CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Rehabilitation and Recovery following Stroke

Evidence Tables

Rehabilitation of Visual Perceptual Deficits

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on Behalf of the Canadian Stroke Best Practice Recommendations
Rehabilitation and Recovery following Stroke Writing Group

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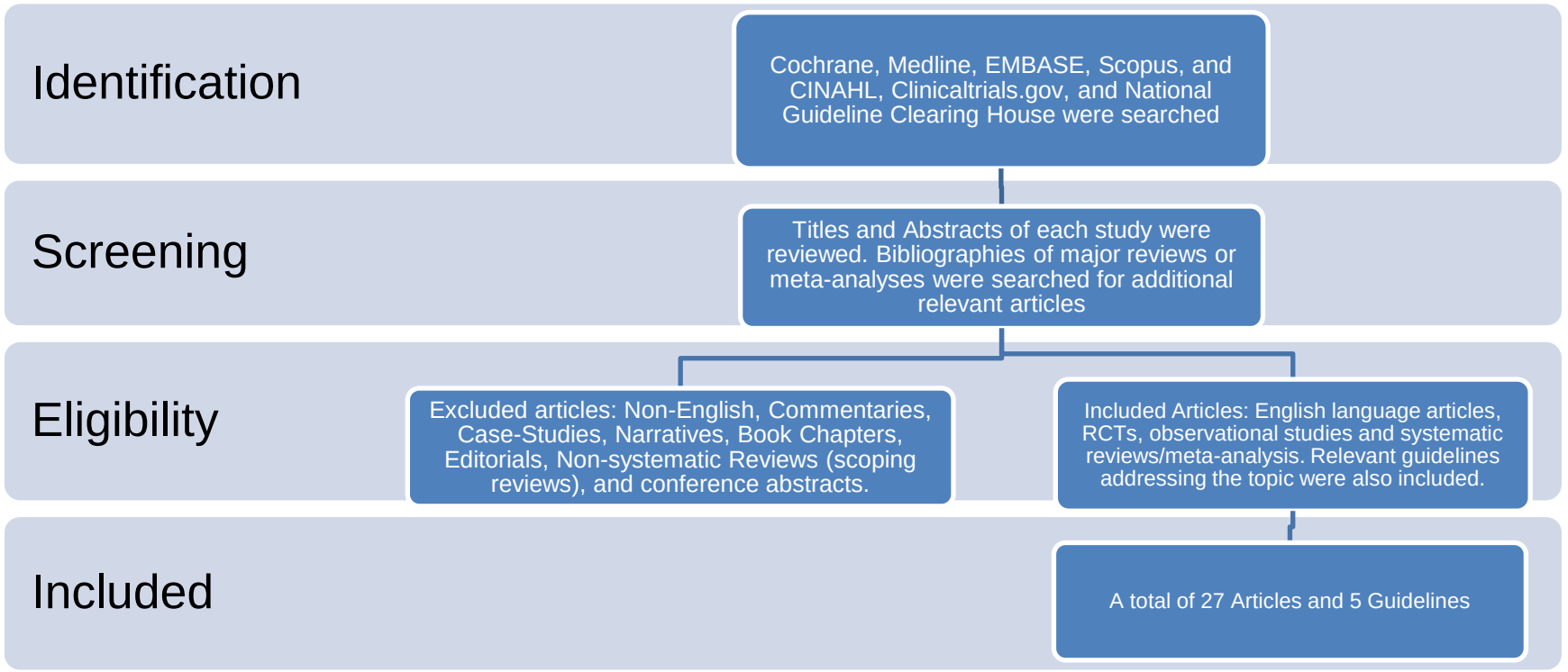
Search Strategy



Cochrane, clinicaltrials.gov, Medline, EMBASE, CINAHL and Scopus were searched using the keywords: Stroke AND (“Visual Disorder” OR “Perception Disorder” OR “Unilateral Neglect” OR Visuoperception”) AND (rehabilitation OR therapy OR intervention). Titles and abstract of each article were reviewed for relevance. Bibliographies were reviewed to find additional relevant articles. Articles were excluded if they were: non-English, commentaries, case-studies, narrative, book chapters, editorials, non-systematic review, or conference abstracts. Additional searches for relevant best practice guidelines were completed and included in a separate section of the review. A total of 27 articles and 5 guidelines were included and were separated into categories designed to answer specific questions.

Published Guidelines

Guideline	Recommendations
Clinical Guidelines for Stroke Management 2017. Melbourne (Australia): National Stroke Foundation.	Weak Recommendation For stroke survivors with mild to moderate weakness, complex regional pain syndrome and/**or neglect**, mirror therapy may be used as an adjunct to routine therapy to improve arm function after stroke. Weak recommendation Updated For stroke survivors with symptoms of unilateral neglect, cognitive rehabilitation (e.g. computerised scanning training, pen and paper tasks, visual scanning training, eye patching, mental practice) may be provided. Weak recommendation New For stroke survivors with symptoms of unilateral neglect, mirror therapy may be used to improve arm function and ADL performance. Weak recommendation AGAINST New Non-invasive brain stimulation should not be used in routine clinical practice to decrease unilateral neglect, but may be used within a research framework
National Clinical guidelines for stroke" 5th Edition 2016; Intercollegiate Stroke Working Party. Royal College of Physicians	A People with stroke should be: – assessed for visual acuity whilst wearing the appropriate glasses to check their ability to read newspaper text and see distant objects clearly; – examined for the presence of visual field deficit (e.g. hemianopia) and eye movement disorders (e.g. strabismus and motility deficit). B People with altered vision, visual field defects or eye movement disorders after stroke should receive information, support and advice from an orthoptist and/or an ophthalmologist. C People with visual loss due to retinal artery occlusion should be jointly managed by an ophthalmologist and a stroke physician.
Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, Deruyter F, Eng JJ, Fisher B, Harvey RL, Lang CE, MacKay-Lyons M, Ottenbacher KJ, Pugh S, Reeves MJ, Richards LG, Stiers W, Zorowitz RD; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. **Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare**	Evaluation of stroke patients for sensory impairments, including touch, vision, and hearing, is probably indicated. Class IIa; LOE B Strategy training or gesture training for apraxia may be considered. Class IIb; LOE B Task practice for apraxia with and without mental rehearsal may be considered. Class IIb; LOE C It is reasonable to provide repeated top-down and bottom-up interventions such as prism adaptation, visual scanning training, optokinetic stimulation, virtual reality, limb activation, mental imagery, and neck vibration combined with prism adaptation to improve neglect symptoms. Class IIa; LOE A Right visual field testing may be considered. Class IIb; LOE B Repetitive transcranial magnetic stimulation of various forms may be considered to ameliorate neglect symptoms. Class IIb; LOE B Multimodal audiovisual spatial exploration training appears to be more effective than visual spatial exploration training

Guideline	Recommendations
professionals from the American Heart Association/American Stroke Association. ***Stroke* 2016;47:e98–e169**	alone and is recommended to improve visual scanning. Class I; LOE B There is insufficient evidence to support or refute any specific intervention as effective at reducing the impact of impaired perceptual functioning. Class IIb; LOE B The use of virtual reality environments to improve visual-spatial/perceptual functioning may be considered. Class IIb; LOE B The use of behavioral optometry approaches involving eye exercises and the use of lenses and colored filters to improve eye movement control, eye focusing, and eye coordination is not recommended. Class III; LOE B For deficits in eye movements: Eye exercises for treatment of convergence insufficiency are recommended. Class I; LOE A Compensatory scanning training may be considered for improving functional ADLs. Class IIb; LOE B Compensatory scanning training may be considered for improving scanning and reading outcomes. Class IIb; LOE C For deficits in visual fields: Yoked prisms may be useful to help patients compensate for visual field cuts. Class IIb; LOE B Compensatory scanning training may be considered for improving functional deficits after visual field loss but is not effective at reducing visual field deficits. Class IIb; LOE B Computerized vision restoration training may be considered to expand visual fields, but evidence of its usefulness is lacking. Class IIb; LOE C
VaDoD Clinical Practice Guideline for the Management of Stoke Rehabilitation **Dept. of Veterans Affairs. Prepared by The Management of Stroke Rehabilitation Working Group with Support from the Office of Quality and Performance & Quality management Division, United States Army USA, 2010.**	• Recommended cognitive rehabilitation for patients with unilateral spatial neglect such as cueing, scanning, limb activation, aids and environmental adaptations (Level B) • Nursing and therapy sessions (e.g. for shoulder pain, postural control, feeding) need to be modified to cue attention to the impaired side in patient with impaired spatial awareness (Level I – or Insufficient evidence)
Management of patients with stroke: rehabilitation, prevention and management of complications, and discharge planning. A national clinical guideline. **Scottish Intercollegiate Guidelines Network, 2010** **Scotland**	• Patients with visuospatial neglect should be assessed and taught compensatory strategies.

Evidence Tables

Rehabilitation of Perceptual Disorders

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Bowen et al. 2011 **UK** **Cochrane Review**	N/A	6 single site trials were identified and included for analysis (n=338). Four of the trials identified were specific to the stroke population. Stroke was the most common etiology for the perceptual deficits of study participants. Time since onset varied from 2 weeks to 5 months, age from 17 to 86 years. Nature and severity of perceptual deficits was often not well described. A battery of neuropsychological tests was used to establish the the presence of a perceptual problem.	RCTs examining the effectiveness of non-pharmacological interventions for the rehabilitation of perceptual deficits post stroke. Treatment contrasts included: sensory stimulation vs. usual care, sensory stimulation coupled with strategy training vs. sham intervention (n=1), sensory stimulation vs. functional training (n=1). All trials were conducted during inpatient rehabilitation.	**Primary outcome**: ADL performance assessed up to 6 months post study baseline. **Secondary outcomes:** ADL performance assessed post intervention, performance on standardized impairment level measures of perception	All studies provided some form of sensory stimulation, either alone or in combination with another intervention, such as strategy training. The most common form of sensory stimulation identified was practicing tasks that required visual processing, with the guidance/supervision of an occupational therapist. Some studies provided computer-mediated tasks and one study (described below) provided a direct comparison between transfer of training and functional approaches to rehabilitation (Edmans 2000). No trials assessed the primary outcome. Based on the results from a single trial, perceptual intervention was not associated with a significant improvement in performance on ADL post intervention (MD=0.94, 95% CI -1.6-3.48) Based on the results from 2 trials, perceptual intervention was not associated with a significantly greater improvement in perceptual impairment at the end of the intervention provided (SMD=0.07, 95% CI -0.29 to 0.43).
Edmans et al. 2000 **UK** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☒	80 patients, admitted to a stroke unit, an average of 34 days post stroke, with perceptual problems and who had functional use of one hand. Mean age was Participants were 69 years, 50% were men. Patients with both left and right-sided strokes were included.	Patients were randomized to receive one of two treatment approaches: 1) transfer of training approach focusing on a perceptual task, i.e. feedback and cueing (n=40) or 2) to a functional approach group focusing on a specific ADL task for 2.5 hours per week (n=40). Perceptual treatment was provided for 6 weeks in addition to general occupational therapy.	**Primary outcome:** Rivermead Perceptual Assessment Battery (RPAB) **Secondary outcomes:** Barthel Index and Edmans ADL Index. Assessment were conducted at baseline and the end of treatment (6 weeks).	There were no significant between group differences reported in terms of inpatient length of stay, number of visits made by the attending occupational therapists or the treatment time spent with participants by occupational therapists. By the end of treatment, patients in both groups demonstrated improvements in ADL tasks and perceptual tasks. There were no significant differences between groups in median RPAB, BI or Edmans ADL Index scores at baseline or the end of treatment.

Unilateral Spatial Neglect

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Systematic Reviews					
Azouvi et al. 2017 **France** **Systematic review**	NA	37 RCTs (n=1,027) assessing the functional effects of a rehabilitation method in the treatment of spatial neglect following stroke.	Trials include 12 bottom-up approaches (visual scanning training, cueing and feedback, and visual imagery therapy); 12 top-down approaches (pursuit eye training, opto-kinetic stimulation, prism adaptation, eye patching, prism, limb activation), 1 interhemispheric competition (low vs. high-frequency rTMS), and 12 trials included a combination of approaches.	**Primary outcome:** None stated *a priori*	Narrative synthesis of results. The authors stated that while there are many published studies suggesting that various rehabilitation methods are effective, the evidence levels remain low due to small sample sizes, methodological bias, and contradictory results. The authors also stated that one rehabilitation approach cannot be recommended over another, and a combination of several methods may be most effective than a single method.
Bowen et al. 2013 **UK** **Cochrane review**	NA	23 RCTs (n=628) including persons with neglect following stroke.	Treatment contrasts included cognitive rehabilitation programs for neglect vs a control group (alternate therapy or none). 12 trials were classified as top-down approaches (visual scanning, feedback or cueing, mental practice or imagery), 9 bottom-up approaches (prisms, half-field, eye-patching, limb activation) and 2, were mixed.	**Primary outcome:** Functional disability **Secondary outcome:** Standardized neglect assessments, discharge destination, balance, depression/anxiety	Cognitive rehabilitation approaches (vs. active or inactive control) were not associated with significant improvements in ADL performance, when measured immediately after the intervention (SMD=0.23, 95% CI -0.02 to 0.48, p=0.068). Results from 10 trials included. In subgroup analysis, neither top-down nor bottom-up approaches, were significant. Cognitive rehabilitation approaches (vs. active or inactive control) were associated with significant improvements in measures of neglect, when measured immediately after the intervention (SMD=0.35, 95% CI 0.09 to 0.62, p=0.0092). Results from 16 trials included. In subgroup analysis, bottom-up approaches were significant (SMD=0.38, 95% CI 0.12 to 0.63), while top-down approaches, were not (SMD=0.36, 95% CI -0.16 to 0.88). Cognitive rehabilitation approaches (vs. active or inactive control) were not associated with significant improvements in ADL performance, when measured at follow-up (SMD=0.31, 95% CI -0.10 to

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					0.72, p=0.14). Results from 5 trials included. Cognitive rehabilitation approaches (vs. active or inactive control) were not associated with significant improvements in measures of neglect, when measured at follow-up (SMD=0.28, 95% CI -0.03 to 0.59, p=0.079). Results from 8 trials included. Secondary outcomes: Falls and discharge destination were assessed in only a single trial each, with non-significant outcomes). Other secondary outcomes were not assessed in any trials.
Yang et al. 2013 **China** **Systematic Review**	N/A	12 RCTs (n=277) including adults with neglect following stroke.	Trials examined any form of rehabilitation therapy associated with the treatment of neglect, and used the Behavioral Inattention Test (BIT), as the primary outcome. Interventions included prism adaptation (n=5), limb activation (n=2), eye patching (n=2), visual feedback (n=1), theta-burst stimulation (n=1) and mental practice (n=1). The duration of treatment ranged from 4 days to 5 weeks.	**Primary Outcomes:** Behavioral Inattention Test (BIT)	Rehabilitation therapies were associated with a significant improvement in performance on BIT (total score), assessed immediately after the intervention; SMD=0.55, 95% CI 0.16-0.94, p=0.006), but the effects were not long-lasting when assessed at follow-up, ranging from 1-24 months (SMD=0.36, 95% CI -0.21-0.92, p=0.22). Rehabilitation therapies were associated with a significant improvement in performance on BIT (conventional sub score), assessed immediately after the intervention; SMD=0.76, 95% CI 0.28-1.23, p=0.002), and were of borderline significance when assessed at follow-up (SMD=0.37, 95% CI -0.0-0.74, p=0.05). Rehabilitation therapies were not associated with a significant improvement in performance on BIT (behavioral sub score), when assessed immediately after the intervention, or at follow-up
Lisa et al. 2013 **Belgium**	N/A	15 RCTs, including persons aged 20-80 years, with unilateral neglect following stroke in the sub acute or chronic stage. All	The experimental groups included mirror therapy, feedback glasses, trunk rotation, virtual reality, limb activation,	**Primary outcome:** Traditional measures of neglect	In almost all studies there were improvements in both the experimental and control groups, but in only 7 trials were there statistically significant between

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Systematic Review		trials, with one exception included persons with sub acute stroke.	prism adaptation, TENS optokinetic stimulation, eye patching, somatosensory stimulation, visual scanning training (VST), and a combination of ≥1 therapy. The duration of the described treatments varies from two to twelve weeks. Therapy for the control group included usual care, no specific treatment for neglect or sham therapy. In most trials, treatments were given five times a week.		group differences, in favor of the experimental group. Large effect sizes (d > 0.80). were found in only four studies: virtual reality vs. VST (d=0.90), somatosensory electrical stimulation + VST vs. sham +VST (d=1.63), TENS vs. control (d=0.87) and OKS vs. control (d=1.59), and individual and group mirror therapy vs. sham (d=2.84 and d= 1.25)
Visual Scanning Training					
Chan et al. 2013 **China** **RCT**	CA: ☒ Blinding: Subjects ☒ Assessor ☑ ITT: ☒	40 patients recruited from 2 inpatient rehabilitation units following with right-sided stroke and associated unilateral neglect. Mean age was 60 years, 90% were men. Mean time from stroke onset was 15 days.	Patients were randomized to receive 12-sessions, (3x/week for 45 minutes) of a visual scanning training program for 4 weeks (including cancellation worksheets, reading and copying training, description of a room/finding groceries in kitchen cabinet/locating objects on a table and upper-limb range of movement) + standard rehabilitation or standard rehabilitation services only (control).	**Primary Outcomes:** Modified Barthel Index (MBI), Mini-Mental State Examination (MMSE) Behavioural Inattention Test Conventional (BIT-C), Catherine Bergego Scale (CBS). Outcomes were assessed at baseline and immediately post-intervention.	There was significant improvement from baseline to post intervention in mean MBI, BIT-C and CBS scores among patients in the visual scanning group. There was significant improvement from baseline to post intervention in mean MMSE, MBI, BIT-C and CBS scores among patients in the control group. There were no significant differences between groups in the mean post intervention BIT-C scores (p=0.052), or the mean BIT-C change scores (26.03 vs. 23) Mean CBS scores for patients in the visual scanning group improved significantly more than those in the control group (-11.3 vs. -5.6, p=0.04).
Ferreira et al. 2011 **Brazil** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☒ ITT: ☑	10 right-handed patients with hemispatial neglect following right hemisphere ischemic stroke, occurring ≥ 3 months. Ages ranged from 46-80 years. 5 patients with hemispatial neglect who declined to participate in the trial were	Participants were randomized to receive either visual scanning (VS, n=5) or mental practice (MP, n=5) training. Visual scanning involved scanning from the left side and touching/ mentioning figures or objects. Mental practice involved 2 motor imagery tasks and 2 visual	**Primary outcomes:** Behavioral Inattention Test (BIT), FIM. Assessments were conducted before and after the intervention period and at a 3-month follow-up. Control group	Participants in the VS group demonstrated a significantly greater change (improvement) in median BIT score from baseline to end of treatment (p<0.05) and at follow-up, compared with the control group (p=0.008). There was no significant difference in median BIT change scores from baseline to end of treatment or baseline to follow-up for patients in the VS

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		included in a control group. Ages ranged from 54 to 73 years.	imagery tasks. For both groups, training was provided over 10, 1-hour sessions for 5 weeks.	participants were evaluated twice within a 2-month interval.	vs. MP groups. There were no significant differences between groups in median FIM scores at baseline, post intervention, or follow-up.
Prisms					
Rode et al. 2015 **France** **RCT**	CA: ☒ Blinding: Patient ☑ Assessor ☑ ITT: ☑	20 patients aged 18-90 years, with left spatial neglect, following a stroke with onset of ≥1 month. 10 patients had mild neglect, 10 had severe neglect.	Patient were randomized to a prism adaptation (PA) or control group. Patients in the PA group wore a pair of glasses producing a 10-degree rightward optical deviation of the visual field. During prism exposure, the patient had to execute 80 rapid pointing movements towards visual targets located 10 degrees to the left or right of the middle of their body. The task took 6-10 minutes to complete, and was completed 4 times (baseline, days 7, 14 and 21). Patients in the control group completed the same task with a pair of placebo glasses	**Primary outcome:** FIM **Secondary outcome:** Behavioural Inattention Test (BIT) Outcomes were assessed before treatment and at 1, 3 and 6 months	Patients in both groups improved over time, with no significant differences in mean total FIM or BIT scores between groups.
Mancuso et al. 2012 **Italy** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☑ ITT: ☑	29 patients with left visual neglect; however, data is only presented for 22 patients (6 dropouts and 1 outlier were excluded). Patients with severe cognitive impairment were excluded.	Participants were randomized to wear receive either prismatic lenses (n=13) or neutral lenses (n=9) for one week. The prismatic lenses produced a 5-degree deviation to the right of the fixation point. Participants in both groups received pointing exercises during 5, 30-minute sessions.	**Primary outcomes:** Albert Test, Bells Test, Line Bisection Test, Bit Test, Object Searching Test, Orientation of Lines Test, and the Deal test. Assessments were conducted before and after treatment.	There was no significant effect of treatment x time for any of the 7 outcome measures. Participants in both groups demonstrated significant improvement on all outcomes over the study period, except for the Albert Test.
Mizuno et al. 2011 **Japan** **RCT**	CA: ☒ Blinding: Patient ☑ Assessor ☑ ITT: ☒	38 patients, aged 41-89 years, admitted to a rehabilitation unit with first-ever hemiparetic stroke occurring within the previous 3 months with no or mild cognitive impairment (MMSE >15), scoring less than the cut-off value in ≥1 Behavioral Inattention Test items. Mean age was 66 years, 75% were men.	Patients were randomized to complete a series of pointing tasks with and without prism glasses that shifted their visual field 12° to the right (n=18) vs. pointing tasks with and without neutral plastic glasses (n=20). Patients completed 20 sessions (20 minutes each), over 2 weeks. All patients participated	**Primary outcome:** Behavioral Inattention Test (BIT); BIT Conventional sub test and BIT Behavioral sub test **Secondary outcomes:** Catherine Bergego Scale (CBS), FIM, Stroke Impairment Assessment	Patients in both groups improved over time but there were no significant differences between groups in the mean change in BIT-C, BIT-B or CBS scores from baseline and follow-up. There were no significant differences between groups in mean total FIM scores at baseline, the end of treatment or at follow-up. The mean discharge FIM score

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		65% of patients had mild neglect. (mild ≥ 55 BIT-B) and the remainder had severe neglect (BIT-B <55).	in conventional rehabilitation therapies.	Set (SIAS) Assessments were conducted before and after treatment and at follow-up (hospital discharge)	of patients with mild USN in the prism group was significantly higher, compared the control condition. 31 patients completed follow-up assessments.
Turton et al. 2010 **UK** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☒	36 patients consecutively admitted with right hemispheric stroke, occurring ≥ 20 days, with confirmed spatial neglect. Mean age was 72 years, 56% were men.	Patients were randomized to complete a series of pointing tasks with and without prism glasses that shifted their visual field 6° to the right (n=17) vs. pointing tasks with and without flat neutral glasses (n=19). Patients completed 20 sessions (20 minutes each), over 2 weeks. All patients participated in conventional rehabilitation therapies.	**Primary outcomes:** Catherine Bergego Scale (CBS), Behavioral Inattention Test-Conventional (BIT-C) Assessments were conducted before, and 4 days after treatment and at 8-weeks follow-up.	There were significant improvements in mean CBS and BIT-B change scores in both groups over time, but no significant differences between groups. 28 patients completed follow-up assessments
Nys et al. 2008 **The Netherlands** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☑ ITT: ☒	16 patients admitted to a stroke unit, recruited within 4 weeks of stroke, with neglect based on performance on 4 tasks of the Behavioral Inattention Test. Mean age was 62 years, 63% were men.	Patients were randomized to complete a series of pointing tasks wearing prism glasses that shifted their visual field 10° to the right (n=10) vs. glasses that shifted their visual field 0° (n=6). Patients completed 4 sessions over 4 days, each session lasting 30 minutes.	**Primary outcomes:** Schenkenberg Line Bisection, Letter Cancellation, Gainotti Scene Copying, assessed before and after treatment each day **Secondary outcomes:** Behavioural Inattention Test (BIT), assessed before treatment and at one month	Patients in the prism group demonstrated significantly better performance on the line bisection test (fewer line deviations and omissions) and on the letter cancellation test, but not the scene copying test. At one month, there were no significant differences between groups in mean BIT-C or BIT-B scores.
Eye Patching					
Aparicio-Lopez et al. 2015 **Spain** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☒ ITT: ☒	12 patients, ≥18 years, with right hemispheric stroke, recruited from a rehabilitation hospital, with visual-spatial neglect. Mean age was 48 years, 50% were men. Mean time from stroke onset to treatment was 90 days.	Patients were randomized to receive a cognitive rehabilitation programme using a computer-based platform (n=5) vs. the same programme + right hemifield eye-patching (RHEP, n=7). Patients participated in a mean of 15.17, hour-long sessions.	**Primary outcomes:** Bell Cancellation Test, Figure Copying of Ogden, Line Bisection, Baking Tray Task, a Reading test and Catherine Bergego scale (CBS)	In the group that received a single treatment, there was significant improvement from pre-to post testing for one outcome (Line Bisection Test-lines omitted). In the group that received dual therapy, there was significant improvement from baseline in 2 outcomes (The Bells Test and Line Bisection [percent positively for rightward deviations]).

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					There was a significant difference between groups, favouring the dual intervention group in the mean change from baseline for a single outcome (Reading task)
Tsang et al. 2009 **Hong Kong** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	35 patients with right hemispheric stroke, recruited from a rehabilitation hospital within 8 weeks of stroke onset, with spatial neglect. Mean age was 75 years, 68% were men.	Patients were randomized 1:1 to a control or intervention group. Patients in the intervention group received 4 weeks of conventional occupational therapy with right half-field eye-patching glasses, which were worn throughout the occupational therapy treatment session. Patients in the control group received the same rehabilitation therapies, without eye-patching. All patients also received physical therapy, and speech therapy, as required.	**Primary outcomes:** Behavioral Inattention Test-Conventional (BIT-C), FIM, assessed at baseline and at the end of treatment	Patients in both groups demonstrated significant gains from baseline in BIT and FIM scores. Mean BIT-C change scores were significantly greater for patients in the intervention group (mean change from baseline 25.1 vs. 8.3, p=0.046). There was no significant difference between groups in mean total FIM gain from baseline (16.0 vs. 12.4, p=0.47), with patients in the intervention group achieving significantly greater gains in 3 individual items (eating, bathing, and lower-body dressing).
Fong et al. 2007 **Hong Kong** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☑ ITT: ☒	60 patients admitted to a rehabilitation hospital following a right hemispheric stroke with duration of onset <8 weeks, with left visual field neglect. Mean age was 69.7 years, 57% were men. Mean time from stroke onset to admission was 12 days.	Patients were randomized to one of 3 groups. Patients in the voluntary trunk rotation (TR) group (n= 19) received 45 minutes of voluntary trunk rotation + 15 minutes of ADL training 5x/week for 30 days. Patients in the voluntary trunk rotation and half-field eye-patching (TR + EP) group (n= 20) received the same training as the trunk rotation group except they had half-field eye patching to the ipsilesional (right) hemifield by wearing specific goggles during training. Patients in the control group (n=15) received conventional occupational therapy, which consisted of 15 minutes of training in ADL and 45 minutes of training in hemiplegic upper	**Primary outcomes:** The Behavioural Inattention Test (BIT) **Secondary outcomes:** Clock Drawing Test (CDT), FIM Motor subscale Assessments were conducted at baseline and days 30 and 60.	There were no significant differences in mean scores, or mean change scores between groups at days 30 or 60 for any of the outcomes. There were 14 dropouts or losses to follow-up.

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			extremity. All patients also received other rehabilitation therapies, as required.		
Virtual Reality					
Kim et al. 2011 **Korea** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☒ ITT: ☒	24 patients admitted to a rehabilitation unit with unilateral spatial neglect, resulting from a right hemisphere stroke. Patients with severe cognitive impairment or aphasia, severely damaged eyesight or sitting balance, or problems with cervical movement were excluded. Mean age was 64.7 years, 58% were men. Mean time from stroke onset to admission to rehabilitation was 24 days.	Patients were randomized to receive either virtual reality training (n=12) or conventional therapy (n=12). Virtual reality training utilized the IREX system® which involves the use of computer-recognizing gloves that transfer participant responses to a virtual environment. Both groups received therapy for 30 minutes a day, five times a week for 3 weeks. Other rehabilitation therapies were provided to all patients, as needed.	**Primary outcomes:** Star cancellation test, the line bisection test, the Catherine Bergego Scale (CBS) and the Korean version of the modified Barthel Index (K-MBI). Assessments were conducted before and after treatment.	Following treatment, both groups demonstrated significant improvement on all outcome measures ($p<0.05$). Mean change in scores on the star cancellation test and CBS were significantly greater for those in the virtual reality training group (8.7 vs. 4.1 and 9.1 vs. 4.6, respectively; both at $p<0.05$). There were no between group differences for the line bisection test or the K-MBI; however, only 3 participants from the intervention group and 7 from the control group completed the line bisection test
Katz et al. 2005 **Israel** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☒ ITT: ☒	19 patients with first-ever right hemispheric stroke, with residual unilateral spatial neglect, recruited from a rehabilitation hospital. Mean age was 63 years, 63% were men. Mean time from stroke onset to treatment was <48 days.	Patients were randomized to a virtual reality (n=11) or a control group (n=8). Patients in the VR group performed a street-crossing exercise using a desk-top computer, with increasing levels of difficulty. Patients in the control group performed computer-based visual scanning tasks. Patients in both groups received the same intensity and duration of treatment (a total of 9 hours over 4 weeks (45 minutes per session, 3x/week).	**Primary outcome:** Star cancellation item from the Behavioral Inattention Test **Secondary outcomes:** Mesulam Symbol Cancellation test, ADL checklist, Street crossing test Assessments were conducted before and after treatment	Patients in both groups improved over time. There were no significant differences between groups in mean change score from baseline to end of treatment for any of the USN measures (star cancellation, symbol cancellation) or the ADL checklist. Patients in the VR group made significantly fewer accidents in the street-crossing test from pre- to post test (mean 7.9 to 3.8 vs. 3.8 to 3.4, $p=0.035$). In the real street-crossing test, the mean number of times persons in the VR group looked left increased from pre-to post test (4.0 to 5.4), while there was a decrease in the control group (6.3 to 5.8). There was no change in the mean decision time to cross the street per vehicle in the VR group over the study period and a slight decrease in the control group. The difference between groups

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					was not significant.
Mirror Therapy					
Pandian et al. 2014 **India** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☒	48 patients, admitted to hospital with thalamic and parietal lobe lesions, occurring within the previous 48 hours, with upper-limb weakness. Mean age was 63.5 years, 58% were men. 23% of patients had left hemispheric lesions.	Patients were randomized to one of two groups: 1) mirror therapy + limb activation (MT, n=27) group or 2) control (sham MT+ limb activation, n=21) group. Treatment sessions lasted 1-2 hours and were given once a day, 5 days a week for 4 weeks.	**Primary Outcomes:** Star Cancellation Test (SCT), Line Bisection Test (LBT), Picture Identification Task (PIT). Outcomes were assessed at baseline, and at 1, 3 and 6 months.	Significantly greater improvement was reported across all outcome measures (SCT, LBT and PIT) for patients in the MR group after 1 month ($p<0.0001$, $p=0.002$, $p<0.0001$, respectively), 3 months ($p<0.0001$, $p=0.005$. $p<0.0001$, respectively) and 6 months ($p<0.0001$, $p=0.006$, $p<0.0001$, respectively)
Thieme et al. 2013 **Germany** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☒ ITT: ☑	60 patients, aged 18-80 years, with a first supratentorial stroke occurring within the previous three months, admitted for inpatient rehabilitation with severe distal hemiparesis of the arm. Mean age was 67.2 years, 58% were men. 37% of patients had left hemispheric lesions. Mean time since stroke was 45 days.	In addition to receiving standard rehabilitation therapies, participants were randomized to one of 3 treatment groups: individual mirror therapy (n=18), group mirror therapy in which one therapist treated 2-6 patients at the same time (n=21), or control, using a sham (i.e., turned mirror) (n=21). Treatment was provided for 30 minutes, 4x/week for 5 weeks (20 sessions)	**Primary outcomes:** Fugl-Meyer Test-arm section, Action Research Arm Test (ARAT) **Visuospatial Neglect outcome:** Star Cancellation Test (SCT) Outcomes were assessed before and after treatment	There were no significant differences in mean change scores for any of the motor outcomes. 14 patients had visuospatial neglect. Of these, 3 patients received individual mirror therapy, 5 received group mirror therapy and 6 patients received the control condition. The mean increases in SCT scores were 20.0 for patients in the individual mirror therapy group, 4.4 for patients in the group therapy group and -2.3 for patients in the control group. The difference in means between the individual mirror therapy and control groups was statistically significant ($p<0.01$).
Dohle et al. 2009 **Germany** **RCT**	CA: ☑ Blinding: Patients ☑ Assessor ☑ ITT:☒	36 patients, age 25-80 years with severe hemiparesis, resulting from a first-ever MCA ischemic stroke, with onset no more than 8 weeks prior to study entry. Mean age was 56 years, 72% were men.	Participants were randomized to either a mirror therapy (MT) where they watched the mirror image of the unaffected arm as if it were the affected arm; or a control therapy (CT) where no mirror was present. Therapy was provided for 30 minutes, 5x/week for 6 weeks. All patients also participated in a standard therapy program	**Primary Outcomes:** Fugl-Meyer Assessment (upper-extremity), Action Research Arm Test (ARAT) **Visuospatial Neglect outcome:** A 5-point neglect score, based on Behavioral Inattention Test items and tests of attentional performance	48 participants were randomized, but there were 12 dropouts over the study period. 20/24 right-handed patients with right hemispheric lesions had signs of hemineglect at the beginning of the study. There was significantly greater improvement in mean neglect scores at the end of treatment among patients in the mirror group (0.9, 95 % CI 0.6-1.2 vs. 0.2, 95% CI -0.2-0.5, $p=0$ .005).
rTMS					

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Yang et al. 2017 **China** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	60 patients, ≥18 years admitted for inpatient rehabilitation following a right hemispheric stroke, with duration of onset >1 week and neglect (score ≥128 on Behavioural Inattention Test) and a MMSE score ≥17. Mean age was 58 years, 28% were men. Mean duration since stroke onset was 42 days.	Patients were randomized 1:1:1 to one of 3 groups: low frequency (1Hz) rTMS at 90% of motor threshold + conventional rehabilitation, low frequency rTMS + sensory cueing (using a wearable device on the left wrist, which vibrated every 5 minutes, for 3 hours a day, 5 days a week) + conventional rehabilitation or conventional rehabilitation for 2 weeks. Conventional rehabilitation consisted of 30 sessions, each lasting 45 minutes (2 PT, 1OT) daily, 5 days a week.	**Primary outcomes:** Behavioural Inattention Test (BIT)-Conventional, The Catherine Bergego Scale (CBS) **Secondary outcomes:** Fugl-Meyer Assessment (FMA)-upper extremity, Action Research Arm Test, Modified Barthel index Assessments were conducted at baseline, post intervention and at 6 weeks	Patient in all groups improved over the study period. Mean BIT scores of the rTMS + sensory cueing group were significantly better immediately post intervention (p=0.025) and at follow-up (p=0.003) compared to the control group. Mean BIT scores of the rTMS group were significantly better at follow-up compared with the control group (p=0.048). There were no significant differences between groups in mean CBS scores or for any of the secondary outcomes.
Kim et al. 2013 **Korea** **RCT**	CA: ☑ Blinding: Patient ☑ Assessor ☒ ITT: ☑	27 patients admitted for inpatient rehabilitation, following acute cortical or subcortical stroke, with visuospatial neglect (confirmed via Line Bisection Test). Mean age was 67 years, 56% were men. Mean time since stroke onset was approximately 15 days	Patients were randomized to receive 10, 20-minute sessions over 2 weeks of 1) low-frequency (1Hz) rTMS over the non-lesioned posterior parietal cortex (PPC), 2) high-frequency (10Hz) rTMS over the lesioned PPC, or 3) sham stimulation. All patients received conventional rehabilitation	**Primary Outcomes:** Motor-Free Visual Perception Test (MFVPT) Line Bisection Test (LBT), Star Cancellation Test (SCT), Catherine Bergego Scale (CBS), Korean-Modified Barthel Index (K-MBI). Outcomes were assessed at baseline and post treatment.	There were no significant differences between groups in mean changes in MFVPT, SCT or CBS scores. There was a significant difference among groups in LBT change scores (p=0.049). Post-hoc analysis indicated the improvement was significantly greater in the high-frequency rTMS group compared to sham-stimulation group (-36.9 vs. 8.3, p=0.03). There was a significant difference among groups in K-MBI change scores (p<0.01). Post-hoc analysis indicated the improvement was significantly greater in the high-frequency rTMS group compared with the sham-stimulation group (30.6 vs. 15.1, p<0.01), and in the low-frequency rTMS group compared with the sham stimulation group. (27.6 vs. 15.1, <0.02).
Limb Activation					
Fong et al. 2013 **China** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑	40 patients, recruited within 8 weeks from 2 rehabilitation hospitals following left hemiplegic stroke, with evidence of unilateral neglect, with	Patients were randomized 1:1 to one of two groups: 1) adornment of a sensory wristwatch cueing device, which emitted vibration and auditory	**Primary Outcomes:** Behavioural Inattention Test (BIT) [cancellation task, drawing task], Fugl-Meyer Assessment (FMA)	Patients in both groups improved over the study period, but the only significantly different difference between groups at the end of follow-up was the mean BIT-neglect drawing task, in which the

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
	ITT: ☑	moderate to severe upper-limb paresis. Mean age was 67 years, 62.5% were men. Mean time from stroke onset to randomization was 23 days.	signals on the hemiplegic arm for 3 hr/d, 5 d/week, followed by consecutive arm movements for 3 weeks + conventional rehabilitation, or 2) adornment of a sham device + conventional rehabilitation (control).	[upper limb, hand], FIM, Functional Test for the Hemiplegic Upper Extremity (FTHUE). Outcomes were assessed at baseline and week 3 and 6.	experimental group performed better (p=0.034). The mean gain from baseline in the experimental group was 126.8% vs. 35.84% in the control group. The mean gain from baseline for the BIT-cancellation task in the experimental group was 51.8% vs. 28.4% in the control group, p=0.908) 3 patients were lost to follow-up in the intervention group and 9 in the control group.
Luukkainen-Markkula et al. 2009 **Finland** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☒ ITT: ☑	12 patients with left-sided neglect within 6 months of a 1st unilateral right-sided stroke. 42.9% of patients screened were eligible for inclusion.	Participants were randomly assigned to receive either 20 – 30 hours of left arm activation training (n=6) or 10 hours of traditional visual scanning training (n=6) over 3 weeks. Both interventions were offered as part of a comprehensive program of post-stroke rehabilitation.	**Primary outcomes:** Behavioural Inattention Test (BIT), Catherine Bergego Scale (CBS). **Secondary outcomes:** FIM, Modified Motor Assessment Scale, Wolf Motor Function Test, and a neuropsychological assessment battery. Assessments were conducted before and after treatment and at a 6-month follow-up.	In the arm activation condition, visual neglect (BIT) improved significantly over the course of the intervention (p<0.05) and from baseline to 6 months (p<0.05). Patients in the visual scanning condition demonstrated non-significant improvement from baseline to the end of intervention but demonstrated significant improvement from baseline to 6-month follow-up (p<0.05). There was a non-significant trend towards improvement in behavioural neglect (CBS) in both groups over the course of treatment and at 6-month follow-up. Between group comparisons were not reported.

Limb Apraxia

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
West et al. 2008 **UK** **Cochrane Review**	N/A	3 RCTs (n=132), including patients with motor apraxia following stroke. Studies examining apraxia of speech and oral apraxia,	Trials examined strategy training vs. usual care (n=113), gesture training vs. conventional aphasia treatment (n=10), and transfer of training vs. a	**Primary outcome:** Independence in ADLs (e.g., Barthel Index, Assessment of Motor and Process Skills, and the Functional Independence Measure), at 6 months.	There was no significant difference between groups in mean BI score change 6 months after the end of treatment (MD=0.17, 95% CI -1.41 to 1.75; p>0.05). Results from 1 trial included (n=83). At the end of therapy, mean BI change was significantly greater for patients in the

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		were excluded. Studies that included patients with conditions other than stroke were excluded unless >75% of the sample was post-stroke or subgroup analyses were reported.	functional approach (n=9).	**Secondary outcomes:** Death, quality of life, ability to gesture/pantomime/use objects, mood, family/carer well-being, and adverse events, assessed at the end of the intervention period and 12-month follow-up.	experimental group (MD=1.28, 95% CI 0.19 to 2.38; p=0.02). Results from 2 trials included (n=102). There were no significant differences between groups on any of the secondary outcomes.

Abbreviations

CA = Concealed Allocation	CI = Confidence Interval
FIM=Functional Independence Measure	ITT = Intention to treat
N/A = Not Assessed	OR = Odds Ratio
RCT= Randomized Controlled Trial	

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