1hr sessions of therapy, 2/wk. The second therapy group followed a standard protocol with the goal to improve spoken word production from therapy. Face-to-face therapy  

1. For word retrieval outcomes, there were statistically significant main effects and interaction effects in all intervention groups at week 8 and week 14, suggesting that these improvements were maintained (p<0.05).  
2. The three groups that received therapy demonstrated statistically significant improvements on treated words compared
was provided in a University lab whereas remote therapy was administered via Face time using iPads. The attention control group received eight remote conversation sessions via the internet using Face Time, 2/wk for 8hrs in total. Assessments were conducted at four time points: weeks 1 and 4 (baseline), and weeks 8 and 14 (post-therapy and follow-up), respectively. 

**Outcomes:** Semantic verification; Picture naming; Assessment of conversation using the POWERS procedure: Proportion of substantive turns; Mean number of content words per turn; Mean number of nouns per turn.

3. There were no significant main effects or interactions for word finding in conversation, as assessed by the POWERS procedure, for any of the intervention groups.

### 14.3.9 Filmed Language Instruction

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Di Carlo</strong> (1980) USA RCT PEDro=4 TPS=NA N=14</td>
<td><strong>Intervention:</strong> 14 aphasic patients were randomized to receive traditional speech therapy (ST) or to the experimental group receiving ST with a systematic filmed program instruction. The control group engaged in viewing slides and other non-programmed activity.</td>
<td><strong>Outcomes:</strong> Reading recognition; Reading comprehension; Figure background; Visual learning; Visual closure; Vocabulary.</td>
<td>1. No significant differences were observed between groups.</td>
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<tr>
<td><strong>Rudnev and Shteinerdt</strong> (2013) Russia Pre-Post No Score TPSstart=NA Nstart=53 Nend=53</td>
<td><strong>Population:</strong> Mean age=55.5±7.8yr; Gender: NA. <strong>Intervention:</strong> Participants completed basic speech exercises and additionally received a biofeedback regime. In the first stage (7-14d long), the biofeedback consisted of observing audiovisual samples of conversation recorded from first-order relatives. In the second stage (14-21d long), the biofeedback consisted of the participant’s own audiovisual speech samples recorded during the first stage. <strong>Outcomes:</strong> Proportion of those with frequent or rare literal paraphasias; Proportion of those with occasional or no verbal paraphasias; Frequency of literal perseverations; First sound at speech initiation; Use of nonverbal components of speech: intonational and kinesthetic construction.</td>
<td>1. A statistically significant difference in the frequency of literal paraphasias was observed post-intervention (p&lt;0.001) with a reduction in the proportion of participants with frequent literal paraphasias (n=&gt;5 per session) and an increase in the proportion of participants with rare literal paraphasias (n=&lt;4). 2. A statistically significant difference in the frequency of verbal paraphasias was observed post-intervention (p=0.003) with a reduction in the proportion of participants with occasional verbal paraphasias and an increase in the proportion of participants with no verbal paraphasias. 3. The proportion of participants with &gt;5 literal perseverations per session decreased significantly post-intervention (p&lt;0.001). 4. There were statistically significant improvements in speech initiation (p&lt;0.001).</td>
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and in the use of intonation and kinesthetic appearances (p<0.001 for both).

Table 14.3.10 Music Based Therapies for Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year Country</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conklyn et. al. (2012) USA RCT</td>
<td><strong>Intervention</strong>: In a RCT design, 30 participants (n=16 treatment, n=14 controls) were randomized to receive either Modified Melodic Intonation Therapy (MMIT) or a control situation. Both consisted of a 10-15min session with a music therapist. The treatment group involved the therapist teaching the participant a melodic phrase, and the control group consisted of the therapist discussing the participants’ impairment, treatment approaches and outcomes. Participants in both groups underwent two treatment sessions. <strong>Outcomes</strong>: Study specific measure (from the Western Aphasia Battery).</td>
<td>1. After the first visit, a significant difference between groups was observed for the adjusted total score (difference=6.4, p=0.02) in favour of the treatment group. 2. The treatment group also demonstrated a significant difference in scores in responsiveness between visits 1 and 2 (p=0.01), whereas this improvement was not observed in the control group. 3. Significant difference in favour of the treatment group between pretest scores for visit 1 and 2 in responsiveness only (p=0.02). 4. Significant differences in favour of the treatment group following visit 1 were observed for total score (p=0.02) and responsive score (p=0.02).</td>
</tr>
<tr>
<td>Lim et al. (2013) South Korea</td>
<td><strong>Population</strong>: Experimental Group Chronic subgroup (EGC; N=6): Mean age=50.7±28.5yr; Gender: Males=5, Females=1. Experimental Group Subacute subgroup (EGS): Mean age=62.2±10.4yr; Gender: Males=4, Females=2. Control Group Chronic subgroup (CGC; N=5): Mean age=53.8±15.4yr; Gender: Males=4, Females=1. Control Group Subacute subgroup (CGS; N=4): Mean age=71.5±7.9yr; Gender: Males=2, Females=2. <strong>Intervention</strong>: The EG received melodic intonation therapy (MIT) as part of neurologic music therapy (NMT) consisting of therapeutic singing, melodic intonation, and rhythmic left-hand slapping. The CG</td>
<td>1. A significant improvement on the AQ was found in the chronic and subacute EG (p&lt;0.05). The CG showed no significant improvement on the AQ. 2. Both chronic groups improved significantly on the repetition subscale of the K-WAB (both p&lt;0.05). 3. Both the chronic and the subacute EG improved significantly on the naming subscale of the K-WAB (p&lt;0.05). 4. The spontaneous speech and the comprehension subscales did not improve significantly in either of the chronic groups.</td>
</tr>
</tbody>
</table>
received speech language therapy (SLT). The intervention lasted for 1mo.

**Outcomes**: Korean version-Western Aphasia Battery (K-WAB): spontaneous speech, comprehension, repetition, naming; Aphasia Quotient (AQ).

However, the subacute EG improved significantly on these subscales (both p<0.05).

5. No significant improvement was found in either subacute group regarding the repetition subscale.

6. No significant differences in improvement were observed between the chronic EG and CG and between the subacute EG and CG; only repetition approached significance between the subacute EG and CG (p=0.067).

**Stahl et al.** (2013)

**Germany**

PCT

No Score

TPSubtest=23.4±37.8mo

NStart=15

NEnd=15

**Population**: Mean age=56±10yr; Gender: Males=8, Females=7.

**Intervention**: Participants were allocated to one of three types of treatment: singing therapy, rhythmic therapy, or standard therapy. Singing therapy involved the intense training of formulaic lyrics and singing to a well-known melody. Rhythmic therapy involved speaking with natural prosody. Standard therapy involved only speech therapy and did not include melodic and rhythmic components. Interim measurements were taken on participants who received singing and rhythmic therapy at 2wk and 4wk after treatment.

**Outcomes**: Production of formulaic and non-formulaic lyrics both sung and rhythmically spoken; Rate of continuous phonation; Variance in fundamental frequency.

1. There was a statistically significant interaction between time, treatment group and the production of formulaic and non-formulaic lyrics (p<0.001).

2. Analysis of the production of formulaic lyrics revealed a strong increase from pre to post-treatment in participants undergoing singing therapy (ΔM =36.47), and rhythmic therapy (ΔM =50.40). The production of formulaic lyrics remained stable from post-treatment to 3mo follow-up in these therapy groups: (ΔM =−0.74; ΔM =2.76). This improvement was not observed in standard therapy participants.

3. Only participants who underwent standard therapy improved in the production of non-formulaic lyrics (ΔM =6.21).

4. A higher rate of continuous phonation post-intervention was observed during singing compared to rhythmic speech (p=0.005), independent of whether participants were allocated to the singing or rhythmic group.

5. A higher variance of fundamental frequency post-intervention was observed during rhythmic speech compared to singing (p=0.002), independent of whether participants were allocated to the singing or rhythmic group.

6. Neither the rate of continuous phonation nor the variance in fundamental frequency depended on whether participants were previously assigned to singing or rhythmic therapy.

**Tamplin et al.** (2013)

**Australia**

Pre-Post

No Score

TPSubtest=NA

NStart=13

NEnd=9

**Population**: Mean age=58.3±13.8yr; Gender: Males=10, Females=3.

**Intervention**: Participants received a choir intervention for 2hr/wk where participants practiced singing songs and simple vocal exercises. Outcomes were assessed after 12wk and 20wk of choir participation.

**Outcomes**: Visual Analogue Mood Scale; Stroke

1. A significant time effect was observed for perceived SIS thinking and memory scores at the 20wk assessment point (p<0.05).

2. No significant time effects were found on any other outcome measure at the 12 and 20wk assessment points.

3. The most frequently reported benefits of treatment were an increase in confidence,
Impact Scale (SIS): thinking and memory, communication, global recovery; Sense of Belonging Instrument; General Health Questionnaire.

**van der Meulen et al.** (2014)  
Netherlands  
Cross-over RCT  
PEDro=6  
TPS<sub>Exp</sub>=9.3±2.0wk  
TPS<sub>Con</sub>=11.9±5.9wk  
N<sub>Start</sub>=25  
N<sub>End</sub>=24

**Population:** Experimental Group (EG; N=16): Mean age=53.1±12.0yr; Gender: Males=4, Females=12.  
Control Group (CG; N=11): Mean age=52.0±6.6yr; Gender: Males=7, Females=4.  
**Intervention:** The EG received intensive Melodic Intonation Therapy (MIT) for 5hr/wk for 6wk then crossed over to receive standard language therapy delivered at the same intensity for 6wk. The CG initially received the language therapy for the first 6wk then crossed over to MIT for the remaining 6wk.  
**Outcomes:** Sabadel task; Aachen Aphasic Test (AAT): repetition, naming; MIT repetition task: overall score and performance on untrained and trained items; Amsterdam Nijmegen Everyday Language Test (ANELT).

1. Statistically significant improvements following MIT were noted in the EG for the following outcomes: ANELT (ΔM=6.6±6.9, p<0.001); AAT naming (ΔM=20.5±20.1); AAT repetition (ΔM=28.5±21.6, p<0.001); MIT overall score (ΔM=27.5±17.9, p<0.001); MIT trained items (ΔM=17.6±11.8, p<0.001); and MIT untrained items (ΔM=9.9±7.8, p<0.001); no significant change was noted following this period on the Sabadel task (p=0.13).  
2. The CG demonstrated significant improvement on only MIT untrained items following the first intervention period (ΔM=8.1±11.8, p<0.001).  
3. No significant difference between interventions was observed on the ANELT.  
4. Significantly greater improvements following the first intervention period were noted in the MIT group compared to the standard language therapy on the following measures: AAT repetition (p<0.05); MIT overall score (p<0.05); and MIT untrained items (p<0.05).  
5. A linear mixed model analysis revealed statistically significant main effect of time on all outcome measures: Sabadel (p =0.011); ANELT (p =0.003); AAT naming (p=0.001); AAT repetition (p<0.001); MIT trained items (p<0.001); and MIT untrained items (p<0.001).  
6. The effect of time was significant on the following outcomes in the EG but not the CG: Sabadel (EG: p =0.02; CG: p =0.28); ANELT (EG: p =0.04; CG: p =0.34); and AAT naming (EG: p =0.01; CG: p =0.27).  
7. A statistically significant interaction effect was observed between time and intervention group for MIT trained items (p=0.01).

**Wan et al.** (2014)  
USA  
PCT  
No Score  
TPS<sub>Exp</sub>=26.6mo  
TPS<sub>Con</sub>=33.0mo  
N<sub>Start</sub>=20  
N<sub>End</sub>=20

**Population:** Experimental Group (EG; N=11): Mean age=55.8yr; Gender: Male=9, Female=2.  
Control Group (CG; N=9): Mean age=56.7yr; Gender: Male=9, Female=0.  
**Intervention:** EG received melodic intonation therapy for 1.5hr/d, 5d/wk for 15wk. Intonation therapy involved the therapist instructing the participant to intone simple phrases on two pitches while simultaneously tapping their left hand with each syllable. CG received no treatment.  
**Outcomes:** Speech fluency from semi-structured conversational interviews measured by correct

1. Speech fluency significantly improved in the EG post-intervention (p<0.001).  
2. Speech fluency showed no significant change in the CG from baseline to post-intervention.
<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zumbansen et al.</strong> (2014)</td>
<td>Mean age=51.6±4.7yr; Gender: Males=3, Females=0.</td>
<td>Each participant received three types of therapy in a randomized order: Melodic intonation therapy (MT); Rhythmic intonation therapy (RT); and Spoken therapy (ST) without melodic or rhythmic elements. RT was similar to MT except it lacked the musical pitch of MT. Each intervention was offered in 1hr sessions, 3/wk for 6wk. Assessments were conducted before and after each intervention.</td>
<td>1. Informativeness in connected speech on the picture description task improved to a statistically significant degree only after MT in all participants (p&lt;0.05); no improvement in informativeness was observed after RT or ST. 2. The number of correct syllables in trained sentences showed a statistically significant increase in all participants after each intervention type (p&lt;0.05). 3. The number of correct syllables in untrained sentences improved after each intervention type in 1 participant (p&lt;0.011), after MT but not after RT or ST in 1 participant (p=0.0017) and after MT and RT but not after ST in 1 participant (p&lt;0.017). 4. Improvement in the number of correct syllables on tested sentences was significantly greater for trained vs. untrained sentences following RT and ST in 1 participant (p=0.016; p=0.028) and following only RT in 1 participant (p=0.037); 1 participant showed no difference in improvement between trained and untrained sentences. 5. There was no significant variation in motor-speech agility assessed by the Diadochokinetic score in any participant, for any of the treatments (p&gt;0.05). 6. There was no significant variation in mood assessed by the VAS (i.e. more than 20 T-score points) between the subjects over the study period (p&gt;0.05).</td>
</tr>
<tr>
<td><strong>Hurkmans et al.</strong> (2015)</td>
<td>Mean age=58.4±11.19yr; Gender: Males=4, Females=1.</td>
<td>Participants received 24 Speech-Music Therapy for Aphasia (SMTA) sessions during two 30min sessions/wk. Assessments were conducted at pre-treatment (T1), post-treatment (T2), and at 3mo post-intervention (T3).</td>
<td>1. All participants improved significantly on the PALPA and on domains of consistency, accuracy, and fluency of the MDT after SMTA (p&lt;0.05 for all). 2. Results of the ANELT show that significant improvements at T2 were made by 5 participants on the intelligibility subtest and 4 on the comprehensibility subtest (p&lt;0.05 for all); results were maintained to T3 by 4 participants on intelligibility and 5 on comprehensibility. 3. Results of the AAT show that significant improvements at T2 were made on subtests of repetition, Token Test and auditory comprehension by 5, 4, and 1 participant respectively (p&lt;0.05 for all); results were maintained to T3 by all 5 participants on all AAT subtests.</td>
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4. Results of the DIAS show that significant improvements at T2 were made on subtests of articulation of phonemes, DDK and articulation of words by 4, 4, and 2 participants respectively (p<0.05 for all); results were maintained to T3 by all 5 participants on all DIAS subtests.

Raglio et al. (2016)
Italy
RCT (5)
TPS=
N_start=20
N_end=20

Population: Music + speech + language therapy (n=10): Mean age=56.6yr; Gender: Males=7, Females=3. Speech and language therapy (n=10): Mean age=70.9yr; Gender: Males=7, Females=3.

Intervention: Both groups received speech and language therapy (Promoting Aphasic’s Communication Effectiveness – PACE). The music therapy group received MT two 30-min sessions a week for 15 weeks, where patient and music therapist played rhythmic-melodic instruments as well as sang/vocalized together.

Outcomes: Rankin Scale, quality of life, Aachener aphasic test (AAT), Token Test, Boston Naming Test, Picture Description Test, Spontaneous Speech subtest, Beck Depression Inventory

1. There were no significant differences post-treatment for any of the outcome measures for the MT or control group.

### 14.3.11 Constraint Induced Therapy (CI) for Aphasia

Table 14.3.11 Constraint Induced Therapy for Aphasia Post-Stroke

<table>
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<tr>
<th>Author, Year Country PEDro Score TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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<tr>
<td><strong>Pulvermuller et al. (2001)</strong> UK, Germany PEDro=6 TPS=NA N=17</td>
<td><strong>Intervention:</strong> 17 patients with language impairment due to a single stroke affecting the left middle cerebral artery with no severe perceptual or cognitive deficits were randomized to either treatment or control groups (CG). Patients in the treatment group received constraint induced therapy (CI) for 3hr/d for 2 wk. The control group received conventional therapy for 3hr/d for 4wk. <strong>Outcomes:</strong> Aachen Aphasia Test (AAT); Communicative Activity Log (CAL).</td>
<td>1. Patients in the CI group demonstrated significant improvement on three of the four components of the AAT while patients in the CG did not demonstrated significant improvement. 2. Patients in the CI group had significantly higher CAL scores of communication of everyday life compared to patients in the CG.</td>
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<tr>
<td><strong>Meinzer et al. (2004)</strong> Germany No score TPS=chronic N=28</td>
<td><strong>Intervention:</strong> 28 patients with chronic aphasia (&gt;12mos post-onset following stroke) participated in intensive speech and language therapy 3hr/d for 2wk. Training techniques included intense use of language together with restraint of non-verbal methods of communication. <strong>Outcomes:</strong> Aachen Aphasia Test (AAT): Token Test.</td>
<td>1. Performance increased on the AAT (p&lt;0.0001) and Token Test (p&lt;0.0001). 2. Decreased delta activity was demonstrated in 16 patients and increased left hemisphere activity was demonstrated in 12 patients after training. This increase co-varied with TPS. Magnitude of change was greater in patients demonstrating significant improvements on the AAT.</td>
</tr>
<tr>
<td><strong>Meinzer et al.</strong></td>
<td><strong>Intervention:</strong> 27 patients with chronic aphasia were</td>
<td>1. Participants in both training groups</td>
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14. Aphasia and Apraxia

[www.ebrsr.com](http://www.ebrsr.com)
assigned to receive either constraint induced therapy (CIAT, n=12) or constraint induced therapy “plus” (CIATplus, n=15). CIAT consisted of 30hr of training over 2wk. This included communicative language games/tasks of increasing difficulty. Tasks took place in a group learning format with screens placed between players to limit nonverbal communication. CIATplus participants performed CIAT plus a written language component (task sessions) and individualized instructions for communication exercises in the home involving family and friends.

Outcomes: Aachen Aphasia Test (AAT); Communicative Effectiveness Index; Communicative Activity Log.

1. There were no significant between group differences for age, AQ, BNT or ANT at baseline. There was a higher incidence of severe apraxia of speech impairment in the PACE group.
2. Both groups demonstrated significant change on the WAB AQ over the course of therapy (p=0.004). There were no significant group or group x time interactions.
3. Similarly, there was significant change over time demonstrated by both groups on the BNT and ANT tests, but there were no significant between group differences on these measures.
4. Linguistic analyses revealed increases in number of words, utterances and sentences produced following treatment in both groups. However, subjective analysis revealed qualitative differences in favour of the CLT group in that the majority of raters preferred narrative samples produced by participants who had received CLT.

Maher et al. (2006)
USA
PCT
No Score
TPS=NA
N=11

Intervention: 11 patients were assigned to receive either constraint-induced language therapy (CILT) or promoting aphasic communicative effectiveness (PACE) therapy. Both groups received 3hr sessions, 4d/wk for 2wk. Therapy was conducted with patients in groups of two or three with two speech language pathologists per group. Therapy tasks and intensity was consistent over groups. PACE participants were encouraged to communicate using any or all modalities available to them (gesturing, writing etc.) whereas CILT participants were restricted to verbal production only. Assessments were conducted at baseline, post-intervention and at 1mo follow-up.

Outcomes: Western Aphasia Battery (WAB): Aphasia Quotient (AQ); Boston Naming Test (BNT); Action naming Test (ANT); Apraxia Battery for adults-2; linguistic analysis of a narrative discourse sample (Cinderella story re-telling).

Meinzer et al.
Intervention: 20 individuals with chronic aphasia were
1. All patients completed the program of CIAT
<table>
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<tr>
<th>Study</th>
<th>Year</th>
<th>Country</th>
<th>Design</th>
<th>PEDro</th>
<th>TPS</th>
<th>N</th>
<th>Population Details</th>
<th>Intervention Details</th>
<th>Outcomes Details</th>
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<td>(2007) Germany RCT</td>
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<td>5</td>
<td>NA</td>
<td>20</td>
<td>Placed in groups according to severity of aphasia. Groups also included relatives of patients who agreed to participate. Groups were randomly assigned to receive either constraint induced aphasia therapy (CIAT) delivered by a psychologist or by a trained layperson (participating relative). Relatives were trained as layperson trainers by attending a 2hr introductory session that included materials, procedures, approaches and information regarding adjustment of task difficulty. In addition, training sessions were offered for the layperson trainers at the end of each daily session. All participant groups received CIAT training for 3hr/d for 10 consecutive working days. Language functions were assessed before and after treatment.</td>
<td>Outcomes: Aachen Aphasia Test (AAT): Token Test, repetition, written language, naming, comprehension. and received the same number of treatment sessions. 2. There was significant improvement in the AAT profile scores in both treatment groups over time. In addition, patients in both groups improved significantly on all subtests of the AAT. 3. Group x time analysis did not demonstrate significant between group differences for either the profile scores or the AAT subtests.</td>
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<tr>
<td>Szaflarski et al. (2008) USA</td>
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<td>NA</td>
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<td>Intervention: Three male patients with moderate to severe aphasia post-stroke received a modified (hierarchical task arrangement) 1wk program of group constraint induced aphasia therapy. Four sessions (45min) were provided per day for 5d with 10-15min breaks in between to provide an additional 30-45min of socialization. Two to three clinicians were involved in the treatment group during all sessions. Clinicians set language goals for each patient based on pre-treatment evaluation and informed the patient of his language target specific to his individual program.</td>
<td>Outcomes: Boston Diagnostic Aphasia Examination: comprehension, verbal expression; mini-Communicative Activity Log (CAL). 1. All participants demonstrated improvement on at least one assessment. 2. Two patients demonstrated notable improvements on comprehension and verbal skills. 3. No subjective improvements were noted on the CAL.</td>
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<td>Rose et al. (2013) Australia</td>
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<td>Cross-over PCT</td>
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<td>Population: Mean age=57.1±10.3yr; Gender: Males=6, Females=5. Intervention: The six participants in group 1 and 2 received multi-modality aphasia therapy (M-MAT) first, followed by constraint induced aphasia therapy plus (CIATplus), while the five participants in groups 3 and 4 received CIATplus first, followed by M-MAT. Intensity of treatment was constant across both treatments: 3.25hr/d, 4d/wk for 2wk. The two groups crossed over to the other treatment following a washout period of 1wk.</td>
<td>Outcomes: Noun and verb probes; Western Aphasia Battery (WAB): Aphasia Quotient (AQ); Rate of substantive verb and noun production; Communication Effectiveness Index (CETI); Stroke and Aphasia Quality of Life (SAQOL): communication and psychosocial subscales. 1. Participants demonstrated improvements in noun and verb probes post-treatment as shown by effect sizes ranging from small to large; higher effect sizes were found for nouns as compared to verbs, and for items that were treated during the first treatment phase. 2. Collectively, participants demonstrated a statistically significant reduction in aphasia severity according to the WAB-AQ from baseline to 1mo follow-up (p=0.006), and from baseline to the 3mo follow-up (p=0.002). 3. There was no significant difference in WAB-AQ scores from 1mo follow-up to 3mo follow-up (p=0.414).</td>
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<td>Sickert et al. (2014) Germany</td>
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<td>Population: Experimental Group (EG; N=50) Mean age=60.7yr; Gender: Males= 30, Females=20. Control Group (CG; N=50): Mean age=60.2yr; Gender: Males=30, Females=20.</td>
<td>1. Both groups demonstrated statistically significant improvements in all sub-tests of the AAT post-intervention (EG: p&lt;0.001 and CG: p&lt;0.001).</td>
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<td>Study</td>
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<td>Wilssens et al. (2015)</td>
<td>Mean age=63.2±8yr; Gender: Males=30, Females=20.</td>
<td>Standard Treatment Group: Mean age=60.7 yr; Gender: Males=30, Females=20.</td>
<td>- Both groups improved significantly over time as a result of treatment on all AAT measures (p&lt;0.001). - Both groups improved significantly on all measures of CAL (p&lt;0.05). - There were no significant differences in how either group improved on outcome measures.</td>
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<td>Sickert et al. (2014)</td>
<td>Population: Constraint Induced Group: Mean age=60.7 yr; Gender: Males=30, Females=20.</td>
<td>The CI therapy group received specific training based on therapeutic language games whereby participants can respond to stimuli with verbal and non-verbal communication. The standard therapy group received standard aphasia therapy which consisted of similar language based games, and participants were only allowed to respond verbally. Training took place over 15 days and totalled 2 hours.</td>
<td>- Both groups improved significantly over time as a result of treatment on all AAT measures (p&lt;0.001). - Both groups improved significantly on all measures of CAL (p&lt;0.05). - There were no significant differences in how either group improved on outcome measures.</td>
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<td>Johnson et al. (2014)</td>
<td>Population: Mean age=70.8±6.6yr; Gender: NA.</td>
<td>Intervention: Participants received 3.5hr of training, every weekday for 3wk. The training model was based on a restructured protocol of constraint-induced aphasia therapy (CIAT). Assessments were conducted at baseline, post-treatment, and at 6mo follow-up.</td>
<td>- At post-treatment, a significant mean gain on the VAL was found in all participants (ΔM=2.1, p=0.022). - Significant improvement on the VAL was also found at follow-up compared to post-treatment (ΔM=0.4, p=0.042). - The change in the mean WAB-R AQ score approached significance post-treatment (ΔM=13.1±9.9, p=0.077).</td>
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<td>Mohr et al. (2014)</td>
<td>Population: Mean age=63.4yr; Gender: Males=7, Females=1.</td>
<td>Intervention: Participants took part in 2wk of constraint induced aphasia therapy (CIAT), which was administered for 3-4hr/d for 10d.</td>
<td>- A significant improvement was found after the intervention on the BDAB auditory comprehension subscale (p=0.032), on the BNT subscale (p=0.029), and on the Token Test (p=0.048). - No significant improvements were found on the synaptic processing subscale of the BDAB. - Participants were significantly more accurate at selecting the correct probe word for low compared to high-ambiguity sentences (p&lt;0.001), however no difference in the proportion of correct answers was observed between pre and post-treatment.</td>
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**TPS**<sup>exp</sup>=36.7d
TPS<sub>core</sub>=32.9d
N<sub>Start</sub>=100
N<sub>End</sub>=100

**Intervention:** The EG received constraint-induced aphasia therapy (CIAT) for 2hr/d over a 15d, 3wk period for a total of 30hr of treatment. Additionally, the EG was offered a group communication treatment. The CG received standard treatment that focused on the training of specific communicative deficits.

**Outcomes:** Aachen Aphasia Test (AAT): spontaneous speech, repetition, Token Test, written language, naming, comprehension; Communicative Activity Log (CAL): language comprehension and amount of communication.

**TPS**=34.8 days
RCT (USA)
Sickert et al. (2014)
No Score
TPS<sub>mean</sub>=3.9yr
N<sub>Start</sub>=12
N<sub>End</sub>=8

**Population:** Mean age=60.7±8.5yr; Gender: Males=22, Females=18.

**Intervention:** Participants were only allowed to respond verbally. The training model was based on a restructured protocol of constraint-induced aphasia therapy (CIAT). Assessments were conducted at baseline, post-treatment, and at 6mo follow-up.

**Outcomes:** Aachen Aphasia Test (AAT): spontaneous speech, repetition, Token Test, written language, naming, comprehension; Aachen Aphasia Battery-Revised (WAB-R): Aphasia Quotient (AQ).
14. Aphasia and Apraxia

14.3.12 Repetitive Transcranial Magnetic Stimulation (rTMS)

Table 14.3.12 Repetitive Transcranial Magnetic Stimulation (rTMS) for Treatment of Nonfluent Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Martin et al. (2004)</td>
<td>International</td>
<td>No Score</td>
<td>TPS=chronic</td>
<td>N=NA</td>
<td>Intervention: Phase 1: Slow, 1Hz rTMS was applied for 10min to 4 R perisylvian language homologues in separate treatment sessions with six chronic stroke patients (1-30 yr post left hemisphere stroke). Immediately following each session, naming ability was tested using a list of 20 Snodgrass and Vanderwart pictures. Five test lists were generated each with the same level of difficulty. Phase 1 was intended to identify which region was associated with the best response following stimulation. Phase 2: Four chronic aphasia patients received slow, 1 Hz rTMS for 20min 5d/wk for 2wk to the area identified as having the best response in phase 1 of the trial. Testing was conducted prior to treatment, at the end of treatment and at 2mos. Outcomes: Boston Naming Test (BNT) (first 20 items); Boston Diagnostic Aphasia Exam (BDAE): animal naming, tools/implements naming; Snodgrass and</td>
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<td>Study</td>
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<td>Outcomes</td>
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| **Naeser et al. (2005)** | **Intervention**: Four stroke patients with chronic, nonfluent aphasia were treated with 1 Hz rTMS applied to the anterior part of R Broca's homologue (pars triangularis) for 20min/d, 5d/wk for 2wk (10 treatments in total). Patients were assessed 1-2wk prior to treatment and at 2wk, 2mos and 8mos post-treatment. | 1. Immediately following treatment, there was significant improvement on number of pictures named (p=0.028) and reaction time (p=0.04).  
2. At 2wk, patients showed significant improvement on the BDAE animal naming subtest (p=0.02).  
3. At 2mos, there was significant improvement on the BNT (p=0.003) and on the animal naming (p=0.02) and the tools/implements naming (p=0.04) subtests of the BDAE.  
4. At 8mos, scores continued to improve relative to baseline, but only the Tools/Implements subtest was significant (p=0.003).  
5. Improvements were also noted in number of words per phrase used in the Cookie Theft picture subtest of the BDAE at 2mos, though these were not sustained.  
6. No patients experienced negative side effects. |
| **Barwood et al. (2011)** | **Intervention**: 12 stroke patients with chronic aphasia were randomized to receive either treatment with 1Hz rTMS for 20min/d for 2wk or a placebo treatment (rTMS using a sham coil). Assessments were performed at baseline and 1wk post-treatment. Results of repeat assessments undertaken at 2mos post-stimulation are reported in Barwood et al. (2010). | 1. The treatment group performed significantly better than the control group on the following subtests: BDAE naming actions, BDAE naming tools and instruments, BDAE repetition of sentences, Cookie Theft picture description complexity index, Cookie Theft picture description longest words per phrase, commands, and the overall BDAE score from the subtests used in the study (p<0.05 for all but the Cookie Theft picture description longest words per phrase which had a p<0.01).  
2. Patients from the treatment group also performed significantly better on the BNT (p<0.05) and in the latency (p<0.01) and accuracy (p<0.05) portions of the Picture Naming assessment. |
| **Weiduschat et al. (2011)** | **Intervention**: A total of 10 stroke patients were randomly assigned to a treatment (n=6) (TG) or a control (n=4) (CG) group. The treatment group received 1 Hz rTMS over the right-hemispheric Broca homologue while control patients received 1 Hz rTMS over the vertex. All rTMS stimulations occurred 5d/wk for 2wk and were followed by 45min of speech and language therapy. All patients received model-oriented aphasia therapy. Outcome measures were assessed at baseline and directly following the 2wk treatment. | 1. It was found that, in the TG, the LI shifted significantly more to the left than the LI of the CG (p=0.008) suggesting suppression of an inferior adaptive strategy used for aphasia patients.  
2. Over time, individuals in the TG demonstrated significant improvement in total AAT scores (p=0.002), while the CG did not (p=ns).  
3. Significant changes in naming function were seen only in the group receiving rTMS. |
<table>
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<tr>
<th>Study</th>
<th>Intervention</th>
<th>Outcomes</th>
<th>Results</th>
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<tr>
<td><strong>Barwood et al.</strong>&lt;br&gt;(2011)&lt;br&gt;Australia&lt;br&gt;(f/u study)&lt;br&gt;TPS=NA&lt;br&gt;N=12</td>
<td><strong>Intervention:</strong> Results of repeat assessments (n=12) at 2mos post-stimulation (see Barwood et al. 2011, above).&lt;br&gt;<strong>Outcomes:</strong> Boston Diagnostic Aphasia Examination (BDAE): naming actions, naming tools and instruments, repetition of sentences, Cookie Theft picture description complexity index, Cookie Theft picture description longest words per phrase, commands; Boston Naming Test (BNT); Picture Naming assessment: latency, accuracy.</td>
<td>1. The treatment group scored significantly higher on the following tests: BDAE naming actions (p&lt;0.01), BDAE naming tools and instruments (p&lt;0.05), BDAE repetition of sentences (p&lt;0.05), Cookie Theft picture description complexity index (p&lt;0.05), Cookie Theft picture description longest words per phrase (p&lt;0.01), Commands (p&lt;0.05), and the overall BDAE score from the subtests used in the study p&lt;0.01), the BNT (p&lt;0.05) and in the latency (p&lt;0.05) and accuracy (p&lt;0.05) portions of the Picture Naming assessment.</td>
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<td><strong>Szaflarski et al.</strong>&lt;br&gt;(2011)&lt;br&gt;USA&lt;br&gt;No Score&lt;br&gt;TPS=NA&lt;br&gt;N=8</td>
<td><strong>Intervention:</strong> Eight patients that experienced a left middle cerebral artery stroke with moderate to severe aphasia underwent treatment of rTMS using fMRI. The rTMS was localized to the left-hemisphere Broca’s area and was applied for 200s during 10 daily treatments using a procedure called intermittent theta burst stimulation (iTBS). Assessments were performed within a week of initiating treatment and within a week of completing treatment.&lt;br&gt;<strong>Outcomes:</strong> Boston Naming Test; Controlled Oral Word Association Test; Semantic Fluency Test; Boston Diagnostic Aphasia Examination: complex ideation; Peabody Vocabulary Test IV; mini-Communicative Abilities Log (CAL).</td>
<td>1. Significant improvements were observed in semantic fluency (p=0.028) and a trend towards significant improvement was seen on the CAL (p=0.075).&lt;br&gt;2. All other tests showed no significant difference from pre-treatment measures.</td>
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<td><strong>Waldowski et al.</strong>&lt;br&gt;(2012)&lt;br&gt;Poland&lt;br&gt;RCT&lt;br&gt;PEDro=8&lt;br&gt;TPS=NA&lt;br&gt;N=26</td>
<td><strong>Intervention:</strong> 26 participants with a confirmed stroke and resulting aphasia were randomized to receive either real inhibiting rTMS or sham rTMS for 5d/wk for 3wk. Both groups also received 45min of speech/language therapy immediately following rTMS treatment/sham. Assessments were completed at baseline, immediately following treatment, and at 15wk follow-up.&lt;br&gt;<strong>Outcomes:</strong> Computerized Picture Naming Test (CPNT).</td>
<td>1. Both treatment and control groups improved significantly on naming ability during the treatment period, however, there were no significant differences observed between group at any time point.&lt;br&gt;2. The treatment group demonstrated slightly better reaction times immediately following rTMS (Bonferroni corrected p=0.048), however, this difference was not maintained at 15wk follow-up.</td>
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<td><strong>Kindler et al.</strong>&lt;br&gt;(2012)&lt;br&gt;Switzerland&lt;br&gt;RCT&lt;br&gt;PEDro=5&lt;br&gt;TPS=NA&lt;br&gt;N=18</td>
<td><strong>Intervention:</strong> 18 participants with aphasia following first ever stroke were included. Patients were randomized to receive either a Theta Burst Stimulation (TBS) application of rTMS (30Hz pulses x 267 bursts) which took approximately 44s, or a sham condition. Participants underwent two sessions separated by a 1wk period. Assessments were administered both before and immediately following treatment.&lt;br&gt;<strong>Outcomes:</strong> Timed picture naming task; Test of Attentional Performance: Alertness test.</td>
<td>1. Significant differences were observed between groups on naming scores in favour of the treatment group (F(1,16)=7.72, p=0.013, r=0.57), as well as on naming latency (F(1,16)=7.56, p=0.014, r=0.56).&lt;br&gt;2. No between group differences were found on measures of alertness.</td>
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<td><strong>Medina et al.</strong>&lt;br&gt;(2012)</td>
<td><strong>Intervention:</strong> 10 participants with left hemisphere ischemic stroke participated. Following baseline</td>
<td>1. In all participants, the rTMS treatment produced significant improvements</td>
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assessment, participants were randomized to receive either real rTMS or sham rTMS (sTMS). In the rTMS participants, the optimal site for rTMS application was identified for each individual. Participants underwent 10 sessions over 12d. A follow-up assessment was competed 2mos following treatment. The sTMS group crossed over to the rTMS group following the 2mo follow-up and also received 10 sessions of treatment over 12d.

**Outcomes**: Cookie Theft picture description.

1. All patients experienced significant long term improvements in SLTA total score and spontaneous speech sub scores (both $p<0.01$), as well as auditory comprehension scores ($p<0.05$).
2. Significant short term improvements were observed in correct answer rates of both the SLTA ($p<0.05$) and WAB ($p<0.01$).
3. In individuals with fluent aphasia, significant long term improvements in SLTA total score ($p<0.01$), as well as the spontaneous speech sub score and reading comprehension sub scores (both $p<0.05$), were found.
4. Significant short term improvements were observed in correct answer rates on the WAB ($p<0.05$).
5. Individuals with nonfluent aphasia produced significant improvements on SLTA total score and spontaneous speech sub score only (both $p<0.05$).

**Barwood et al. (2013)**

<table>
<thead>
<tr>
<th>Australia</th>
<th>RCT</th>
<th>PEDro=8</th>
<th>TPS=Exp=3.5±1.3yr</th>
<th>TPS=Con=3.5±1.5yr</th>
<th>N Start=12</th>
<th>N End=12</th>
</tr>
</thead>
</table>

**Population**: Experimental Group (EG; N=6): Mean age=60.8±6.0yr; Control Group (CG; N=6): Mean age=67±13.1yr; Gender: Male=9, Female=3.

**Intervention**: Participants were randomized to receive either real or sham rTMS for 20min/d, 5d/wk for 2wk. Real rTMS was delivered at 1Hz to the Broca’s area. Sham rTMS produced no magnetic field or sensory stimulation but produced the same noise as in the EG. Assessments were conducted at 1wk, 2mo, 8mo and 12mo post-intervention.

**Outcomes**: Boston Diagnostic Aphasia Examination (BDAE): picture description (longest words per phrase and complexity index), word comprehension, word comprehension by category, commands, complex ideational materials, repetition (sentences, single words and non-words), responsive naming, naming screening of special categories, naming colours, naming actions, naming animals, naming tools and implements; Picture naming: total score, naming latency.

1. No significant differences in the CG were observed for any outcomes across all time points.
2. Significantly greater scores were observed in the EG compared to the CG in the following BDAE subtests post-intervention: naming actions at 8mo ($p<0.05$) and 12mo ($p<0.01$); naming tools and instruments at 2mo ($p<0.05$), 8mo ($p<0.05$) and 12mo ($p<0.01$); complex ideational materials at 8mo ($p<0.05$) and 12mo; picture description-longest words per phrase at 8mo ($p<0.01$) and 12mo ($p<0.05$); picture description-complexity index at 2mo ($p<0.05$), 8mo ($p<0.05$) and 12mo ($p<0.05$); repetition of sentences at 12mo ($p<0.05$); repetition of non-words at 2mo ($p<0.05$), 8mo ($p<0.05$) and 12mo ($p<0.05$); and commands at 8mo ($p<0.05$) and 12mo ($p<0.05$).
3. No significant group x time interactions.
were observed for the following BDAE subtests: word comprehension, word comprehension by category, repetition of single words, responsive naming, naming screening of special categories and naming colours.

4. Significantly greater scores were observed in the EG compared to the CG post-intervention on picture naming latency at 2mo (p<0.05), 8mo (p<0.05) and 12mo (p<0.05); and picture naming total score at 8mo (p<0.05) and 12mo (p<0.05).

Seniów et al. (2013) Poland RCT PEDro=8
TPS<sub>EG</sub>=33.5±24.1d
TPS<sub>Con</sub>=39.9±28.9d
N<sub>Start</sub>=40
N<sub>End</sub>=38

**Population:** Experimental Group (EG; N=20): Mean age=61.8±11.8yr; Gender: Males=8, Females=12.
Control Group (CG; N=20): Mean age=59.7±10.7yr; Gender: Males=10, Females=10.

**Intervention:** The EG received real inhibiting rTMS and the CG received sham rTMS. After either rTMS session, participants received 45min of speech language therapy (SLT). A follow-up assessment was conducted at a mean of 106.7d in the EG and 106.5d in the CG following the post-intervention assessment.

**Outcomes:** Boston Diagnostic Aphasia Examination (BDAE): naming, repetition, comprehension.

1. A two factor ANOVA analysis of time and group for the BDAE-Comprehension test revealed a significant effect of time (p<0.0005); however, post-hoc comparisons revealed no significant between-group differences post-treatment (p=0.49) or at follow-up (p=0.21).
2. A two factor ANOVA analysis of time and group for the BDAE-Repetition subtest revealed a significant effect of time (p=0.001) and an effect of group that approached significance (p=0.053); no significant interaction was observed between factors (p=0.1).
3. A two factor ANOVA analysis of time and group for the BDAE-Naming subtest revealed a significant effect of time (p=0.001) with no main effect of group (p=0.12) and an interaction effect that approached significance (p=0.059).

Heiss et al. (2013) Germany RCT PEDro=5
TPS<sub>EG1</sub>=39.7±18.4d
TPS<sub>EG2</sub>=59±48.1d
TPS<sub>Con</sub>=50.1±24.0d
N<sub>Start</sub>=41
N<sub>End</sub>=31

**Population:** Experimental Group 1 (EG1; N=15): Mean age=68.5±8.2yr; Gender: NA. Experimental Group 2 (EG2; N=2): Mean age=68±5.7yr; Gender: NA. Control Group (CG; N=14): Mean age=69.0±6.3yr; Gender: NA.

**Intervention:** EG1 was comprised of right-handed participants that received 20min of inhibitory 1Hz rTMS, EG2 was comprised of left-handed participants that also received 20min of rTMS but were analyzed separately, and the CG consisted of right-handed participants that received sham stimulation. Participants in both groups also received 45min of deficit-specific aphasia therapy.

**Outcomes:** Aachen Aphasia Test (AAT): global comprehension, Token Test, naming, written, repetition.

1. The change in global AAT test scores between baseline and follow-up was significantly greater in EG1 (ΔM=22.4±11.77) compared to the CG (ΔM=8.6±10.06) (p=0.002).
2. A two factor ANOVA analysis of treatment and AAT subtest in EG1 revealed a significant main effect of treatment (p=0.002) but no significant effect of subtest (p=0.209) and no interaction between factors (p=0.938), indicating that all AAT subtests contribute equally to the observed treatment effect in EG1.
3. EG2 also improved on the AAT, with one participant showing a treatment effect (ΔM=23.0) within the 95% CI of the EG1, while the second participant showed improvement in the AAT considered less
<table>
<thead>
<tr>
<th>Study</th>
<th>Location</th>
<th>Design</th>
<th>PEDro Score</th>
<th>TPS Exp</th>
<th>TPS Con</th>
<th>N Start</th>
<th>N End</th>
<th>Population</th>
<th>Intervention</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Thiel et al. (2013)</td>
<td>Canada</td>
<td>RCT</td>
<td>5</td>
<td>37.5±18.5d</td>
<td>50.6±22.6d</td>
<td>30</td>
<td>24</td>
<td>Experimental Group (EG; N=13): Mean age=69.8±8.0yr; Gender: NA. Control Group (CG; N=11): Mean age=71.2±7.8yr; Gender: NA.</td>
<td>The EG received 20min of inhibitory 1Hz rTMS over the right triangular part of the posterior inferior frontal gyrus. The CG received sham rTMS over the midline at the vertex. Both groups also received 45min of deficit-specific aphasia therapy.</td>
<td>Aachen Aphasia Test (AAT): comprehension, Token Test, naming, writing, repetition.</td>
</tr>
<tr>
<td>Tsai et al. (2014)</td>
<td>Taiwan</td>
<td>RCT</td>
<td>9</td>
<td>17.8±7.2mo</td>
<td>18.3±8.2mo</td>
<td>56</td>
<td>53</td>
<td>Experimental Group (EG; N=33): Mean age=62.3±12.1yr; Gender: Males=24, Females=9. Control Group (CG; N=23): Mean age=62.8±14.5yr; Gender: Males=17, Females=6.</td>
<td>The EG underwent 10min of 1-Hz rTMS treatment for 10 consecutive days. The CG received sham rTMS for the same duration. All subjects from both groups also participated in a conventional speech rehabilitation program and received other standard medical treatments. Daily, participants received the same 1hr speech therapy &lt;30min after undergoing rTMS or sham stimulation.</td>
<td>Concise Chinese Aphasia Test (CCAT): conversation, family picnic picture description, expression, repetition; Picture Naming Test (PNT): object and action naming reaction time and naming accuracy.</td>
</tr>
</tbody>
</table>

1. The change in the global AAT score was significantly higher in the EG (ΔM=23.6±12.15) compared to the CG (ΔM=7.5±11.00) (p=0.003).
2. A two factor ANOVA analysis of treatment and AAT subtests revealed a significant effect of treatment (p=0.003) but no interaction between treatment and subtest.
3. A significant difference in improvement between groups was observed only on the naming subtest of the AAT (p=0.002) with differences approaching significance on subtests of comprehension (p=0.082), Token Test (p=0.078) and writing (p=0.065); a greater mean increase in all subtest scores was observed in the EG compared to the CG.
4. A two factor ANOVA analysis of group and aphasia type revealed no significant effects and no interaction between factors.

1. The EG demonstrated statistically significant within-group differences from pre-to post-intervention for the overall CCAT score (p=0.001) and in the CCAT subtests of conversation (p=0.002), expression (p=0.002), and repetition (p=0.012); no within group difference was observed for picture description.
2. After the rTMS intervention, the EG also demonstrated a significantly greater improvement compared to the CG for the overall CCAT score (p<0.001) and in the CCAT subtests of conversation (p=0.032), picture description (p=0.024), expression (p=0.002) and repetition (p=0.023).
3. The EG also showed a greater improvement compared to the CG in the PNT subcategories of object naming accuracy (p=0.01), action naming accuracy (p=0.003), object naming reaction time (p=0.004), and action naming reaction time (p=0.005).
4. At 3mo post-intervention, the differences between EG and CG on the CCAT were maintained with the EG showing a greater improvement from baseline to 3mo follow-up in the overall CCAT score (p=0.008) and in the CCAT subtests of picture description (p=0.031), expression (p=0.026) and
### Chieffo et al. (2014)

**Italy**

Cross-over RCT

PEDro=8

TPS\text{mean}=3.2±1.6yr

N\text{Start}=5

N\text{End}=5

**Population:** Mean age=54.8±8.4yr; Gender: Males=3, Females=2.

**Intervention:** Participants received excitatory (10Hz), inhibitory (1Hz), and sham rTMS in a randomized sequence. Each treatment was provided once with a 6d washout period in between. Assessments were conducted at baseline and at pre- and post-treatment for each rTMS session.

**Outcomes:** Snodgrass Naming Test (SNT).

1. ANOVA analysis revealed a significant difference in the percentage of correct answers on the SNT between baseline and post-intervention (p=0.041).
2. Post hoc analysis revealed that only excitatory rTMS was associated with a significant improvement on the SNT in comparison to baseline (p=0.042) and to the post-inhibitory stimulation assessment (p=0.043).
3. Within session comparisons revealed that improvement on the SNT was only associated with excitatory rTMS (p=0.043).

### Wang et al. (2014)

Taiwan

RCT

PEDro=8

TPS\text{EG1}=16.8±6.4mo

TPS\text{EG2}=15.7±8.5mo

TPS\text{Con}=16.1±7.3mo

N\text{Start}=45

N\text{End}=43

**Population:** Experimental Group 1 (EG1; N=15): Mean age= 61.3±13.2yr; Gender: Males=14, Females=1. Experimental Group 2 (EG2; N=15): Mean age=62.1±12.7yr; Gender: Males=13, Females=2. Control Group (CG; N=15): Mean age=60.4±11.9yr; Gender: Males=13, Females=2.

**Intervention:** All participants received either real or sham 1-Hz rTMS over the Broca’s area for 20min/d over 10 daily sessions. Participants in EG1 received real rTMS coupled with a synchronous picture-naming task. Participants in EG2 received real rTMS followed by a picture-naming task for 20min. Participants in the CG received sham rTMS combined with a 20min concurrent naming task. Each participant also received a 60min speech training session 2/wk.

**Outcomes:** Concise Chinese Aphasia Test (CCAT): conversation (Conv), describing a family picnic picture (Desp), naming objects and their use (Exp); Picture Naming test: action-naming, object-naming.

1. EG1 demonstrated statistically significant improvement from pre to post-intervention on all language tests, including total CCAT score (p<0.001), subtests of Conv (p<0.001), Desp (p=0.002), Exp (p=0.001), action-naming accuracy (p=0.011), and object-naming accuracy (p=0.003) at post-intervention; and in total CCAT score (p=0.003), Exp (p=0.019), action-naming accuracy (p=0.006), and object naming accuracy (p=0.003) at the 3mo follow-up.
2. EG2 demonstrated statistically significant improvements in total CCAT score both at post-intervention (p=0.004) and the 3mo follow-up (p=0.017), and in Conv at post-intervention (p=0.014).
3. CG demonstrated statistically significant improvements in action-naming accuracy at post-intervention (p=0.046) and a non-significant improvement in object-naming accuracy at the 3mo follow-up; the CG demonstrated no improvement on the CCAT.
4. Intergroup comparisons for overall CCAT score revealed significant differences between EG1 and EG2 only at post-intervention (p<0.001) and between EG1 and CG post-intervention and at the 3mo follow-up (p<0.05).
5. Intergroup comparisons for Conv CCAT scores revealed significant differences between EG1 and CG post-intervention and at the 3mo follow-up (p<0.05 for both); no significant differences were observed between EG1 and EG2.
6. Intergroup comparisons for Desp CCAT scores revealed significant differences between EG1 and EG2 at post-intervention repetition (p=0.013).
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Type</th>
<th>PEDro Score</th>
<th>TPS (mo)</th>
<th>N Start</th>
<th>N End</th>
<th>Population</th>
<th>Intervention</th>
<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Khedr et al. (2014)</td>
<td>Egypt</td>
<td>RCT</td>
<td>7</td>
<td>5</td>
<td>30</td>
<td>29</td>
<td>Experimental Group (EG; N=19): Mean age=61.0±9.8yr; Gender: Males=8, Females=11. Control Group (CG; N=10): Mean age=57.4±9.6yr; Gender: Males=5, Females=5. <strong>Intervention:</strong> The EG received real rTMS and the CG received sham rTMS. Each participant received 1000 rTMS pulses (1 Hz) over the unaffected right Broca’s area and 1000 pulses (20 Hz) over the affected left Broca’s area for 10 consecutive days. Assessments were conducted before and after the 10 sessions, and at 1mo and 2mo following the last session. <strong>Outcomes:</strong> Hemispheric Stroke Scale (HSS)-Language: comprehension, naming, repetition, fluency; Aphasia Severity Rating Scale (ASRS); Stroke Aphasic Depression Questionnaire Hospital Version (SADQ-H); National Institute of Health Stroke Scale (NIHSS); Hand grip strength.</td>
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<tr>
<td>Yoon et al. (2015)</td>
<td>South Korea</td>
<td>PCT</td>
<td>No Score</td>
<td>6.8±2.4 to 5.2±2.7</td>
<td>20</td>
<td>20</td>
<td>Experimental Group (EG; N=10): Mean age=60.64±9.63yr; Gender: Males=8, Females=2. Control Group (CG; N=10): Mean age=60.5±9.6yr; Gender: Males=7, Females=3. <strong>Intervention:</strong> EG received rTMS sessions for 5d/wk over 4wk and additionally received speech-language therapy (SLT). The CG received only SLT. Both groups received SLT for 60min/d, 2/wk for 4wk.</td>
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</table>

7. Intergroup comparisons for Exp CCAT scores revealed significant differences between EG1 and EG2 post-intervention and between EG1 and CG post-intervention and at the 3mo follow-up (p<0.05 for all).
8. For the Picture Naming test, action and object naming abilities were significantly greater in EG1 compared to EG2 (p=0.02; p=0.008) and in EG1 compared to CG (p=0.003; p=0.001) at post-intervention; the comparisons between EG1 and EG2 and between EG1 and CG remained significant at the 3mo follow-up (p<0.05).

1. Improvement on the ASRS was greater in the EG (ΔM=1.8±1.2) compared to the CG (ΔM=0.9±0.3) indicated by a significant interaction of time and group (p=0.018).
2. A significantly greater improvement in the overall HSS language score was observed in the EG compared to the CG both after the treatment and at the 1 and 2mo follow-up (p=0.00; p=0.003; p=0.01).
3. A significantly greater improvement in the EG compared to the CG was found in all four main items of the HSS-Language subscale (comprehension: p=0.04; naming: p=0.0; repetition: p=0.002; fluency: p=0.025).
4. A significant group by time interaction was observed on the SADQ-H (p=0.02) with significantly better scores observed in the EG compared to the CG at post-intervention and 1mo post-intervention (p=0.006; p=0.04) but not 2mo post-intervention.
5. A significant group by time interaction was observed on the NIHSS (p=0.03), however no significant differences were observed between groups.
6. No significant group by time interaction was observed for grip strength, indicating a similar increase in strength within both groups.
Outcomes: Korean version of the Western Aphasia Battery (K-WAB): spontaneous speech, comprehension, repetition, naming, Aphasia Quotient (AQ).

3. For AQ, spontaneous speech, repetition and naming, there were no significant differences in improvement from baseline to post-intervention between groups.
4. For comprehension, there was a significant difference in improvement from baseline to post-intervention between groups (p<0.05) with the EG showing greater improvement than the CG.


Population: Repetitive Transcranial Magnetic Stimulation group (EG; n=15): Mean age=67.9±8.12yr; Gender: Males=5, Females=10. Sham Stimulation group (EG; n=15): Mean age=69.6±6.67yr; Gender: Males=9, Females=6.

Intervention: Participants were randomly allocated to receive 1Hz repetitive transcranial magnetic stimulation (EG) over Brodmann Area 45 or sham-tTMS for 10, 20min over 2wk. All participants underwent traditional speech and language therapy. Outcomes were assessed at baseline and 2wk.

Outcomes: Aachen Aphasia Test (AAT); Amsterdam-Nijmegen Everyday Language Test (ANELT); Naming Screening; Functional Independence Measure (FIM).

1. The EG group showed a significantly greater improvement in AAT Profile Score (p=0.006), Written Language (p=0.036), Naming (p=0.006), and Comprehension (p=0.04), as well as ANELT (p=0.05) at 2wk compared to the CG group.
2. There was no significant difference between groups at 2wk in AAT Token Test (p=0.08) and Repetition (p>0.05), as well as Naming Screening (p=0.064) or FIM (p>0.05).

14.3.13 Transcranial Direct Current Stimulation

Table 14.3.13 Transcranial Direct Current Stimulation (tDCS) on Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Monti et al. (2008)</td>
<td>Italy</td>
<td>No Score</td>
<td>TPS=chronic</td>
<td>N=8</td>
<td>Intervention: Eight individuals with chronic non-fluent aphasia participated in sessions of anodal, cathodal and sham tDCS over i) Broca’s region or ii) occipital areas. 2mos lapsed between i and ii. A tDCS of 2mA, for 10min was delivered via a constant current electrical stimulator connected to two electrodes. Patients were assigned to an “anodal” (anodal stimulation + sham) or “cathodal” (cathodal stimulation + sham) group. Testing of active (anodal or cathodal) and sham tDCS were conducted in random order and at least 1wk lapsed between sessions. Assessment was conducted immediately before and following each session.</td>
</tr>
<tr>
<td>Study</td>
<td>Location</td>
<td>Study Design</td>
<td>PEDro Score</td>
<td>TPS Mean Age</td>
<td>N Start</td>
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<tr>
<td>Baker et al. (2010)</td>
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<td>RCT</td>
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<td>Kang et al. (2011)</td>
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<td>No Score</td>
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<tr>
<td>Marangolo et al. (2013a)</td>
<td>Italy</td>
<td>Cross-over RCT</td>
<td>9</td>
<td>37.2±22.2mo</td>
<td>12</td>
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<td>Fiori et al. (2013)</td>
<td>Italy</td>
<td>Cross-over RCT</td>
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order in which they received separate verb and noun naming treatments with an interval of 1mo in between the two interventions. Participants also received tDCS for 20min during the action and noun naming treatments under three different simulation conditions: (1) stimulation of the left Wernicke’s area; (2) stimulation of the left Broca’s area; and (3) sham stimulation. Each stimulation condition was administered for 5d (T1-T5) with a 6d intersessional interval. Outcomes were assessed at T1 and T5 after each stimulation condition and at 1 and 4wk after the end of each intervention phase. Effects of stimulation condition, task (noun vs. verb) and time were analyzed.

**Outcomes:** Response accuracy on the verb and noun naming tasks.

Improved at the end of each stimulation period (p=0.000); no significant effects were observed for task or stimulation condition.

2. There was a statistically significant interaction between time, task and stimulation condition for response accuracy (p=0.000); post-hoc analysis revealed a significant improvement in correct responses on both the noun and verb tasks after each stimulation condition (Wernicke’s: p=0.000, p=0.012; Broca’s: p=0.040, p=0.000; sham: p=0.043, p=0.019).

3. There were no significant differences in performance on the noun and verb tasks between stimulation conditions at each T1 measurement.

4. The mean percentage of correct nouns was significantly greater following the Wernicke’s condition compared to the other two conditions (Wernicke vs. Broca: p=0.002; Wernicke vs. Sham: p=0.000); no significant difference was observed between the sham and Broca’s conditions.

5. The mean percentage of correct verbs was statistically significantly greater in subjects following the Broca’s condition compared to the other two conditions (Broca vs. Wernicke p< 0.000; Broca vs. Sham p=0.000); no significant difference was observed between sham and Wernicke’s conditions.

6. Analysis of follow-up results showed a statistically significant effect of stimulation condition (p=0.010), indicating a greater response accuracy for Wernicke’s and Broca’s conditions vs. sham; no significant effects of task or time were observed.

7. At follow-up, there was a statistically significant interaction between task and stimulation condition (p=0.000).

8. Follow-up results showed there was a statistically significantly greater mean percentage of correct nouns in the Wernicke’s condition than that of the other two conditions (p=0.000); no significant difference was observed between Broca’s and sham conditions.

9. Follow-up results showed that Broca’s stimulation was associated with a statistically significantly higher accuracy of verbs compared to the other two conditions (p=0.000); no significant difference was
<table>
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<tr>
<th>Study</th>
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<th>Intervention</th>
<th>Outcomes</th>
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<tr>
<td><strong>Marangolo et al.</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(2013b) Italy Cross-over RCT PEDro=8 TPSmean=29±2.2mo NStart=8 NEnd=8</td>
<td>Population: Mean age=55±9.6yr; Gender: Males=4, Females=4. Intervention: All participants received both real and sham tDCS delivered to the Broca’s area in a randomized order. The active or sham conditions were administered for 10d each with a 14d intermission between conditions. Participants also received language therapy concurrent with tDCS where they attempted to repeat auditorily presented stimuli. Assessments were conducted before, after, and at 1wk follow-up. Outcomes: The proportion of correct syllables, words and sentences; Vocal reaction time: words and sentences.</td>
<td>1. The mean percentage accuracy for syllables, words, and sentences was significantly greater in the real stimulation compared to the sham condition, both after the treatment (p=0.027; p=0.000; p=0.009) and at follow-up (p=0.041; p=0.004; p=0.041). 2. The mean vocal reaction times for words and sentences were significantly faster in the real stimulation compared to the sham condition after the treatment (p=0.013; p=0.006), and at follow-up (p=0.042; p=0.048).</td>
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<td><strong>Polanowska et al.</strong></td>
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<tr>
<td>(2013a) Poland RCT PEDro=8 TPSExp=63.5±43d TPSCon=55.7±44.8d NStart=40 NEnd=37</td>
<td>Population: Experimental Group (EG; N=18): Mean age=57.6±9.6yr; Gender: Males=11, Females=7. Control Group (CG; N=19): Mean age=62±11.9yr; Gender: Males=13, Females=6. Intervention: The EG received language therapy in combination with excitatory anodal-tDCS. They received 15 sessions of real anodal-tDCS at an intensity of 1mA for 10min. The CG received the same therapy but with sham stimulation. Outcomes: Boston Diagnostic Aphasia Examination (BDAE): naming, comprehension, repetition.</td>
<td>1. Both groups demonstrated statistically significant improvements in all language outcome measures (p&lt;0.05). 2. There were no significant differences between groups in short or long term tDCS effects for naming function, comprehension, or repetition. Effect sizes for all three outcome measures were observed to be higher in the EG (moderate effect sizes) compared to the CG (smaller effect sizes) but these differences were not statistically significant. 3. The analysis of test scores at the 3mo follow-up assessment showed that there were no statistically significant differences between groups in naming, comprehension, or repetition.</td>
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<tr>
<td><strong>Marangolo et al.</strong></td>
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<tr>
<td>(2013c) Italy Cross-over RCT PEDro=7 TPSchronic N=7</td>
<td>Intervention: Seven participants with left hemisphere stroke at least 6mos prior to study baseline were included. Participants received tDCS (1mA) therapy of anodic simulation on Wernicke’s area, anodic simulation of Broca’s area, or sham simulation for 20min intervals. During application of tDCS, participants completed an action naming task of video clips of actions as they appeared on a computer screen. Each participant underwent a randomly chosen experimental condition in five consecutive daily sessions over 3wk with 6d of intersession interval during which subjects underwent intensive language training. Assessments were completed 1wk and 4wk following training. Outcomes: Naming assessments.</td>
<td>1. A significant effect of time vs. fifth training day vs. condition was observed (F2,12 = 8.88; p=0.004). 2. The mean percentage of correct responses was significantly greater in the anodic Broca’s condition than in the other two conditions (p=0.004). This was also observed at both follow up time points.</td>
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<tr>
<td><strong>Marangolo et al.</strong></td>
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<tr>
<td>Population: Mean age=62.43±3.59yr; Gender:</td>
<td>1. The mean percentage of correct responses observed between Wernicke’s and sham conditions. 10. Follow-up results were consistent between 1 and 4wk post-treatment.</td>
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<tr>
<td>Study</td>
<td>Country</td>
<td>Design</td>
<td>PEDro</td>
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<tr>
<td>Polanowska et al. (2013b)</td>
<td>Poland</td>
<td>Cross-over RCT</td>
<td>7</td>
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<tr>
<td>Lee et al. (2013)</td>
<td>South Korea</td>
<td>Cross-over RCT</td>
<td>6</td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Type</td>
<td>PEDro</td>
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<tr>
<td>Santos et al. (2013)</td>
<td>Brazil</td>
<td>Pre-post</td>
<td>8</td>
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<tr>
<td>Marangolo et al. (2014)</td>
<td>Italy</td>
<td>Cross-over RCT</td>
<td>8</td>
</tr>
<tr>
<td>Rosso et al. (2014)</td>
<td>France</td>
<td>Cross-over RCT</td>
<td>7</td>
</tr>
</tbody>
</table>
### Vestito et al. (2014)

**Italy**  
**Case Series**  
**No Score**  
**TSP_{mean}=36.6\pm23.8mo**  
**N_{start}=3**  
**N_{end}=3**

**Population:** Persons with Aphasia (PWA); Mean age=64.6±2.5yr; Gender: Males=2, Females=1.  
**Intervention:** Participants received 10 consecutive sessions (5d/wk for 2wk) of anodal (A) tDCS (20min, 1.5mA) and sham (S) tDCS over the left frontal (perilesional) region, coupled with simultaneous picture naming training. A-tDCS and S-tDCS were both administered during one session with a 60min washout period in-between. Participants were followed up to 21wk post-stimulation.  
**Outcomes:** Aachener Aphasia Test (AAT); Boston Naming Test (BNT); Naming performance on the picture naming task.

6. A non-significantly greater proportion of BA+ participants responded to tDCS compared to BA- participants (p=0.13).

1. Naming performance was significantly better during A-tDCS compared to S-tDCS in two participants at all time points and in one participant during all points in the first week but only in the last 3d of the second week (p<0.05).  
2. Naming performance in all participants remained significantly better compared to baseline until 16wk post-intervention (p<0.05).  
3. One participant showed significant improvement on both the AAT and BNT up to 12wk post-intervention (p<0.05), one participant showed a significant improvement on only the AAT (p<0.01) and a non-significant improvement on the BNT up to 12wk post-stimulation and one participant showed a non-significant improvement in both the AAT and BNT during follow-up.  
4. Results of the AAT and BNT persisted above baseline up to 21wk post-stimulation in all participants.

### Richardson et al. (2015)

**USA**  
**Cross-over RCT**  
**PEDro=5**

**TSP_{mean}=100.2\pm91.9mo**  
**N_{start}=8**  
**N_{end}=8**

**Population:** Mean age=60.6±8.8yr; Gender: Males=4, Females=4.  
**Intervention:** In a crossover design, participants were randomized to receive high-definition (HD)-tDCS or conventional sponge-based (CS)-tDCS first before crossing over to receive the other treatment. Each treatment was administered for 5d with a washout period of 1wk in between before crossover. Outcomes were assessed immediately following and 1wk after each treatment phase.  
**Outcomes:** Naming accuracy and the response time of accurate naming for trained and untrained items.

1. For both stimulation conditions, there was a statistically significant difference in the accuracy of trained items (CS-tDCS: p<0.01; HD-tDCS: p<0.01), but not for untrained items (CS-tDCS: p=0.96; HD-tDCS: p=0.25).  
2. For the response time, there were statistically significant differences for trained and untrained items for CS-tDCS (p<0.01; p<0.01) and HD-tDCS (p<0.01; p=0.03).  
3. Pair-wise comparisons revealed statistically significant increases in the naming accuracy of trained items with CS-tDCS from baseline to post-treatment (p=0.011) and from baseline to 1wk follow-up (p=0.012); the naming accuracy of trained items following HD-tDCS was significantly improved post-intervention compared to baseline (p=0.012) and from baseline to 1wk follow-up (p=0.028).  
4. Pair-wise comparisons revealed statistically significant differences on the accuracy of untrained item at follow-up compared to baseline (p=0.033).  
5. There were no statistically significant differences in outcome measures between
14. Aphasia and Apraxia

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Location</th>
<th>Design</th>
<th>PEDro</th>
<th>TPS (mean±SD)</th>
<th>N Start</th>
<th>N End</th>
<th>Population</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wu et al. (2015)</td>
<td>China</td>
<td>Pre-Post</td>
<td></td>
<td>4.5±1.3mo</td>
<td>12</td>
<td>12</td>
<td>Mean age=43.2±5.6yr; Gender: Males=10, Females=2.</td>
<td>Aphasic participants received 20 sessions of computer based speech language therapy (SLT) under three conditions in the following order: sham tDCS (A1); active tDCS (Phase B); and sham tDCS (A2). SLT was provided for 30min/d and tDCS was applied for 20min/d 5d/wk over 4wk.</td>
<td>Psycholinguistic Assessment in Chinese Aphasia (PACA).</td>
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<tr>
<td>Meinzer et al. (2016)</td>
<td>Australia</td>
<td>RCT(7)</td>
<td>6</td>
<td>45.7mo</td>
<td>26</td>
<td>26</td>
<td>Mean age=59.9yr; Gender: Males=18, Females=8.</td>
<td>All patients received naming therapy for 1.5 hours a day for 8 days spaced over two weeks. The intervention group also received transcranial direct current stimulation to the left primary motor cortex twice daily before each session, the control group received sham stimulation.</td>
<td>Naming ability of trained and untrained items, Aachen Aphasia Test, Communicative Effectiveness Index.</td>
</tr>
<tr>
<td>Shah-Basak et al. (2015)</td>
<td>USA</td>
<td>RCT</td>
<td>6</td>
<td>31.0±29.7mo</td>
<td>12</td>
<td>12</td>
<td>Mean age=63.6±8.6yr; Gender: Males=6, Females=3.</td>
<td>Participants were first stimulated with transcranial direct current stimulation (tDCS) and then randomly allocated to receive real-tDCS or sham-tDCS for 10 consecutive days. Participants in the sham-tDCS group than completed the real-tDCS for 10 consecutive days. Outcomes were assessed at baseline and post treatment 2wk, and 2mo.</td>
<td>Western Aphasia Battery (WAB).</td>
</tr>
<tr>
<td>Richardson et al. (2015)</td>
<td>USA</td>
<td>RCT Crossover</td>
<td>6</td>
<td>100.25±92mo</td>
<td>8</td>
<td>8</td>
<td>Mean age=60.63±8.88yr; Gender: Males=4, Females=4.</td>
<td>Participants were randomly allocated to receive conventional sponge-based tDCS (CG) or high definition tDCS (EG) for 5 consecutive days and then crossed over to the opposite treatment. All participants underwent computerized anomia treatment over the 5d. Outcomes were assessed at baseline, post treatment, and follow-up.</td>
<td>Naming Accuracy.</td>
</tr>
</tbody>
</table>

14.3.14 Unilateral Forced Nostril Breathing

Table 14.3.14 Unilateral Forced Nostril Breathing on Aphasia Recovery

1. PACA scores were significantly higher post-phase B compared to post-A1 and baseline (p<0.05 for both); no significant difference in PACA scores were observed between post-A1 and baseline and between post-A2 and post-phase B.

2. Both groups improved significantly in trained item naming over time (p<0.001), however, the tDCS group outperformed the control group (p<0.005).

3. There was a significant interaction effect for untrained items, with the tDCS group showing significant improvement over the control group (p<0.001).

4. The tDCS improved significantly on both the AAT and CEI measures (p<0.001, p<0.001).

5. 7 of the 12 subjects responded optimally to the tDCS therapy.

6. Following treatment with real-tDCS there were significant improvements in WAB at 2wk (p<0.05) and 2mo (p<0.01) compared to the sham-tDCS.

7. There was a significant improvement in naming accuracy of trained items in the EG group at post treatment (p=0.012) and follow-up (p=0.028), and in the CG group at post treatment (p=0.011) and follow-up (p=0.012).
<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshall et al. (2014)</td>
<td>USA</td>
<td>PCT</td>
<td>No Score</td>
<td>TPS\textsubscript{Exp} = 27.5±23.8mo, TPS\textsubscript{CG} = 32.0±37.8mo, N\textsubscript{Start} = 11, N\textsubscript{End} = 11</td>
</tr>
<tr>
<td>Population:</td>
<td>Experimental Group (EG; N=6): Mean age=58.2yr; Gender: Male=5, Female=1. Control Group (CG; N=5): Mean age=52.4yr; Gender: Male=4, Female=1.</td>
<td>Intervention: EG (aphasic participants) and CG (non-aphasic stroke participants) received unilateral nostril breathing (UNB) training which required participants to close one nostril and breathe through the other. The intervention was provided for 10wk, with the first 4wk consisting of instruction guided practice for 1hr/wk and the remaining 6wk consisting of individual practice performed for 5-40mins, 6-7d/wk. Assessments were conducted at baseline, at 4wk, and at post-treatment.</td>
<td>Outcomes: Beck Anxiety Inventory (BAI); Beck Depression Inventory (BDI); Aphasia Diagnostic Profiles (ADP): alternative communication, lexical retrieval, ADP severity, gestures, information units, personal information, phrase length, reading, repetition, singing, auditory comprehension, naming, writing; Controlled Oral Word Association Test (COWAT); Revised Token Test (RTT); Benton Judgement of Line Orientation Test (BJLOT).</td>
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<td>1. BAI scores significantly decreased for both groups at the 4wk assessment (p=0.0069); no difference was reported between baseline and post-treatment scores.</td>
<td>2. An ANOVA analysis of group and time for BAI scores revealed a significant main effect of time (p=0.0092); no main effect of group and no interaction between factors were observed.</td>
<td>3. An ANOVA analysis of group and time for BDI scores revealed no significant effect of time or group and no interaction between factors.</td>
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<td>4. In the EG, ADP scores for alternative communication, personal information, information units, phrase length, reading, repetition, singing, auditory comprehension, naming, writing showed a significant difference between baseline and post-intervention (p=0.001).</td>
<td>5. In the EG, ADP scores decreased from 4wk to post-treatment for all measures except for gestures, repetition, auditory comprehension and naming; only the gestures measure showed a significant difference between baseline and post-intervention (p=0.001).</td>
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<td>6. COWAT scores were significantly higher for CG compared to EG (p=0.0003) across all assessment time points; CG showed a significant improvement on the COWAT from baseline to post-treatment (p=0.001).</td>
<td>7. RTT scores were not significantly different within both groups from baseline to post-intervention; scores in the CG were significantly higher compared to EG (p=0.0088).</td>
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<td>8. BJLOT scores were not significantly different within both groups from baseline to post-intervention; scores in the CG were significantly higher compared to EG (p=0.0370).</td>
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</table>

| Marshall et al. (2015) | USA | Case Series | No Score | TPS\textsubscript{mean} = 18.3±5.5mo, N\textsubscript{Start} = 3, N\textsubscript{End} = 3 |
| Population: | Mean age=58±13.9yr; Gender: Males=1, Females=2. | Intervention: Participants received unilateral forced nostril breathing (UFNB) for 40min/d for a mean of 14wk in addition to conventional aphasia therapy. Assessments were conducted before and after the intervention. | Outcomes: Western Aphasia Battery-Revised (WAB- |
| | 1. From pre to post-treatment, CADL-2 scores and WAB-R scores increased in two participants. | 2. For the two participants with apraxia of speech (AOS), the ABA scores did not clearly improve. | 3. Overall, some changes were observed in the total number of CIUs and word |

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R); Communication Abilities of Daily Living-2 (CADL-2); Apraxia Battery for Adults (ABA); Color Trials Test (CTT); Number of correct information units (CIU); Word productivity.

4. No marked improvement from baseline to post-treatment was found on the CTT.

14.4 Rehabilitation of Specific Aphasic Deficits

14.4.1 Specific Treatment for Word-Retrieval Deficits

Table 14.4.1 Treatment for Word-Retrieval Deficits in Aphasia Rehabilitation Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year Country PEDro Score TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saito &amp; Takeda (2001) Japan No Score TPS=NA</td>
<td>Intervention: 11 mildly to moderately impaired aphasic patients with word-retrieval deficits but no comprehension problems were included in this within-subject study design. Four different cueing conditions were investigated for their effect on target retrieval: phonological, semantically-related, semantic category member, and baseline (no cue). 68 black and white pictures were used as experimental stimuli and six cues were chosen for each picture (three for each type of semantic cue). The study continued for 3 sessions (3d) during which each subject performed a picture-naming task and then a picture-word matching task. Outcomes: Number of correct responses.</td>
<td>1. The phonological cue condition prompted significantly more correct responses than the other cue conditions. 2. There was no significant difference in the number of correct responses received between the category member and baseline cue conditions.</td>
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<tr>
<td>Doesborg et al. (2004) Netherlands RCT PEDro=8 TPS&lt;sub&gt;EG1&lt;/sub&gt;=4mo TPS&lt;sub&gt;EG2&lt;/sub&gt;=4mo N&lt;sub&gt;Start&lt;/sub&gt;=58 N&lt;sub&gt;End&lt;/sub&gt;=55</td>
<td>Population: Experimental Group 1 (EG1; N=29): Mean age=66±10yr; Gender: Males=18, Females=11. Experimental Group 2 (EG2; N=29): Mean age=58±14yr; Gender: Males=15, Females=14. Intervention: Participants with semantic and phonological deficits were randomly assigned to receive either semantic treatment (EG1) focused on interpretation of written words, sentences and text or to receive phonological treatment (EG2) focused on sound structure. Patients’ received 40-60hr of individual treatment. Outcomes: Amsterdam Nijmegen Everyday Language Test (ANELT); Semantic Association Test (SAT); Synonym judgement; Repetition non-words; Lexical decision.</td>
<td>1. Both groups improved significantly on the ANELT post-intervention (EG1: ΔM=5.1±9; EG2: ΔM=6.2±7) (p&lt;0.05 for both); no significant differences were observed between groups. 2. EG1 demonstrated significant improvement on the SAT post-intervention (p&lt;0.05). 3. No other significant differences were observed on the semantic measures of SAT and synonym judgement; no significant between group differences were observed for both semantic measures. 4. EG2 demonstrated significant improvements on phonological measures of repetition non-words and lexical decision post-intervention (p&lt;0.05 for both); no significant improvements on these measures were observed in EG1. 5. Lexical decision was significantly different between groups post-intervention (p&lt;0.05). 6. No significant between group difference</td>
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</tbody>
</table>
De Jong-Hagelstein et al. (2011)  
The Netherlands  
RCT  
PEDro=8  
TPS_{EG}=22d  
TPS_{CG}=23d  
N_{Start}=80  
N_{End}=75

**Population:** Experimental Group 1 (EG1; N=38): Mean age=68±13yr; Gender: Males=14, Females=24. Control Group (CG; N=42): Mean age=67±15yr; Gender: Males=24, Females=18.

**Intervention:** Participants were randomized to the EG and received cognitive-linguistic treatment (CLT), consisting of a semantic treatment program (BOX) and a phonological treatment program (FIKS), or to the CG and received a communicative treatment using verbal and non-verbal strategies such as role playing and conversational coaching. Each treatment program was administered for 2-5hr/wk and lasted up to 6mo. Assessments were performed at baseline, 3mo, and 6mo post-stroke.

**Outcomes:** Amsterdam-Nijmegen Everyday Language Test (ANELT); Semantic Association Test; Semantic Word Fluency (SWF); Psycholinguistic Assessment of Language Processing in Aphasia: semantic association with low image ability words, non-word repetition task, auditory lexical decision; Letter Fluency (LF).

1. Both groups demonstrated improvement on the ANELT measure; no significant between group differences were observed at 3mo (p=0.48) and 6mo (p=0.42) post-stroke.
2. There was no between-group difference in proportion of patients demonstrating an improvement of ≥ 7 points on the ANELT-A.
3. EG demonstrated significantly better scores on fluency tasks of SWF at 3mo (p<0.05) and LF at 6mo (p<0.05) than those in the CG.
4. There were no other significant differences between groups on any measures at 3 or 6mo post-stroke.

Best et al. (2013)  
UK  
Pre-Post  
No Score  
TPS_{mean}=3.6yr  
N_{Start}=16  
N_{End}=16

**Population:** Mean Age=60.9yr; Gender: Male=7, Female=9.

**Intervention:** Participants received picture naming training for 1hr/wk for 8wk. During training, if participants could not name the picture after 5s, they were given a single phenome and schwa and/or a single graphene. Participants were then provided with the first syllable of the word if they could not name the picture. If the participant could still not name the picture then they were given the word to repeat while viewing the picture.

**Outcomes:** Picture naming accuracy; Verbal short term memory span; Written sentence comprehension.

1. Naming performance of treated items increased significantly in 15 participants (p<0.05) while one participant showed no significant gain.
2. A minimal effect size was observed for the change in naming performance of untreated items (d=0.134).
3. No significant differences were observed between baseline and post-intervention in verbal short term memory span (p=0.88) or written sentence comprehension (p=0.40).

Bonifazi et al. (2013)  
Italy  
Pre-Post  
No Score  
TPS_{mean}=38.5±19.9mo  
N_{Start}=6  
N_{End}=6

**Population:** Mean age=52.2±13.6yr; Gender: Males=5, Females=1.

**Intervention:** A rehabilitation therapy based on the observation of action was administered daily to each participant for 2wk. Four different rehabilitation procedures were adopted: 1) observation of action performed by the examiner; 2) observation and then execution of action; 3) observation of video clips of actions; and as a control condition 4) observation of meaningless movement. The participants were divided into two groups based on their lexical-phonological disturbance (Group 1; N=4), or their verb semantic-based deficit (Group 2; N=2). Assessments were conducted before and after the treatment.

1. A significant improvement in verb retrieval from pre to post-treatment was found for the three experimental conditions in Group 1 (p<0.0001).
2. No significant effect was found between the three treatment types.
3. No significant improvement in verb retrieval was found in Group 2 (p=0.892).
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Study Type</th>
<th>No Score</th>
<th>TPS Mean</th>
<th>N Start</th>
<th>N End</th>
<th>Population</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carragher et al. (2013) UK Case Series</td>
<td>44.8mo</td>
<td>9</td>
<td>9</td>
<td>Mean Age=53.2yr; Gender: Male=7, Female=2.</td>
<td>Participants received one session/wk for 8wk of verb retrieval therapy. The therapy consisted of learning gestures to represent semantic features of verbs before attempting to name the verb with increasing phonological and orthographic assistance. Participants were also assigned a mean of 7.15hr of homework practice that mirrored the therapy sessions.</td>
<td>Verb retrieval performance of trained and untrained verbs; Verb and Sentence Test (VAST): spoken sentence production; Light Verb Elicitation Test.</td>
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<td>Verb naming of trained items significantly improved from baseline to 1wk post-intervention (p=0.0046) and remained significantly improved from baseline to 1mo post-intervention (p=0.0045).</td>
<td>1. Verb naming of trained items significantly improved from baseline to 1wk post-intervention (p=0.0046) and remained significantly improved from baseline to 1mo post-intervention (p=0.0045).</td>
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<td>Verb naming of untrained items significantly improved from baseline to 1wk post-intervention (p=0.0091) and remained significantly improved from baseline to 1mo post-intervention (p=0.0087).</td>
<td>2. Verb naming of untrained items significantly improved from baseline to 1wk post-intervention (p=0.0091) and remained significantly improved from baseline to 1mo post-intervention (p=0.0087).</td>
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<td>Performance on trained verbs compared to untrained was significantly greater in six participants 1wk post-intervention (p&lt;0.05); five participants performed significantly better on trained compared to untrained verbs from baseline to 1mo post-intervention (p&lt;0.023).</td>
<td>3. Performance on trained verbs compared to untrained was significantly greater in six participants 1wk post-intervention (p&lt;0.05); five participants performed significantly better on trained compared to untrained verbs from baseline to 1mo post-intervention (p&lt;0.023).</td>
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<td>Homework practice was significantly correlated with performance on trained verbs (p=0.006) but not with untrained verbs (p=0.5).</td>
<td>4. Homework practice was significantly correlated with performance on trained verbs (p=0.006) but not with untrained verbs (p=0.5).</td>
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<td>Sentence production from baseline to 1wk post-intervention significantly improved in two participants (p&lt;0.05), significantly decreased in three participants (p&lt;0.05) and showed no significant change in four participants; sentence production from baseline to 1mo post-intervention improved significantly in one participant (p=0.0138), decreased significantly in four participants (p&lt;0.05) and showed no significant change in four participants.</td>
<td>5. Sentence production from baseline to 1wk post-intervention significantly improved in two participants (p&lt;0.05), significantly decreased in three participants (p&lt;0.05) and showed no significant change in four participants; sentence production from baseline to 1mo post-intervention improved significantly in one participant (p=0.0138), decreased significantly in four participants (p&lt;0.05) and showed no significant change in four participants.</td>
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<td>Light verb retrieval significantly improved in one participant from baseline to 1mo post-intervention (p=0.002) while the other eight participants showed no significant change.</td>
<td>6. Light verb retrieval significantly improved in one participant from baseline to 1mo post-intervention (p=0.002) while the other eight participants showed no significant change.</td>
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</table>

| Kendall et al. (2013) USA Pre-Post Case Series | 68mo | 10 | 10 | Mean age=54±15.2yr; Gender: NA. | Participants were randomly selected from a larger ongoing treatment study. Participants received 60hrs of phonomotor treatment over 6wk. 39 trained and 37 untrained nouns were randomly presented and administered 1wk pre-treatment, 1wk immediately post-treatment, and at the 3mo follow-up post-treatment. | Verb retrieval performance of trained and untrained verbs; Accuracy of spoken word production; Number of errors produced: phonologic, semantic, unrelated, mixed, omissions or neologisms. |
| | | | | A statistically significant improvement in the naming accuracy of trained words was observed from pre- to post-treatment (p=0.001) and from pre-treatment to follow-up (p=0.001). | 1. A statistically significant improvement in the naming accuracy of trained words was observed from pre- to post-treatment (p=0.001) and from pre-treatment to follow-up (p=0.001). |
| | | | | No significant difference was found regarding the accuracy of untrained items at any time point. | 2. No significant difference was found regarding the accuracy of untrained items at any time point. |
| | | | | A trend towards significance was found in the number of errors produced on trained items with a decrease in omissions from pre to post-treatment (p=0.055). | 3. A trend towards significance was found in the number of errors produced on trained items with a decrease in omissions from pre to post-treatment (p=0.055). |
| | | | | A trend towards significance was found in the number of errors produced on trained items with a decrease in omissions from pre to post-treatment (p=0.055). | 4. A trend towards significance was found in the number of errors produced on trained items with a decrease in omissions from pre to post-treatment (p=0.055). |
van Hees et al. (2013)  
**Population:** Mean age=56.3±9.14yr; Gender: Males=3, Females=5.  
**Intervention:** All participants received three treatment sessions each week for 4wk. Participants received equal amounts of Semantic Feature Analysis (SFA) and Phonological Components Analysis (PCA) training during the intervention period. Each treatment used a particular set of picture naming tasks and one set was not used during training for control comparisons.  
**Outcomes:** Boston Naming Test (BNT); Comprehensive Aphasia Test; Western Aphasia Battery-Revised; Picture naming accuracy: treated and untreated items; Mini Mental State Examination; Glasgow Depression Scale; Errors during picture naming: semantically-related paraphasias, phonologically-related paraphasias or no-responses.

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPS</td>
<td>52.2±49.8mo</td>
<td></td>
</tr>
<tr>
<td>NStart</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>NEnd</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

1. Seven participants demonstrated a statistically significant improvement from baseline to post-intervention in the naming accuracy of items treated using PCA (p<0.05); six of these seven participants maintained their improvement on PCA treated items at the 2-3wk follow-up (p<0.05).
2. Four participants demonstrated a statistically significant improvement from baseline to post-intervention in the naming accuracy of items treated using SFA (p<0.05); three of these four participants maintained their improvement on SFA treated items at the 2-3wk follow-up (p<0.05).
3. No significant differences between baseline and post-intervention scores were observed for any of the untreated items.
4. Seven participants demonstrated no significant change on BNT scores from baseline to post-intervention; one participant showed significant improvement (p=0.03).
5. In regards to errors made during the picture naming task at the post-intervention and follow-up assessments: two participants demonstrated no changes in errors at any time point; three participants demonstrated a significant decrease in no-response errors for both SFA and PCA treated items at both time points (p<0.05 for all); one participant demonstrated a significant decrease in no-response errors for PCA treated items at both time points, but only at follow-up for SFA items (p<0.05 for all); one participant demonstrated a significant decrease in phonologically-related errors for PCA items at post-intervention only and in SFA items at follow-up only (p<0.05 for both); and one participant demonstrated a significant decrease in semantically-related errors for only PCA items at both time points (p<0.05 for both).

Altmann et al. (2014)  
**Population:** Experimental Group 1 (EG1; N=7): A two factor ANOVA analysis of time and
USA  
RCT  
PEDro=6  
TPSOverall≥6mo  
NStart=14  
NEnd=14

Mean age=72.1yr; Gender: Male=2, Female=5. Experimental Group 2 (EG2; N=7): Mean age=63.0yr; Gender: Male=6, Female=1.

**Intervention:** Participants were stratified to receive either gesture (EG1) or no-gesture (EG2) naming treatment for 1hr/d, 5d/wk for 6wk. Sessions 1-20 involved naming five different pictures of black and white drawings of objects. Sessions 21-30 involved auditory and orthographic presentations of category names which required participants to give an example of an object fitting that category. EG1 initiated each session by reaching into a box and pushing a red button and made a circular gesture with their hand if a response was incorrect. In EG2, the therapist pressed the button to initiate each session and no gesture was made.

**Outcomes:** Picture naming performance; Category member generation; Boston Naming Test (BNT); Western Aphasia Battery (WAB); Discourse quantity: utterances, words, verbs, nouns; Discourse quality: grammatical, correct information units (CIUs), propositions, utterances with new information.

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**Mattioli et al.** (2014)  
Italy  
RCT  
PEDro=6  
TPSmean=2.2±1.3d  
NStart=12  
NEnd=12

**Population:** Experimental Group (EG; N=6): Mean age=65.5±15yr; Gender: Males=4, Females=2. Control Group (CG; N=6): Mean age=62.6±11yr; Gender: Males=3, Females=3.

**Intervention:** The EG received daily language rehabilitation for 2wk. The rehabilitation program was focused on practicing verbal comprehension and lexical retrieval and was delivered at an intensity of 1hr session/d for 5d/wk. The CG received no language rehabilitation. Assessments were conducted at three intervals: baseline (T1), at 16.2d post-stroke (T2), and at 190d post-stroke (T3).

---

1. Participants in the EG obtained significantly higher scores in both the naming and written subsets of the AAT compared to the participants receiving no rehabilitation at T2 (p=0.01; p=0.02) and at T3 (p=0.004; p=0.03).
2. The remaining AAT subtests were not significantly different between groups.
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Design</th>
<th>PEDro</th>
<th>TPS Mean</th>
<th>Start</th>
<th>End</th>
<th>Population</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benjamin et al.</td>
<td>USA</td>
<td>RCT</td>
<td>5</td>
<td>37.4±33.5mo</td>
<td>14</td>
<td>14</td>
<td>Experimental Group (EG; N=7): Mean age=72.1±10.5yr; Gender: Male=2, Female=5. Control Group (CG; N=7): Mean age=63.0±9.2yr; Gender: Male=6, Female=1.</td>
<td>All participants received picture and category naming training for 10 sessions/wk for 3wk. The EG received the picture or category stimuli after pushing a button while the CG received the stimulus from the therapist. The EG repeated the correct responses given by the therapist while making hand gestures if the response to the stimuli was not correct while the CG made no gestures during correction. Assessments were conducted at baseline, post-intervention and at 3mo follow-up.</td>
<td>No significant differences between groups were observed in picture or category naming accuracy at any time point (p&gt;0.05). EG showed significant gains from pre to post-intervention in picture (p&lt;0.005) and category (p&lt;0.005) naming accuracy. CG showed significant gains from pre to post-intervention in picture (p&lt;0.0005) and category (p&lt;0.01) naming accuracy.</td>
</tr>
<tr>
<td>Woolf et al.</td>
<td>UK</td>
<td>Cross-over RCT</td>
<td>5</td>
<td>28.3±22.4mo</td>
<td>8</td>
<td>8</td>
<td>Mean age=63.6±14.1yr; Gender: Males=3, Females=5.</td>
<td>Participants were randomized to the order they received two programmes of standard therapy for the improvement of speech discrimination and auditory comprehension. One programme consisted of phonological therapy. The other programme consisted of semantic-phonological therapy. Each programme was administered for 6wk with an intensity of two sessions/wk.</td>
<td>A two factor analysis of condition and time for word and non-word discrimination tasks revealed a significant main effect of condition (words: p&lt;0.001; non-words: p&lt;0.001), indicating that participants scored more highly in the quiet condition. No main effect of time and no interaction effect between time and condition was observed (p&gt;0.05). A two factor analysis of condition and time for picture-word verification scores revealed a main effect of condition (p&lt;0.005) with scores being highest in the quiet condition. There was also a main effect of time (p&lt;0.05) but no significant interaction between condition and time. Scores at post-intervention and the 6wk follow-up were significantly higher than baseline (p&lt;0.01). A one factor analysis of time for synonym judgement scores revealed no significant effect. A three factor analysis of time, condition and treated vs. untreated responses for the Priming task revealed no significant main effects and no interactions between factors; thus performance did not improve after either intervention programme. However, the priming condition approached significance with both the phonological (p=0.079) and semantic-phonological (p=0.074) programmes. Only one participant from each training programme showed significant</td>
</tr>
</tbody>
</table>
1. There were statistically significant improvements in all components of picture description from pre-to-post-treatment except for untrained word agents (p<0.05) and in all components from pre-treatment to follow-up (p<0.05); no improvement was demonstrated on the control task at either time point (p>0.05).

2. There were statistically significant improvements in noun and verb naming accuracy on the OANB from pre to post-treatment (p<0.05); the OANB was not assessed at follow-up.

3. There was a significant improvement the NAVS from pre-treatment to follow-up (p=0.005); no significant improvement was noted from pre to post-treatment (p=0.086).

4. Analysis of discourse production revealed a statistically significant increase in the percentage of complete utterances from pre to post-treatment (p=0.026) and a significant improvement in the % CIUs from pre-treatment to follow-up (p=0.047); no other significant changes were observed in discourse production.

5. There was a statistically significant improvement in the WAB-AQ from pre to post-treatment (p<0.05 for both); no participants showed significant improvement on the synonym judgement task; and one participant showed a significant decrease in priming task score while one participant showed a significant increase in priming task score (p<0.05 for both).

6. Across contrasts of initial/final position and initial/final voice, significant improvements in facilitation scores were observed for all contrasts from pre to post-treatment in both the phonological (p<0.001 for all) and semantic-phonological programmes (p<0.002 for initial/initial voice and initial voice; p<0.025 for final voice).

7. A one factor analysis of time for the telephone message task revealed a significant main effect (p<0.05); scores at post-intervention and at the 6wk follow-up were significantly greater than at baseline (p<0.05 for both); no individual improvements were significant.

**Edmonds et al. (2014)**  
USA  
Pre-Post  
No Score  
TPS start=54.4±41.0mo  
N start=11  
N end=11  

| Population: Mean age=63.09±12.42yr; Gender: Males=7; Females=4.  
Intervention: Participants received a four-phase Verb Network Strengthening Treatment (VNeST) that targets verbs and their related thematic roles. The experimental task was sentence production for pictures depicting trained and untrained semantically related verbs. A control task was also administered during the same time points for demonstration of experimental control. Outcomes were assessed at pre and post-treatment and at a 3mo follow-up.  
Outcomes: Untrained and trained picture description: sentence production, word agents, verbs; Object and Action Naming Battery (OANB): nouns, verbs; Northwestern Assessment of Verbs and Sentences (NAVS); Discourse production during procedural, personal and picture stimuli: % of complete utterances, number of words, number of content information units (CIU), % CIUs, CIUs/min, number of utterances, % pauses, % mazes; Western Aphasia Battery (WAB): Aphasia Quotient (AQ); Communication Effectiveness Index (CETI). |

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14. Aphasia and Apraxia  
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### Kendall et al. (2014)

**USA**  
Case Series  
No Score  
**TPS** mean=63.1mo  
N\text{Start}=8  
N\text{End}=8  

**Population:** Mean age=62±9.65yr; Gender: Males=4, Females=4.  
**Intervention:** Word-retrieval treatment was administered 3d/wk, 1 hr/d for a total for 20hr (6-7wk). The treatment incorporated semantic, phonologic, repetition, orthographic cues, and delayed recall. Assessments were conducted before and after the treatment and at 3mo follow-up.  
**Outcomes:** Daily picture naming task probe; Western Aphasia Battery (WAB); Boston Naming Test (BNT); Stroke and Aphasia Quality of Life (SAQOL).  

1. Positive acquisition effects for the picture naming task were evident in all participants at post-treatment and at follow-up.  
2. WAB scores improved significantly from baseline to post-treatment (p=0.02) and from baseline to follow-up (p=0.008) but not from post-treatment to follow-up.  
3. No significant changes were found on the BNT or the SAQOL post-treatment or at follow-up.

### Kurland et al. (2014)

**USA**  
Pre-Post  
No Score  
**TPS** mean=31.9±28.8mo  
N\text{Start}=8  
N\text{End}=5  

**Population:** Mean age=67.4±9.0yr; Gender: Males=4, Females=4.  
**Intervention:** All subject received a 2wk intensive aphasia treatment program prior to participating in an iPad-based home practice (HP) program for maintaining and augmenting prior intensive language therapy treatment gains. The HP program consisted of practicing word retrieval for objects and actions with phonological, semantic and orthographic cueing. Participants were instructed to practice for at least 20min/session, 5-6d/wk for 6mo. Assessments were conducted during and following the 2wk aphasia treatment program and during the HP program.  
**Outcomes:** Naming of trained words to be practiced (TR-PR); Naming of untrained words to be practiced (UNTR-PR); Naming of trained words not to be practiced; Naming of untrained words not to be practiced (UNTR-UNPR); Boston Naming Test (BNT); Boston Diagnostic Aphasia Examination (BDAE): auditory comprehension, naming and repetition.  

1. All participants showed a trend towards maintenance or continued improvement of TR-PR at all time points.  
2. All participants showed a strong integrated effect size on UNTR-PR while only three participants showed a strong integrated effect size on the TR-PR.  
3. Four participants demonstrated dramatic gains on UNTR-PR, while the UNTR-UNPR condition remained unchanged for all participants throughout the course of treatment.  
4. Clinical significance (>20%) was achieved on all practiced words.  
5. After 6mo of HP, participants generally had scores equal to or greater than pre-treatment scores on the BDAE and BNT.

### Milman et al. (2014)

**USA**  
Case Series  
No Score  
**TPS** mean=41±19.5mo  
N\text{Start}=3  
N\text{End}=3  

**Population:** Mean age=62.3±6.4yr; Gender: Males=1, Females=2.  
**Intervention:** Integrated training for aphasia (ITA) was administered in three 60min sessions/wk. Each session targeted three levels of language processing: lexical retrieval, sentence production, and discourse-level interactions integrating the target vocabulary and target morphosyntactic structures. Participants also completed daily homework exercises and attended a 60min group session 1/wk for additional practice.  
**Outcomes:** Western Aphasia Battery-Revised (WAB-R) post-treatment (p=0.017); the WAB-AQ was not assessed at follow-up.  

1. All participants demonstrated improvements on the WAB-R with two participants showing a significant improvement on repetition and one participant showing significant improvement on both the AQ and information content subtests (p<0.05 for all).  
2. No other significant improvements on the WAB-R were observed.  
3. Two of three participants showed a significant increase in MLU
R): Aphasia Quotient (AQ), information content, repetition, naming, auditory verbal comprehension, fluency; Communication Effectiveness Index (CETI); Scales of Cognitive and Communicative Ability for NeuroRehabilitation (SCCAN); Language sample analysis: total number of meaningful words, total number of utterances, noun-verb ratio, open-closed class ratio, mean length of utterance (MLU).

ΔM=1.2±0.5 morphemes), two participants showed a significant change on the noun-verb ratio and two participants showed a significant change in the open-closed class ratio (p<0.05 for all).

4. No significant changes were observed for the total number of words and utterances.

5. No change in the CETI or the SCCAN was observed in two participants, whereas one participant showed a significant increase in both measures (p<0.05 for both).

Population: Mean age=60.0±9.2yr; Gender: Males=7, Females=5.

Intervention. Each participant received naming training for abstract words in one of two context-categories: hospital or courthouse. An untrained context-category and the context-category church served as controls. This intervention was offered as a generative naming paradigm and was delivered 2/wk for 2hr/session.

Outcomes: Efficacy of training abstract words; Effect of generalization to concrete words when abstract words are trained, the results showed statistically significant improvements for the naming ability of untrained concrete words in the trained context-category (p<0.05). There were statistically significant improvements observed for naming the target untrained abstract words (p<0.01), but not untrained target concrete words (p=0.10) in the control context category and for naming untrained concrete words (p<0.05) but not untrained abstract words (p=0.30) in the untrained context category.

Regarding the change in quality of generative naming responses after treatment, there was a statistically significant decrease in non-specific responses in both the untrained category (p<0.01) and trained context-category (p<0.01). Category-specific responses significantly increased in the trained context-category (p<0.01) but not in the untrained category.

Population: Experimental Group 1 (EG1; N=7): Mean age=51.8yr; Gender: Male=6, Female=1. Experimental Group 2 (EG2; N=7): Mean age=50.1yr; Gender: Male=4, Female=3.

Intervention: Participants were randomized to receive either phonological (EG1) or semantic therapy (EG2) first in an alternating 1wk crossover design in an ABBA or BAAB format for 4wk total. Each week of semantic therapy consisted of naming 15 pictures with increasing semantic cues for assistance. Phonological therapy followed the same design except used phonological cues for assistance. Abel et al. 2015 analyzed EG1 and EG2 as a composite group and compared results to a healthy population:

EG participants showed a significant improvement in total naming score from baseline to post-intervention (p<0.001).

2. EG participants showed a significant improvement in naming response time from baseline to post-intervention (p<0.008).

Abel et al. 2014
1. No significant differences in picture naming ability were observed between treatment orders (p>0.10).
2. Significant improvements from baseline to...
### Carragher et al. (2015)
**Population:** Mean age=53.2yr; Gender: Male=7, Female=2.
**Intervention:** Participants received one session/wk for 8wk of sentence construction therapy. The therapy consisted of constructing sentences in response to black and white line drawings. Participants were also assigned homework practice that mirrored the therapy sessions.
**Outcomes:** Production of trained and untrained syntactic structures; Verb and Sentence Test (VAST): spoken sentence production and comprehension; Verb production: verb phrases as a proportion of total utterances and in isolation.

- A two factor ANOVA analysis of condition (trained vs. untrained) and time for syntactic construction showed significant main effects for both condition (p=0.019) and time (p<0.001) and a significant interaction between factors (p=0.002).
- A one factor ANOVA analysis of time for VAST sentence production showed a main effect of time (p<0.001), indicating improvement not related to the intervention stimuli.
- A one factor ANOVA analysis of time for VAST sentence comprehension showed no main effect of time (p=0.629).
- A two factor ANOVA analysis of condition (pre vs. post-intervention) and time of testing for verb phrases as a proportion of total utterances approached significance (p=0.068) but showed no main effect for time of testing (p=0.445).
- A two factor ANOVA analysis of condition (pre vs. post-intervention) and time of testing for isolated verbs as a proportion of total utterances showed no effect of condition (p=0.208) or time of testing (p=0.175).

### Kiran et al. (2015)
**Population:** Mean age=58yr; Gender: Males=7, Females=1.
**Intervention:** Participants received a 10wk semantic feature-based rehabilitation program, based on two tasks: the picture naming task; and the semantic verification task of trained categories, untrained monitored categories and untrained assessed categories.
**Outcomes:** Naming of trained and untrained items.

- All participants showed improvement in naming performance following the intervention.
- A one way ANOVA on effect size and percent change on the trained category, untrained category, and the untrained assessed category showed a significant effect of category on effect size (p=0.0001).
- A significantly larger effect size and percent change was observed for the trained category relative to the untrained assessed category (p=0.0001) and the untrained

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control group that did not receive the intervention. **Outcomes:** Picture naming ability of trained and untrained items: total score and naming response time.

- post-intervention were observed in the picture naming ability of both EG1 and EG2 in terms of total score and score of trained and untrained items (p<0.001 for all).
- Both EG1 and EG2 showed significantly greater improvement in trained items compared to untrained items (EG1: p<0.01; EG2: p=0.012).
- Phonologically disordered participants improved significantly more on trained items than semantically disordered participants (p=0.008); no significant difference was observed on untrained items.
Leonard et al. (2015)
Canada
Case Series
No Score
TPS\text{mean}=1.6\text{yr}
N_{\text{start}}=5
N_{\text{end}}=5

Population: Experimental Group 1 (EG1; N=3): Mean age=81.3yr; Gender: Males=2, Females=1. Experimental Group 2 (EG2; N=2): Mean age=71.5yr; Gender: Males=2, Females=0.

Intervention: All participants received phonological component analysis training where photographs of nouns were presented to participants. EG1 participated in the “Choice” condition, where they were allowed to choose from a list of correct responses if they could not provide a response. EG2 participated in the “No Choice” condition where participants were provided with the correct response if no response was given. 1hr treatment sessions were administered 3/wk for 10wk. Assessments were conducted at baseline, at post-treatment, at 4wk follow-up, and at 8wk follow-up.

Outcomes: Philadelphia Naming Test.

1. All participants showed significant improvement in naming performance from baseline to post-test and from baseline to 4wk follow-up (p<0.01 for both time points).
2. Naming performance was significantly better at the 8wk follow-up compared to baseline in three participants only (p<0.001).

14.4.2 Specific Treatment for Global Aphasia

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexander &amp; Loverso (1991)</td>
<td>No Score</td>
<td>TPS=NA</td>
<td>Intervention: Six right-handed stroke patients presenting with global aphasia (n=5) and Wernicke’s aphasia (n=1) received treatment stimuli of 24 common, everyday objects, realistic pictures of those objects, and realistic pictures of the location in which those objects would unambiguously be found. Therapy was designed to support categorical and associational semantic discrimination using an 8-step hierarchy. Therapy was initiated at the level of performance breakdown, in that, patients moved to the next level using a 90% accuracy criterion. Failure was defined as five sessions completed with less than 60% accuracy. Treatment was provided 6/wk for a range of 4-10wk following three baseline sessions prior to therapy.</td>
<td>Western Aphasia Battery (WAB).</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denes et al. (1996)</td>
<td>Italy</td>
<td>RCT</td>
<td>PEDro=4</td>
<td>TPS=acute</td>
<td>Intervention: 17 patients with global aphasia (mean duration 2.5-4.5mos) were randomly assigned to receive standard or intensive language therapy. Approach to therapy in both groups was “ecological” – emphasis was on restoration of language in a conversational setting. More attention was paid to comprehension than production and production was treated in terms of engagement in conversation rather than single word production. Patients assigned to</td>
</tr>
</tbody>
</table>
standard therapy received an average of 60 sessions over a 6mo period while intensive therapy consisted of an average of 130 sessions. All sessions were individual and lasted from 45-60min. Assessment was conducted at baseline and at 6mos.

**Outcomes:** Aachen Aphasia Test (AAT).

### 14.4.3 Specific Treatment for Alexia in Aphasia

**Table 14.4.3 Treatment for Alexia in Aphasia Post-Stroke**

<table>
<thead>
<tr>
<th>Author, Year Country</th>
<th>Pedro Score</th>
<th>Methods</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherney et al. (1986)</td>
<td>Case Series No Score TPS=NA</td>
<td>Intervention: 10 patients received oral reading for language in aphasia (ORLA) consisting of repeated reading aloud of sentences in unison with the clinician. ORLA focuses on the connected discourse rather than on single words, modeling natural intonation and speech. <strong>Outcomes:</strong> Boston Diagnostic Aphasia Examination (BDAE); Aachen Aphasia Test: Token Test; Gates-MacGintie Reading Test (GMRT): reading comprehension.</td>
<td>1. There was a significant increase in post-treatment score on the BDAE, Token Test and the reading comprehension subtest of the GMRT.</td>
</tr>
<tr>
<td>Lacey et al. (2010)</td>
<td>US Case Series No Score TPS_overall=37.2mo N_Start=6 N_End=6</td>
<td>Population: Mean age=57.3yr; Gender: Males=3, Females=3. <strong>Intervention:</strong> Participants with pure (n=2) and phonological text (n=4) alexia received reading training in one 2hr sessions/wk for 8wk. <strong>Outcomes:</strong> Reading trained and untrained passages: accuracy, speed.</td>
<td>1. Significant increases in syllables/s for reading training passages were observed in all participants (p&lt;0.05). 2. All participants with phonological text alexia and pure alexia showed significant increases in speed for reading trained passages (p&lt;0.05). 3. Participants with low reading accuracy showed a significant increase in accuracy for reading trained passages (p&lt;0.05). 4. No significant improvements were observed on untrained control passages.</td>
</tr>
<tr>
<td>Lott et al. (2010)</td>
<td>US Case Series No Score TPS_overall&gt;1yr N_Start=3 N_End=3</td>
<td>Population: Mean age=71yr; Gender: Males=2, Females=1. <strong>Intervention:</strong> Participants with alexia post-stroke received treatment in two phases administered for 1hr 3/wk. Phase 1 consisted of tactile-kinesthetic letter naming treatment and Phase 2 consisted of rapid letter-by-letter word reading treatment. <strong>Outcomes:</strong> Accuracy when reading without strategy; Rapid letter-by-letter word reading: accuracy, speed.</td>
<td>1. No statically or clinically significant improvements were observed following Phase 1 in accuracy when reading without strategy; one participant showed an improvement approaching significance (p=0.08). 2. All participants showed significant improvements on the rapid letter-by-letter word reading task in accuracy (p&lt;0.05) and speed (p&lt;0.05) following Phase 2.</td>
</tr>
</tbody>
</table>

### 14.5 Drug Therapy in Aphasia

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### 14.5.1 Piracetam

#### Table 14.5.1 Effect of Piracetam on Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platt et al. (1993)</td>
<td>Germany</td>
<td>RCT</td>
<td>PEDro=8</td>
<td>TPS=overall&lt;3d</td>
<td><strong>Population</strong>: Experimental Group (EG; N=27): Mean age=77±6yr; Gender: Males=14, Females=13. Control Group (CG; N=29): Mean age=78±7yr; Gender: Males=19, Females=10. <strong>Intervention</strong>: Participants were randomized to receive either piracetam or placebo for 28d. <strong>Outcomes</strong>: Reduction in the area of reduced perfusion; Changes in perfusion; Self-reported measures: arm motor movements, leg motor movements, sensitivity, aphasia, state of consciousness; Functional Psychosis Scale B (FPS-B).</td>
</tr>
<tr>
<td>Enderby et al. (1994)</td>
<td>Belgium</td>
<td>RCT</td>
<td>PEDro=6</td>
<td>TPS=acute</td>
<td><strong>Intervention</strong>: Multi-centre, double blind placebo controlled trial of 158 stroke patients who had sustained their injury 6-9wk prior to the study were randomized to receive either 4.8g/d of piracetam or placebo for 12wk. <strong>Outcomes</strong>: Aachen Aphasia Test (AAT).</td>
</tr>
<tr>
<td>Huber et al. (1997)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Population</strong>: Experimental Group (EG; N=24): Mean</td>
</tr>
</tbody>
</table>
14. Aphasia and Apraxia

<table>
<thead>
<tr>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>N</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>RCT</td>
<td>7</td>
<td>50</td>
<td>Participants were randomised to receive either 4.8g/d of piracetam and 6wk of intensive language therapy (experimental group, EG) or only 6wk of intensive language therapy.</td>
<td>Aachen Aphasia Test: Token Test, repetition, written language, naming, comprehension, profile language.</td>
</tr>
<tr>
<td>Germany</td>
<td>RCT</td>
<td>7</td>
<td>26</td>
<td>Mean age=51.9±12.2yr; Gender: Males=20, Females=6. Participants were randomised to receive 4.8g/d of piracetam or placebo 2/d for 6wk.</td>
<td>Activation effect; Language areas.</td>
</tr>
<tr>
<td>Germany</td>
<td>RCT</td>
<td>6</td>
<td>24</td>
<td>Participants were randomised to receive either piracetam or placebo for 6wk while continuing with comprehensive language therapy, occupational therapy and physiotherapy.</td>
<td>Syntactic structure of spontaneous speech.</td>
</tr>
</tbody>
</table>

14.5.2 Bromocriptine

Table 14.5.2 Effect of Bromocriptine on Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gupta et al. (1995)</td>
<td>USA</td>
<td>RCT</td>
<td>7</td>
<td>20 adult males who had incurred a cerebral infarction resulting in aphasia at least 1yr prior to study and demonstrated a mean phrase length of 1-5 words and a score &gt;5 on the Auditory Comprehension subsection of WAB. Patients were randomised in Phase 1 to receive either Bromocriptine (5 mg gradually increased to 15mg by 3wk) or placebo. In phase 2 the treatment was crossed over. Each phase lasted 8wk with a 6wk washout period between each phase.</td>
<td>Western Aphasia Battery (WAB); Boston Naming Test (BNT); Wechsler Memory Scale-Revised: figure memory, visual paired associates I, visual reproduction I, visual memory; Raven’s Progressive Matrices (RPM); Rey-Osterrieth Figures (R-OF).</td>
</tr>
</tbody>
</table>

on all AAT subtests from baseline to post-intervention; improvement was significantly different between groups only for the written language subtest (p=0.05) and approached significance for the Token Test (p=0.08) with greater improvements on both measures observed in the EG.

1. Piracetam group showed greater increased activation effect than control in the left transverse temporal gyrus, left triangular part of inferior frontal gyrus and left posterior superior temporal gyrus after treatment.
2. Piracetam group improved on six language areas while control improved on only three.

1. Patients treated with piracetam demonstrated a significant improvement in syntactic structure of spontaneous speech compared to the controls.

No significant differences were found between groups on the WAB, BNT, figure memory, visual paired associates I, visual reproduction I, visual memory, RPM, R-OF.
**Intervention:** Study involved seven non-fluent aphasics who were 1yr post brain injury and had stable scores on aphasia evaluations with a mean Western Aphasia Battery Aphasia Quotient of 68.2 points. Patients were randomized to either 3.75mg/d of bromocriptine with dosage increased weekly to 7.5 mg/d and for the final 2wk maintained at 60mg/d or placebo, followed by a 3wk wash out period. Patient groups were crossed over post-wash out and both protocols were repeated.  
**Outcomes:** Western Aphasia Battery (WAB); Boston Diagnostic Aphasia Examination (BDAE); Controlled Oral Work Associated Test (FAS test); Boston Naming Test (BNT).

1. No significant differences were found between groups on the WAB, BDAE, Controlled Oral Work Association Test (FAS test) and the BNT.

**Intervention:** Study involved 11 non-fluent chronic aphasics following stroke in a double blind protocol trial. All patients went through each phase of study: Phase 1: inclusion; phase 2: language retest to evaluate stability of aphasia; phase 3: placebo treatment combined with speech therapy; phase 4: treatment with bromocriptine combined with speech therapy; phase 5: treatment with Bromocriptine alone; and phase 6: washout.  
**Outcomes:** Dictation; Reading comprehension; Repetition; Verbal latency; Qualitative scores.

1. Significant improvements during bromocriptine treatment were observed in dictation, reading comprehension, repetition and in verbal latency.  
2. Improvement was also observed in qualitative scores reported by patients’ relatives during phases 3 and 4 of the treatment regime.

**Population:** Experimental Group (EG; N=14): Mean age=54.1±11.4yr. Control Group (CG; N=14): Mean age=52.8±14.4yr; Gender: Males=20, Females=18.  
**Intervention:** Participants randomized to the EG were started on a 2.5mg/d dosage of bromocriptine which steadily increased to 10mg/d by 4wk – this dosage was maintained for the remaining 12wk of treatment. Those randomized to the CG received an identical looking placebo that was administered with the same dosage protocol as the active drug.  
**Outcomes:** Persian Language Test (PLT): verbal fluency, gesture to command, naming, single-word responses, automatic speech, prosody, repetition, global score.

1. Significant improvements were observed in both groups on all subtests of the PLT (EG: p<0.05; CG: p<0.001); no significant differences were observed between groups on any subtest.

### 14.5.3 Levodopa

**Table 14.5.3 Use of Levodopa During Speech and Language Therapy in Aphasia Post-Stroke**

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Seniow et al. (2009) | Poland | RCT | PEDro=7 | **Intervention:** 40 patients were assigned at random to receive either 100 mg levodopa or matching placebo 30min prior to speech/language therapy sessions. Therapy was conducted Monday to Friday for 3wk. Sessions were 45min in length. The therapy method | Both groups made significant improvements on all BDAE subtests over the 3wk intervention.  
2. The treatment group made significantly greater progress on only animal naming |
<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Outcome 1</th>
<th>Outcome 2</th>
<th>Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leeman et al. (2011) Switzerland RCT</td>
<td>In a crossover design study, 12 patients with aphasia onset 2-9wk post-stroke were randomized into two groups. Group 1 received computer-assisted therapy (CAT) with first set of naming lists, associated standard therapy (2-5hrs speech therapy/wk) and treatment with levodopa for the first 2wk interval. Group 2 received CAT + standard treatment + placebo. After a 1wk washout period during which standard therapy was maintained, participants crossed over conditions and a second naming list was used. Oral naming was assessed at baseline and post-treatment. Order of naming list presentation (two lists) was counterbalanced.</td>
<td>Oral naming accuracy was equivalent at baseline. Both groups improved significantly (F=48.98, p&lt;0.0001) at the end of CAT + levodopa therapy, but there was no significant difference in improvement between groups.</td>
<td>Administration of levodopa did not appear to affect the amount of improvement associated with CAT.</td>
<td></td>
</tr>
<tr>
<td>Breitenstein et al. (2015) Germany Cross-over RCT</td>
<td>Participants were randomized to receive either 100mg/25mg of levodopa (L-dopa)/carbidopa or a placebo first followed by the other treatment in a crossover design. The treatments were administered daily in 10d phases with a 4wk washout period in between. Each administration of levodopa/carbidopa and the placebo was followed by intensive language therapy consisting of 3hr of naming exercises followed by 1hr of conversational training. Assessments were conducted at baseline, after each condition, and at 1mo and 6mo follow-up.</td>
<td>Analysis of the change in object naming performance revealed a significant main effect of time (p&lt;0.001) with no main effects of condition or sequence of conditions and no interaction between factors.</td>
<td>Both groups showed significant improvement on the ANELT scale over time (p&lt;0.05 for both); however, no significant effects of condition or sequence of conditions were observed.</td>
<td>No significant main effects of condition or sequence of conditions were observed for the CAL and SAQOL.</td>
</tr>
</tbody>
</table>

**14.5.4 Amphetamines**

14. Aphasia and Apraxia

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### Table 14.5.4 Amphetamines in Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year Country PEDro Score TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Walker-Batson et al. (1992)</strong> USA No Score (single group intervention study) TPS=NA N=6</td>
<td><strong>Intervention:</strong> Study involved six patients with presence of aphasia as defined by an overall score between the 10th and 70th percentile on the Porch Index of Communicative Ability (PICA). Patients received either 10 or 15mg of d-amphetamine every 4d for 10 sessions. 30min after drug was administered, patient began a 1hr session of speech and language therapy. <strong>Outcomes:</strong> PICA; Single-photon emission computed tomography (SPECT) neuroimaging.</td>
<td>1. By 3mos post-onset, five of the six patients achieved scores in excess of 100% of the 6mo projection on the PICA. 2. SPECT neuroimaging revealed significant cortical hypoperfusion in all of the aphasic subjects regardless of lesion site of CT.</td>
</tr>
<tr>
<td><strong>Walker-Batson et al. (2001)</strong> USA RCT PEDro=7 TPS=acute N=21</td>
<td><strong>Intervention:</strong> In a prospective, double blind study, 21 aphasic patients with an acute nonhemorrhagic infarction were assigned randomly to receive either 10mg dextroamphetamine or a placebo. Patients were entered between 16d-45d post-onset and were treated on a 3d/4d schedule for 10 sessions. 30min after drug/placebo administration, patients received a 1hr session of speech and language therapy. Assessment was conducted at baseline, 1wk off the drug, and 6mos after onset. <strong>Outcomes:</strong> Porch Index of Communicative Ability (PICA).</td>
<td>1. Although there were no differences between the drug and placebo groups before treatment, by 1wk after the 10 drug treatments ended there was a significant difference in gain scores between the groups, with the greater gain in the dextroamphetamine group. The difference was still significant when corrected for initial aphasia severity and age. 2. At the 6mo follow-up, the difference in gain scores between the groups had increased.</td>
</tr>
</tbody>
</table>

### 14.5.5 Bifemelane

### Table 14.5.5 Bifemelane in Aphasia Post-Stroke

<table>
<thead>
<tr>
<th>Author, Year Country PEDro Score TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tanaka et al. (1997)</strong> Japan and USA RCT PEDro=6 TPSOverall=6-8wk NStart=4 NEnd=4</td>
<td><strong>Population:</strong> Mean age: NA; Gender: Males=4, Females=0. <strong>Intervention:</strong> Participants were assigned randomly to the experimental group (EG) receiving 300mg of the cholinergic agent bifemelane or to a non-treatment control group (CG). All participants received standard speech therapy. <strong>Outcomes:</strong> Comprehension; Animal category naming; Confrontation naming; Cerbrospinal fluid (CSF) Acetylcholinesterase (AChE) levels.</td>
<td>1. The CG did not demonstrate significant improvement on comprehension, animal category naming or confrontation naming and showed a slight decrease in CSF AChE levels. 2. The EG demonstrated significant improvements on comprehension, animal category naming and confrontation naming (p&lt;0.05 for all) and showed a slight increase in CSF AChE levels.</td>
</tr>
</tbody>
</table>

### 14.5.6 Dextran-40

### Table 14.5.6 Amphetamines in Aphasia Post-Stroke
### 14.5.7 Moclobemide

**Table 14.5.7 Moclobemide in Aphasia Post-Stroke**

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Laska et al. (2005)</strong></td>
<td>Sweden</td>
<td>RCT</td>
<td>PEDro=9</td>
<td>TPS=acute</td>
<td>N=90</td>
<td><strong>Intervention:</strong> 90 stroke patients were randomly allocated to receive either 600mg Moclobemide or matching placebo daily. Treatment commenced within 3mos of stroke onset and continued for 6mos. <strong>Outcomes:</strong> Reinvang’s Aphasia Test; Amsterdam-Nijmegen Everyday Language Test.</td>
</tr>
</tbody>
</table>

### 14.5.8 Donepezil

**Table 14.5.8 Donepezil in Aphasia Post-Stroke**

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Berthier et al. (2003)</strong></td>
<td>Spain</td>
<td>No Score</td>
<td>PEDro=4</td>
<td>TPS=chronic</td>
<td>N=11</td>
<td><strong>Intervention:</strong> 11 patients with chronic aphasia following stroke (mean duration = 4.4yr) received 5mg/d of donepezil for 4wk, followed by 10mg/d for 10wk. Treatment was followed by a 4wk withdrawal period. All patients also received 2 weekly sessions of conventional speech-language therapy. Testing was conducted at baseline, 4wk,16wk and 20wk. <strong>Outcomes:</strong> Western Aphasia Battery: Aphasia Quotient (AQ); Psycholinguistic Assessment of Language Processing in Aphasia (PALPA): nine selected tests.</td>
</tr>
</tbody>
</table>
### 14. Aphasia and Apraxia

<table>
<thead>
<tr>
<th>Berthier et al. (2006)</th>
<th>Intervention: 26 patients with chronic post-stroke aphasia (&gt;1yr) and under the age of 70yr were randomly assigned to receive either treatment with donepezil (n=13) or matching placebo (n=13). Treatment consisted of donepezil HCl 5mg/day for 4wk (titration), followed by 10 mg/d for 12wk (maintenance with possible adjustments for tolerability) and 4wk washout. Outcomes: Western Aphasia Battery: Aphasia Quotient (AQ); Communicative Activity Log (CAL); Psycholinguistic Assessment of Language Processing in Aphasia (PALPA) subtests; Stroke Aphasic Depression Questionnaire.</th>
<th>patients experienced irritability and increased sexual drive (10mg/d).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. AQ scores and PALPA subtest scores improved more in the treatment group than in the placebo group from baseline to 16wk (p=0.037 &amp; p=0.025, respectively). 2. Comparisons of the CAL revealed no significant differences from baseline to 16wk and by 20wk (post washout) CAL performance had declined in the treatment group relative to the placebo condition (p=0.008). 3. 61% (n=8) patients in the treatment condition reported adverse events including irritability (n=4), insomnia or tiredness (n=2) and recurrence of post-stroke seizures (n=2). Seizures occurred during maintenance only and did not recur following dose reduction.</td>
<td></td>
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</table>

| Berthier et al. (2014) | Population: Mean age=58.3yr; Gender: Male=3, Female=0. Intervention: During the first 16wk, participants received increasing amounts of donepezil up to 5mg/d in addition to distributed speech-language therapy (DSLT) for 40hr (2.3hr/wk). DSLT involved practicing exercises for naming, repetition, sentence completion, following commands, spoken object-picture matching and conversation. After a washout period of 4wk where no intervention was given, participants received donepezil and massed sentence repetition therapy (MSRT) for 40hr (1hr/d, 5d/wk). MSRT involved completing sentence repetition exercises where participants repeated audio taped sentences. Assessments were conducted at baseline (A1, 0wk), post-DSLT (16wk), following the washout period (A2, 20wk) and post-MSRT (28wk). Outcomes: Western Aphasia Battery (WAB): Aphasia Quotient (AQ), picture description-correct information units (CIU); Psycholinguistics Assessments of Language Processing in Aphasia (PALPA): repetition syllable length, repetition non-words; Word pair repetition in conditions of no delay direct, no delay inverted and unfilled delay; Word triplet repetition (verb-adjective-noun); Repetition of clichés and novel sentences. | 1. WAB AQ scores improved significantly in all participants from A1 to post-DSLT (p<0.016) and from A1 to post MSRT (p<0.01). 2. The % of CIUs during picture description from A1 to post-DSLT improved in two participants and decreased in one participant. 3. The % of CIUs during picture description improved in all participants from A1 to post-MSRT. 4. No significant changes in PALPA single word repetition were observed from A1 to post-MSRT in all participants despite intervention type (p=0.063); one participant showed an improvement approaching significance after both interventions (p=0.063). 5. No significant changes in PALPA non-word repetition were observed from A1 to post-MSRT in all participants despite intervention type (p=0.063); one participant showed an improvement approaching significance after both interventions (p=0.063). 6. Assessment of word pair repetition under the no delay direct condition showed that one participant significantly improved from A1 to post-DSLT (p=0.001) and post-MSRT (p=0.001) and from A2 to post-MSRT (p=0.031); one participant showed improvement approaching significance from baseline to post-DSLT and significantly |
improved from A1 to post-MSRT (p=0.008) and from A2 to post-MSRT (p=0.031); no changes were observed in one participant; and no differences were observed between treatments.

7. Assessment of word pair repetition under the no delay inverted condition showed that one participant significantly improved from A1 to post-DSLT (p=0.002) and post-MSRT (p=0.001) and from A2 to post-MSRT (p=0.031); one participant significantly improved from A1 to post-MSRT (p=0.008) and showed a significantly greater improvement with MSRT compared to DSLT (p=0.031); no changes were observed in one participant; and no other differences were observed between treatments.

8. Assessment of word pair repetition under the unfilled 5s delay condition showed that two participants significantly improved from A1 to post-DSLT (p=0.008 for both) and post-MSRT (p=0.004; p=0.001); no changes were observed in one participant; and one participant showed significantly greater improvement following MSRT compared to DSLT (p=0.002).

9. Word triplet repetition scores significantly improved in all participants from A1 to post-DSLT (p<0.001) and to post-MSRT (p<0.001); all participants had significantly better scores after MSRT compared to DSLT (p<0.001).

10. Cliché repetitions did not significantly improve in two participants after either intervention while one participant significantly improved from A1 to post-DSLT (p=0.008) and to post-MSRT (p=0.016).

11. Repetition of novel sentences significantly improved in two participants from A1 to post-DSLT (p<0.016) and from A1 to post-MSRT in all three participants (p<0.031).

### 14.5.9 Memantine

**Table 14.5.9 Memantine in Aphasia Post-Stroke**

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>TPS</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
</table>

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**Berthier et al. (2009)**
Spain
RCT
PEDro=8
TPS=NA
N=28

| Intervention: 28 patients were randomized to receive either 10mg memantine 2/d or matching placebo. All patients in the drug/no drug streams went through the following study phases: 1) 3wk titration 2) drug/placebo only (to end of 16wk) 3) combined treatment - drug or placebo + constraint induced aphasia therapy (CIAT) (16-18wk) 4) drug or placebo only (18-20wk) 5) 4wk drug washout (20-24wk). Following the washout period, all patients were provided with open-label memantine treatment for 24wk. CIAT therapy from 16-18wk was provided in a small group setting 3hr/d, 5d/wk. Improvement was defined as an increase in Western Aphasia Battery (WAB) Aphasia Quotient (AQ) and communicative activities log (CAL) test score of more than 5% of total range.
| Outcomes: WAB: AQ, spontaneous speech, auditory comprehension, naming, ; CAL.

1. In the drug only phase (4-16wk), patients treated with memantine demonstrated significantly greater improvement on the AQ (p=0.002) and the naming subtest of the WAB (p=0.015) than those in the placebo condition.
2. Within group analysis revealed that both groups made significant improvements from 16-18wk with the addition of CIAT therapy; however, individuals also receiving memantine made greater gains on the AQ (p=0.0001), the spontaneous speech (p=0.024), auditory comprehension (p=0.037) and naming (p=0.009) subtests of the WAB in addition to the CAL (0.04).
3. Outcomes were not affected by duration of aphasia, or treatment with antiepileptic or psychoactive drugs.
4. Following the washout phase, the drug-related benefit associated with memantine treatment appeared to diminish, but scores remained greater than those in the placebo groups (AQ, p=0.41 at 24wk).
5. No adverse events associated with drug use were reported.

**Barbancho et al. (2015)**
Spain
RCT
PEDro=8
TPS\textsubscript{Overall}>1.8yr
N\textsubscript{Start}=28
N\textsubscript{End}=27

| Population: Experimental Group (EG; N=14): Mean age=53.7±2.1yr; Gender: Male=7, Female=7. Control Group (CG; N=14): Mean age=48.5±2.1yr; Gender: Male=11, Female=3.
| Intervention: Participants were randomized to receive either memantine therapy (EG) or a placebo (CG). The treatment was administered 2/d for 10wk following a 3wk period where a steady state dosage was achieved. From 16-18wk, participants discontinued the drug treatment and instead received 3hr/d of constraint induced aphasia treatment (CIAT) for 30hr. CIAT required participants to request picture cards from others using only verbal language. From 18-20wk, participants received memantine therapy or the placebo without CIAT according to prior group assignments.
| Outcomes: Western Aphasia Battery (WAB): Aphasia Quotient (AQ). |

1. WAB AQ scores significantly increased in the EG prior to CIAT (p<0.002); no significant change was observed in the CG prior to CIAT and improvement in the EG was significantly greater compared to the CG (p<0.0001).
2. WAB AQ scores improved significantly in both groups following CIAT (p<0.05); a significant between group difference was observed indicating the EG improved to a significantly greater extent compared to the CG (p<0.0001); improvement in WAB AQ scores remained stable from 18-20wk in both groups.

### 14.5.10 Galantamine

<table>
<thead>
<tr>
<th>Author, Year Country PEDro Score</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
</table>

Table 14.5.10 Galantamine in Aphasia Post-Stroke

14. Aphasia and Apraxia

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**TPS**

| **Hong et. al. (2012)** | **Intervention:** 45 patients with chronic aphasia were randomly assigned to either a galantamine treatment group (8mg/d for 4wk, and 16mg/d for the following 12wk), or a control group (no placebo). Patients were evaluated at baseline and endpoint. **Outcomes:** Western Aphasia Battery (WAB): Aphasia Quotient (AQ), spontaneous speech, comprehension, naming. |
| **RCT** | **PEDro=7** |
| **TPS=chronic** | **N=45** |
| **1.** | **Endpoint WAB-AQ score was significantly higher in the galantamine group compared to the control group (p=0.003). Researchers also noted significant improvements in spontaneous speech (54.3-66.7 percentile, p=0.027), comprehension (52.1-58.8 percentile, p=0.018), and naming (49.0-57.2 percentile, p=0.013) domains in the galantamine treatment group.** |
| **2.** | **Endpoint WAB AQ was independently associated with baseline WAB AQ. No associations were found with age, gender or education level.** |
| **3.** | **Significant determinants for good responsiveness (WAB AQ baseline – WABAQ endpoint ≥20 points, assumption 5% increase from baseline) in the treatment group included subcortical dominant lesion pattern, baseline MMSE score and a higher education level. A subcortical dominant pattern was an independent determinant for good responsiveness to treatment (OR 30.3; 95% 1.1 to 805.9, p=0.041).** |

### 14.5.11 Nao-Xue-Shu

**Table 14.5.11.1**

| **Author, Year** | **Methods** | **Outcomes** |
| **Yan et al. (2015)** | **Population:** Experimental group (EG; n=54): Mean age=63.32±5.1yr; Gender: Males=38, Females=16. Control group (CG; n=51): Mean age=64.6±4.9yr; Gender: Males=37, Females=14. **Intervention:** Participants were randomly allocated to receive standard western medicine plus Nao-Xue-Shu Oral liquid (EG) or standard western medicine alone (CG) for 2wk. Outcomes were assessed at baseline, 2wk, and 4wk. **Outcomes:** Western Aphasia Battery (WAB). | **1.** There was no significant difference in WAB scores between EG and CG groups at 2wk for any components (p>0.05); however, the EG group improved in Comprehension, Repetition, Reading, and Calculating (all p<0.05). **2.** There was a significantly greater improvement in WAB scores at 4wk in the EG group compared to the CG group in all components (all p<0.05). |
| **China** | **RCT** | **PEDro=6** |
| **TPS=Acute** | **NStart=116** | **NEnd=105** |

### 14.7 Apraxia

**14.7.4 Treatment of Apraxia**
### 14.7.4.1 Strategy Training

#### Table 14.7.4.1 Treatment of Ideomotor Apraxias and Ataxia

<table>
<thead>
<tr>
<th>Author, Year Country</th>
<th>Methods</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Van Heugten et al. (1998)</strong>&lt;br&gt;Netherlands&lt;br&gt;No Score</td>
<td>33 stroke patients with ataxia received activity training to learn compensatory strategies (based on personal consultation with a therapist). New activities were chosen and goals set every 2 weeks. Each activity was approached in 3 stages: initiation, execution and control. Specific guidelines for instructions, assistance and feedback were provided to each occupational therapist. Therapy continued for a total of 12 weeks. The number of treatments per week was determined by each therapist.</td>
<td>Significant improvement was seen in motor functioning, apraxia, ADL observations, Barthel Index scores, and on the occupational therapies ADL questionnaire when baseline evaluations were compared with post-treatment evaluations. Effect sizes ranged from 0.19 for motor functioning to 1.06 for OT-ADL questionnaire results.</td>
</tr>
<tr>
<td><strong>Donkervoort et al. (2001)</strong>&lt;br&gt;Netherlands&lt;br&gt;8 (RCT)</td>
<td>113 patients with apraxia secondary to left hemisphere stroke were randomly assigned to either strategy training integrated in usual OT or to regular OT. Strategy training involved the use of strategies to compensate for the apraxic impairment during the performance of ADL. Usual OT concentrated on sensory, motor, perceptual and cognitive deficits of the stroke patients and increasing independent functioning in ADL task. Patients underwent 8 weeks of treatment.</td>
<td>After 8 weeks of treatment, strategy training group improved significantly more than controls on ADL observations and on the Barthel ADL. No significant differences between the groups were noted at the 5 month follow-up.</td>
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<td><strong>Geusgens et al. (2006)</strong>&lt;br&gt;Netherlands&lt;br&gt;8 (RCT)</td>
<td>113 patients with left hemisphere stroke were randomly assigned to receive strategy training (n=56) or usual occupational therapy (n=57). Outcomes were assessed at week 8 and week 20. &lt;br&gt;Note: This study represents further analysis of data collected as part of the study by Donkervoort et al. (2001).</td>
<td>Over time, ADL observation scores for trained tasks improved for the group as a whole (p=0.004), for the strategy training group (p=0.025), but not for the usual treatment group. Similarly, for untrained tasks, the group as a whole improved significantly (p=0.00) as did the strategy treatment group (p=0.00). Improvement on untrained tasks approached significance in the usual treatment group (p=0.05). At week 8, change scores on ADL observations on untrained tasks were larger for the strategy group than for the usual treatment group (p=0.40). There were no significant between group differences reported for change scores at 20 weeks for untrained tasks or for either assessment period for trained tasks.</td>
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### 14.7.4.2 Gesture Training

#### Table 14.7.4.2 Gesture Training in the Treatment of Ideomotor Apraxia

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<th>Author, Year</th>
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<th>Country</th>
<th>Pedro Score</th>
<th>Methods</th>
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<tr>
<td>Smania et al. (2000)</td>
<td>3 (RCT)</td>
<td>13 patients with “left-sided unilateral vascular lesions” were randomly assigned to receive either a behavioural training program for limb apraxia consisting of gesture production exercises (n=6) or conventional treatment (n=7) for aphasia. Thirty-five 50-minute treatment sessions were provided at a rate of 3/week.</td>
<td>No significant change was noted in performance on the Token, Raven, Oral or Constructive apraxia test in the treatment group. However, pre and post training assessments revealed significant improvement on measures of ideational and ideomotor apraxia (p=0.039 and p=0.043 respectively) for patients assigned to the treatment condition. Praxis errors were reduced significantly within the training group (p=0.001) – analysis of errors revealed improvements in awkwardness, omission, unrecognizable gestures, intrusion and position. No improvements on any of the neuropsychological tests were found for patients assigned to the control group.</td>
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<td>Smania et al. (2006)</td>
<td>5 (RCT)</td>
<td>33 patients with left hemisphere stroke, limb apraxia, and aphasia were randomized to an apraxia treatment or a control (aphasia treatment) group. Before and after treatment, patients underwent tests of verbal comprehension, intelligence, oral apraxia, constructional apraxia, ideation apraxia, ideomotor apraxia, and gesture comprehension. As well, 9 patients in the apraxia group and eight in the control were assessed at a 2 month follow-up for performance on tests of ideational apraxia, ideomotor apraxia, gesture comprehension and ADL.</td>
<td>The apraxia treatment group displayed significant pre- to post-treatment improvements on tests of ideational apraxia (p&lt;0.01), ideomotor apraxia (p&lt;0.01), gesture comprehension (p&lt;0.01) and ADL (p&lt;0.001), while the control group displayed significant improvements on intelligence and verbal comprehension tests. No between-group analyses were conducted. Treatment effects differed significantly between the groups on tests of ideomotor apraxia (p=0.016), gesture comprehension (p=0.018) and ADL (p&lt;0.01). Performance on limb praxic functional tests and the ADL questionnaire did not change significantly between the post-treatment evaluation and the two month follow-up.</td>
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References


Stimulation (rTMS) and sham condition rTMS on behavioural language in chronic non-fluent aphasia: Short term outcomes. *NeuroRehabilitation*, 28(2), 113-128.


Cherney, L. R. M., CT; Grip, J.C.; (1986). Efficacy of oral reading in aphasia treatment outcome. *Rehabil Lit, 47*(5-6), 112-118.


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