

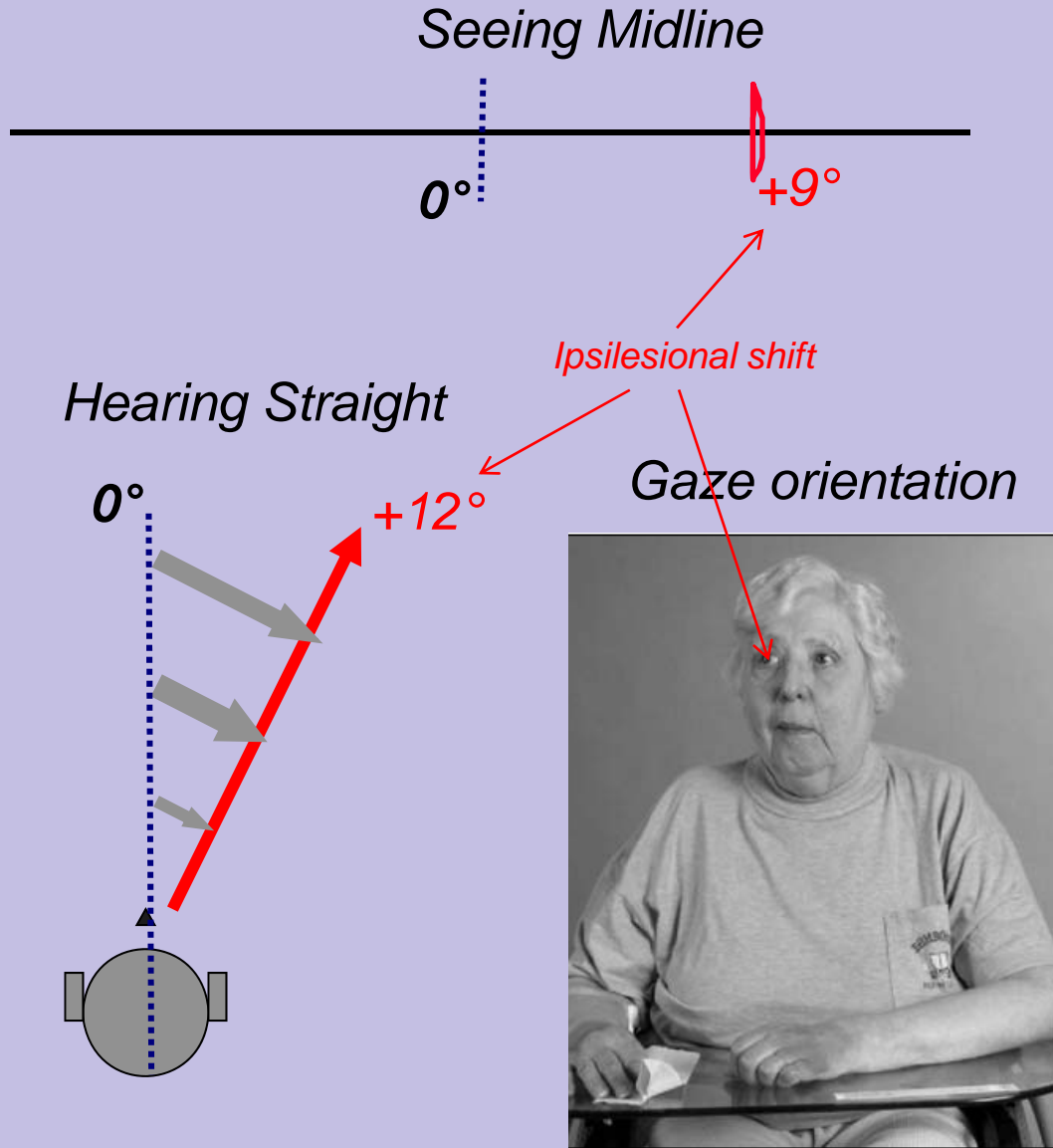
Smooth pursuit eye movement training accelerates recovery from auditory/visual neglect and reduces disability and unawareness: results from 2 randomized controlled trials

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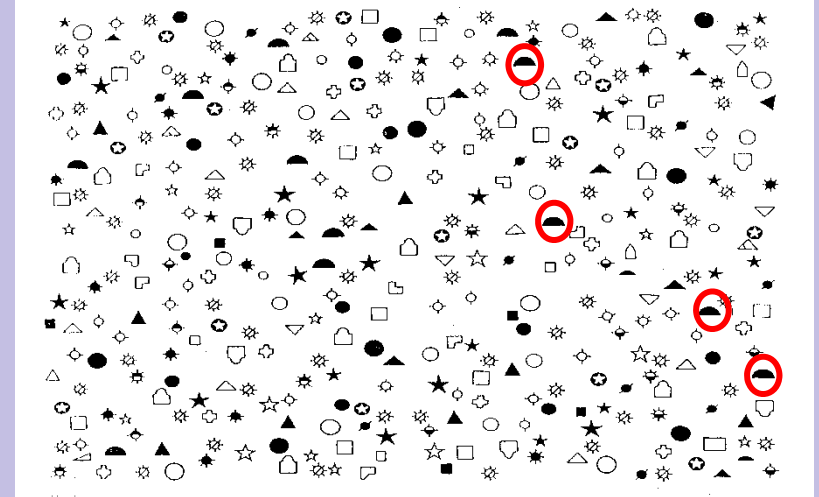
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Spatial Neglect: Components and Modalities



Fruhmann-Berger et al, 2005

Visual Search



Reading

Der sommergrüne Laub- oder Mischwald bedeckte einst fast ganz Mitteleuropa. Eichen und Buchen, Ulmen, Pappeln und Birken, Eschen und Kastanien bieten vielen Vögeln, Insekten und kleinen Säugetieren Schutz und Nahrung. Der Wald in den Ländern rund um das Mittelmeer heißt Buschwald. Dieser einzigartige Wald...

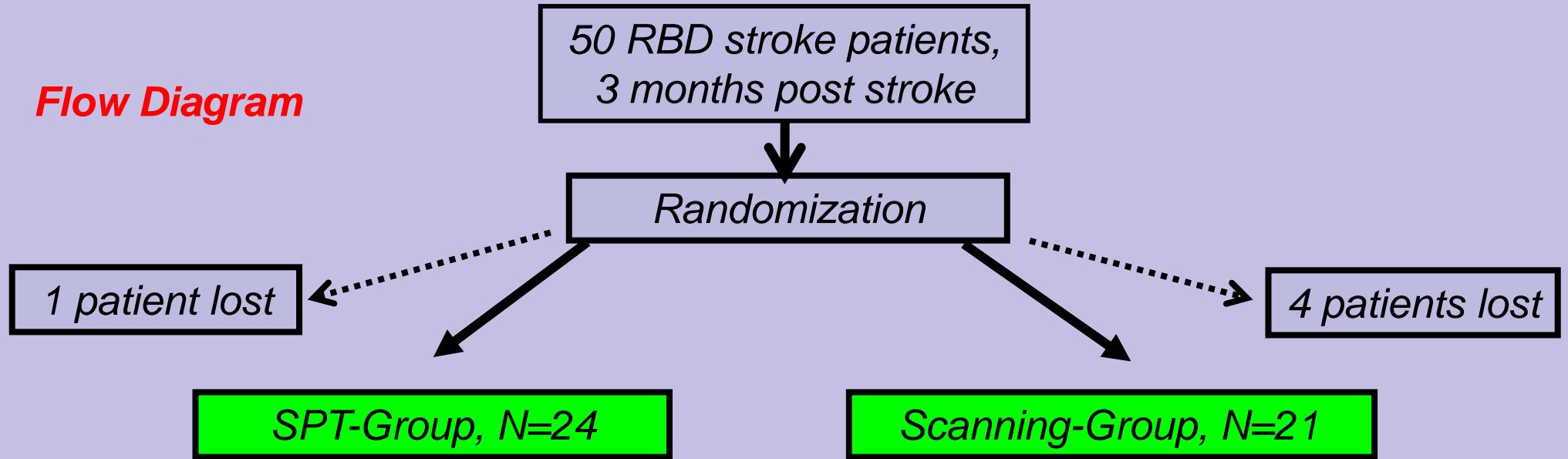
Omissions in Reading

Unawareness & Poor Rehab Outcome in Neglect

- unawareness impairs neglect therapy
- poor outcome, functional dependency in neglect
- few Randomized Controlled Trials (RCTs) available
- often focus on tests, few functional measures
- no treatments for *auditory* neglect evaluated
- few treatments suitable for early stroke patients („bedside“)

RCT-trial 1: Effects of Smooth Pursuit Training (SPT) vs. Scanning Training on visual/auditory neglect

Flow Diagram



2 Baselines

5 Treatments à 50 min

Post-test

Follow-up

Time

1-2 weeks

1 week

2 weeks

RCT-trial 1: Treatments

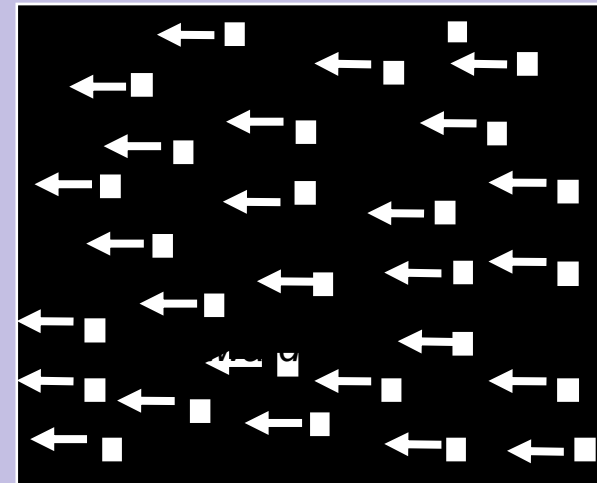
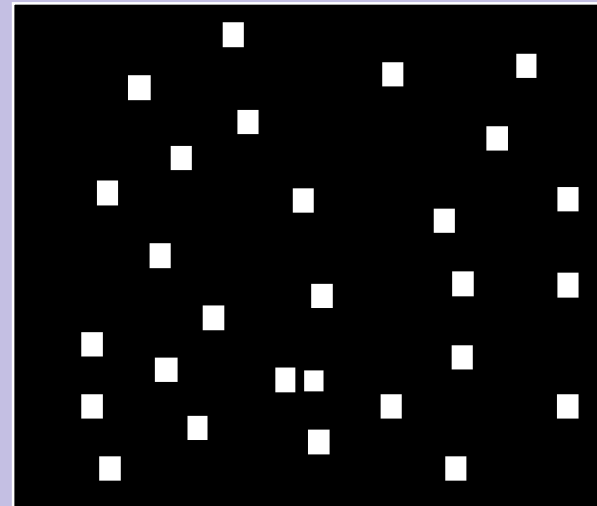
Visual Scanning Therapy on stationary displays

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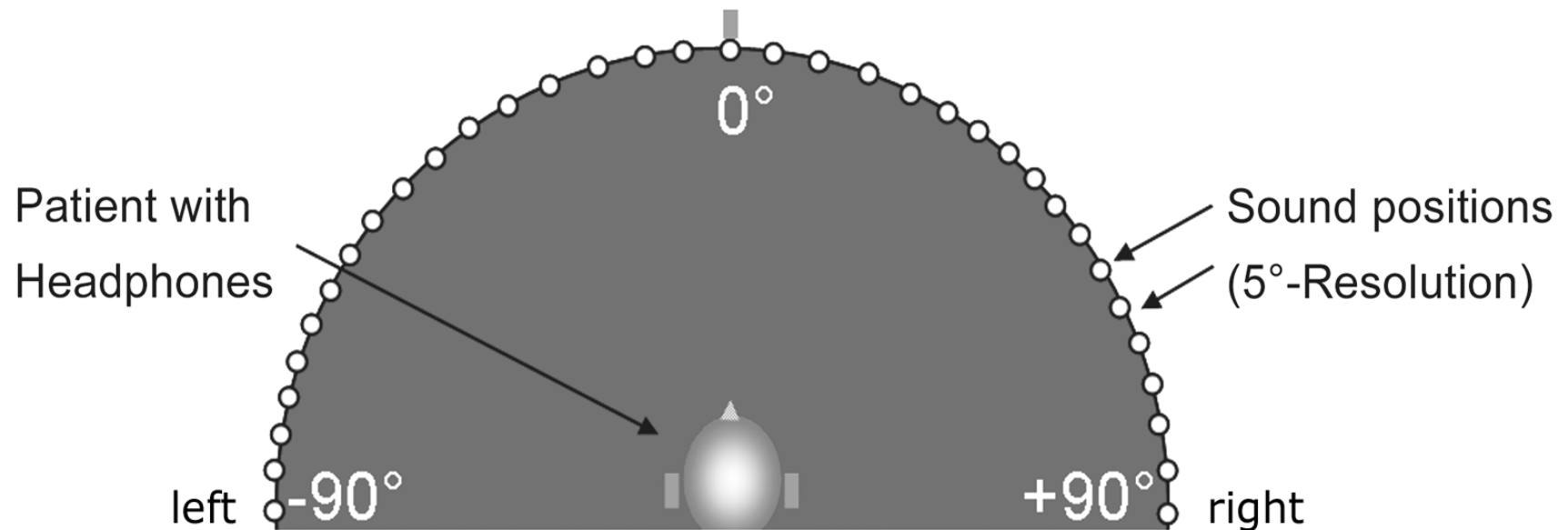
Smooth Pursuit Therapy with
Leftward Moving displays

Nelgect Patients RCT-1 trial

	Visual Scanning Training VST	Smooth Pursuit Training SPT	Statistical comparison (p)
Sample size	n=21	n=24	-
Stroke aetiology	17 ischemic, 4 haemorrhagic	20 ischemic, 4 haemorrhagic	-
Parietal Lesion	10	9	-
Temporal Lesion	7	9	-
Frontal Lesion	1	1	-
Occipital Lesion	1	2	-
Subcortical Lesion (Thalamus, BG)	2	3	-
Months since Stroke (Mean, Median)	Mean: 5.24 (1-34), Md: 3	Mean: 3.58 (1-10), Md: 3	0.29
Age (years; range)	59.86 (36-73)	58.50 (37-74)	0.64
Sex (male/female)	14 m, 7 f	16 m, 8 f	1.00*
Hemiparesis	19 left	23 left	0.47*
Visual Field Defect; Field Sparing (°)	15/ 5°	19/ 6°	0.55*
Perceptual Line Bisection (deviation in mm)	+18.99 right-sided (-15 – 65)	+25.15 right-sided (-2 – 94)	0.47
Visuomotor Line Bisection (deviation in mm)	+15.93 right-sided (-13 – 60)	+19.54 right-sided (-2 – 88)	0.57
Digit cancellation, single target (omissions left/right, max 10/10)	6.52/2.61 (0-10 / 0-9)	5.98/1.81 (0-10 / 0-9)	0.59/0.30
Digit cancellation, dual targets (omissions left/right, max 20/20)	11.11/5.00 (0-20 / 0-17)	11.77/4.64 (2-20 / 0-20)	0.75/ 0.81
Reading (omissions, max 55)	12.90 (0-44)	12.97 (0-47)	0.99
Auditory midline (deviation from midline in °, max 90° left/right)	+13.71° rightsided (1-28)	+10.53° rightsided (-3 – 33)	0.13

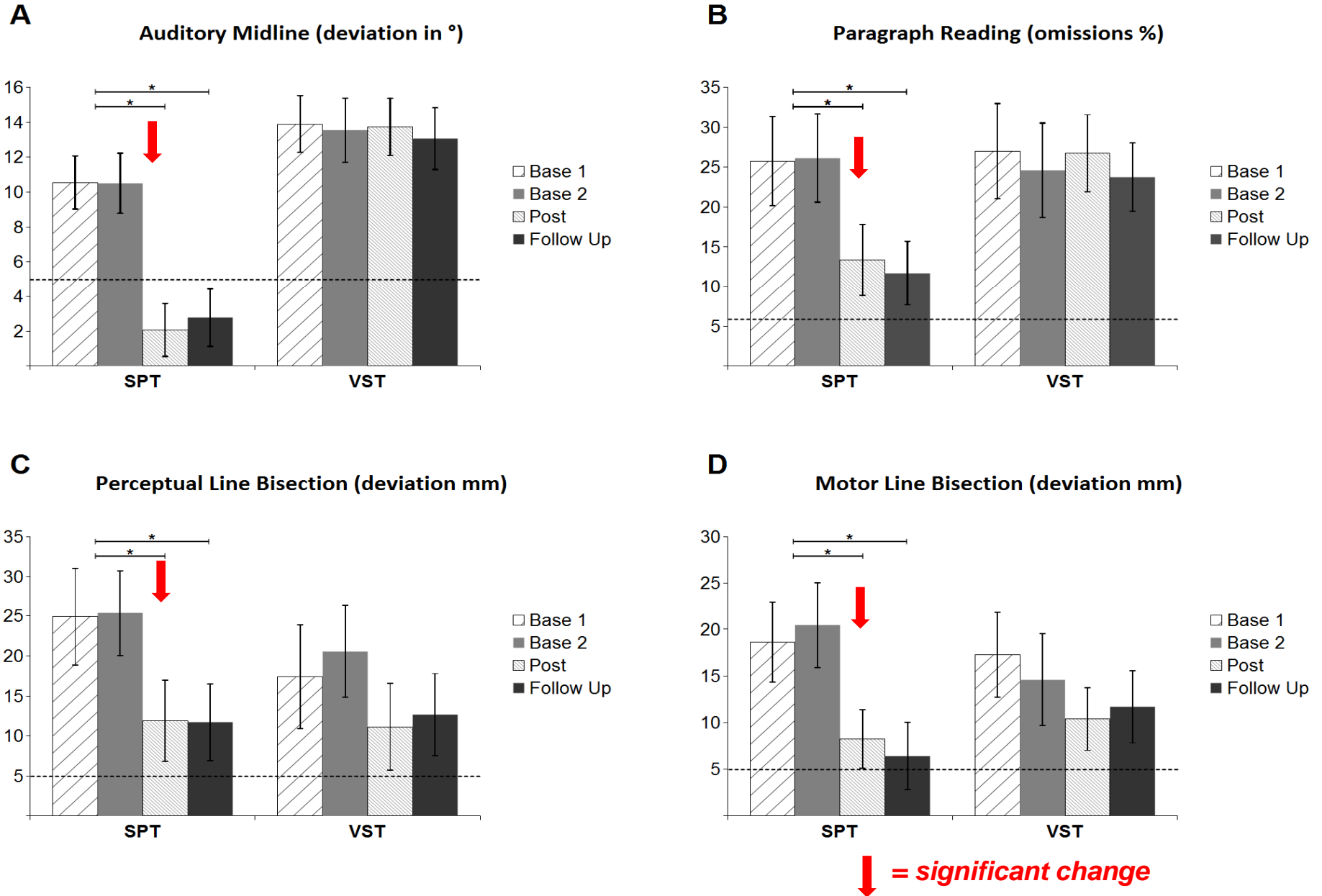
Measuring the Auditory Midline in Neglect

Auditory Subjective Median Plane



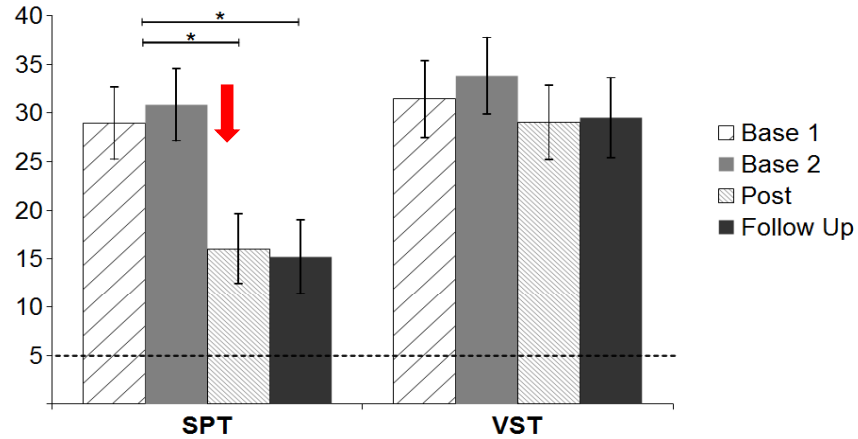
More details about technique: see Kerkhoff et al, Neuropsychologia, 2006, 2012

RCT-trial 1: Results for visual/auditory neglect

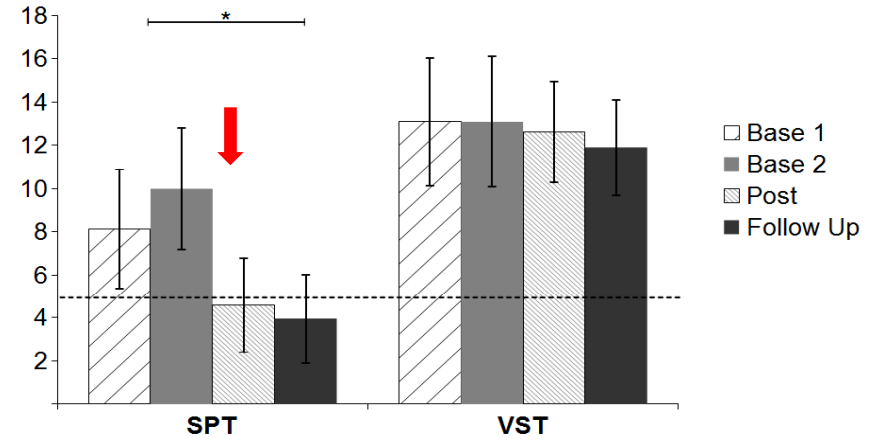


RCT-trial 1: Results for Cancellation Tasks

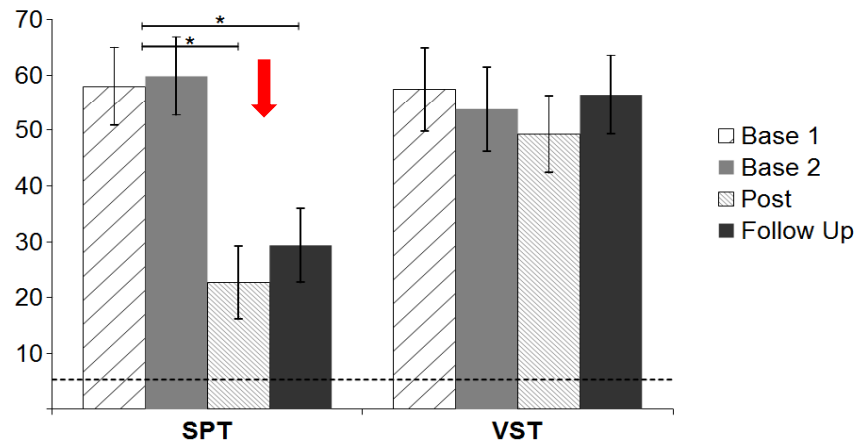
A Single Number Cancellation (left omissions %)



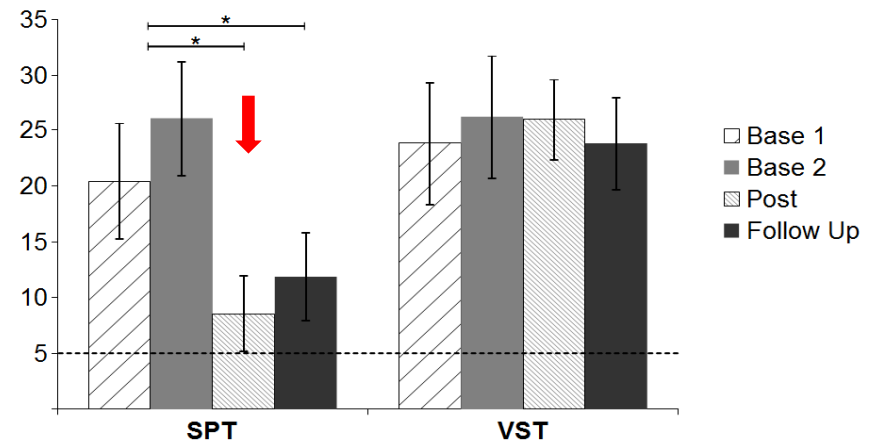
B Single Number Cancellation (right omissions %)



C Double Number Cancellation (left omissions %)

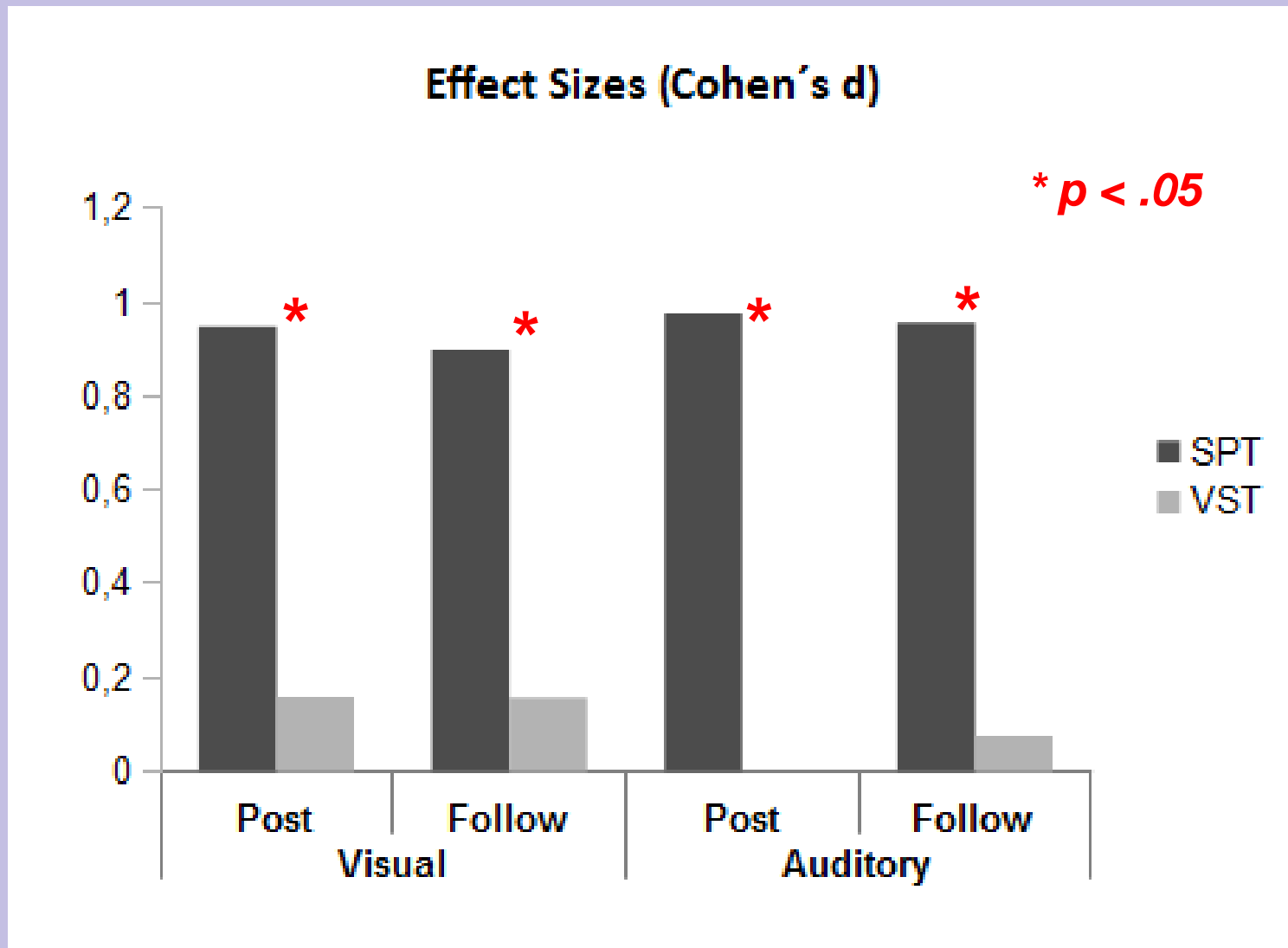


D Double Number Cancellation (right omissions %)



↓ = significant change

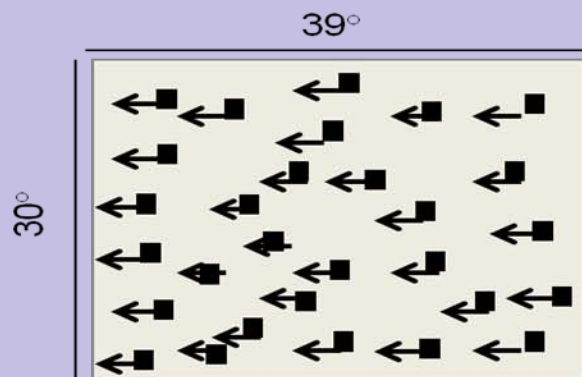
RCT-trial 1: Effect Sizes



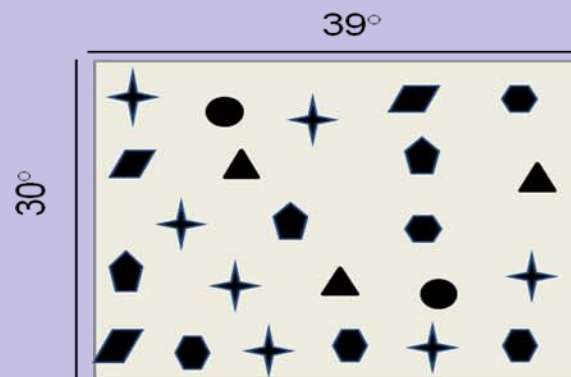
Kerkhoff, G., Reinhart, S., Ziegler, W., Artinger, F., Marquardt, C., Keller, I. (2013) Smooth pursuit eye movement training promotes recovery from auditory and visual neglect. A randomized controlled study. *Neurorehabilitation and Neural Repair* 27, 789-798.

RCT-trial 2: Effects of Smooth Pursuit Therapy vs. Scanning Therapy on Functional Neglect & Unawareness

Pursuit Eye Movement Training



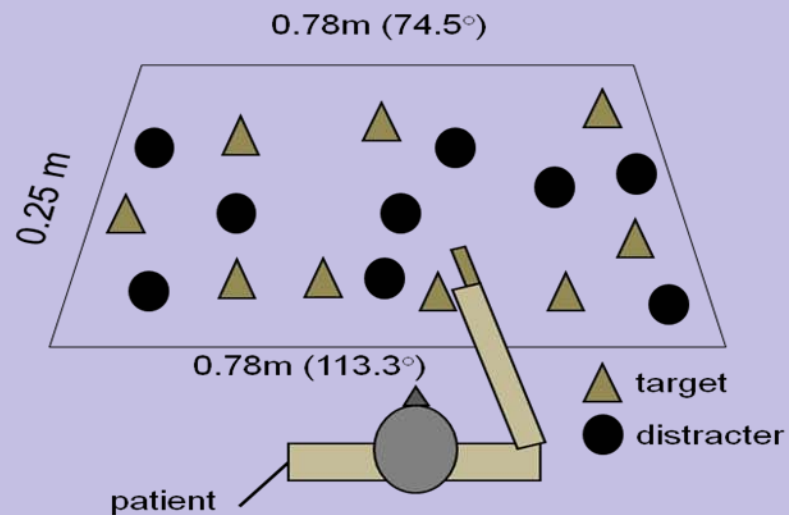
Visual Scanning Training



Bedside Treatment



Tray Test



RCT-trial 2: Outcome Measures

Functional Neglect Index (FNI)

- Gaze orientation
- Object search on tray
- Picture search
- Stick bisection (1 m)
- Composite rating („blind“)

Unawareness & Behavioral Neglect Index (UBNI)

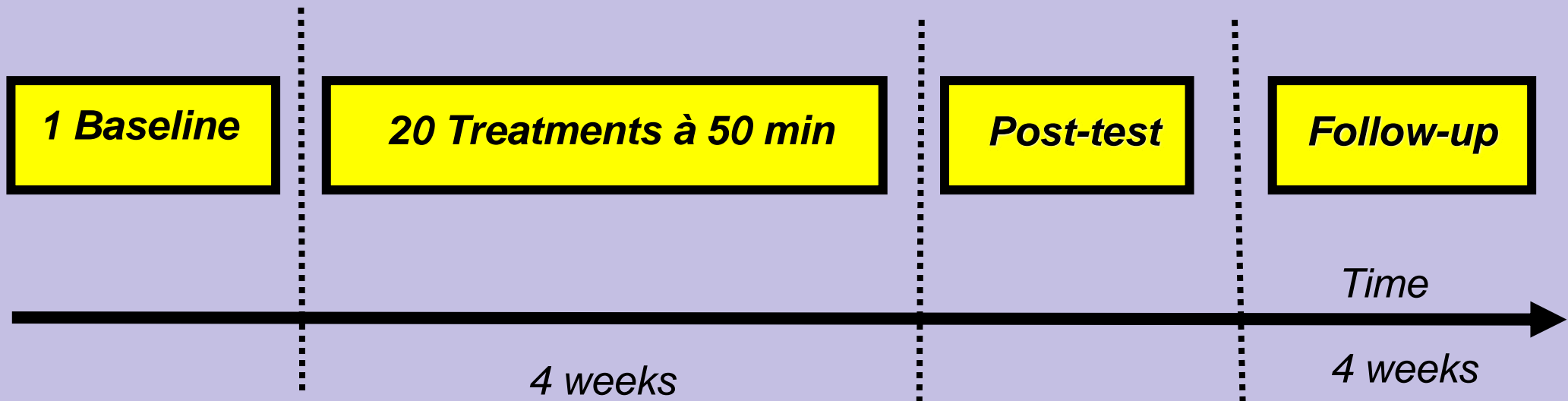
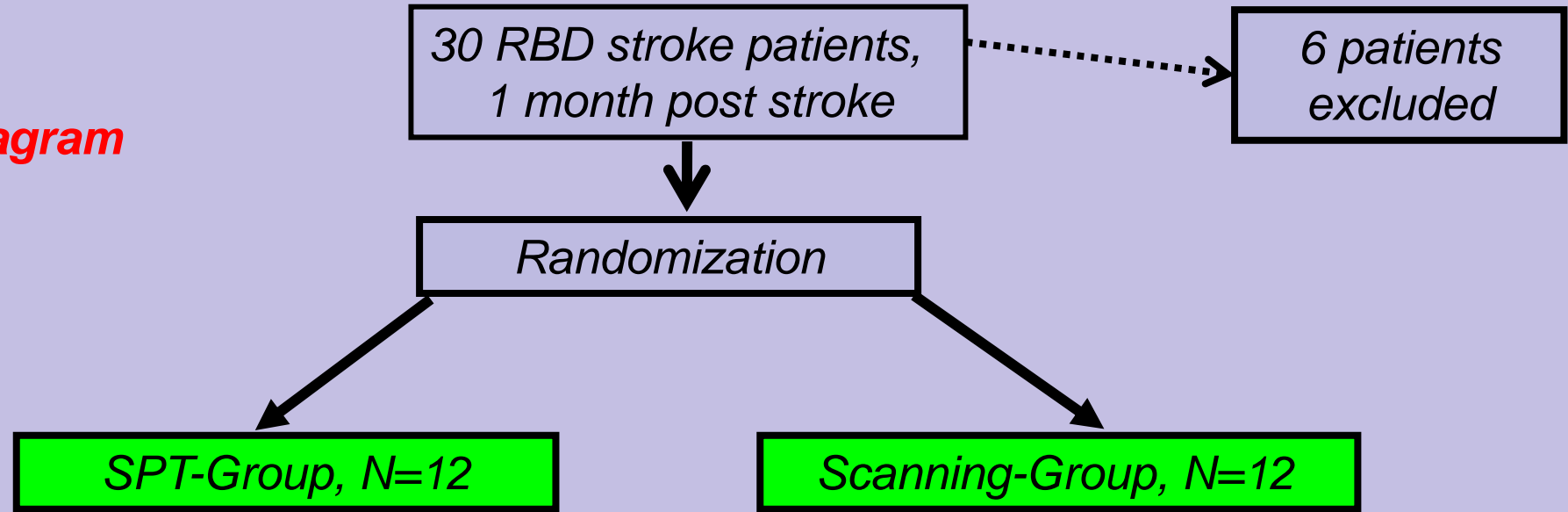
- 6 items on unawareness
- 4 items on neglect in ADLs
- rating by nurses („blind“)

Barthel Index
Help Index } rated by staff („blind“)

*Kerckhoff, G., Bucher, L., Brasse, Leonhart, E., Holzgraefe, M. Völzke, V., Keller I., Reinhart, S. (2013) Smooth Pursuit Bedside Training reduces disability and unawareness during the activities of daily living in neglect. A randomized controlled trial. **Neurorehabilitation & Neural Repair, in press 1.9.2013***

RCT-trial 2: Effects of Smooth Pursuit Therapy vs. Scanning Therapy on Functional Neglect & Unawareness

Flow Diagram



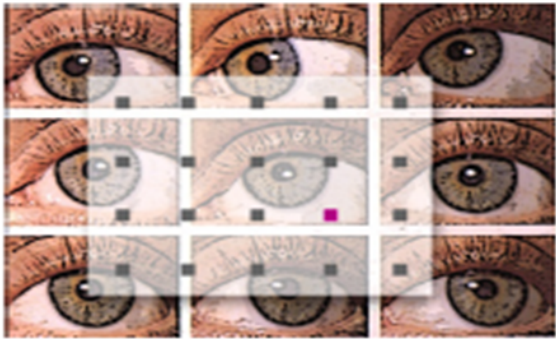
Neglect Patients RCT-2 trial

Code	Treat-ment	Age, gender	Etiology, days since lesion	Lesion location (right)	Motor Status	Visual field (defect)	Treatment Period [days]	Rehabilitation status					
								Barthel index			Rehab phase*		
								Pre	Post	Foll	Pre	Post	Foll
DS	VST	65, f	I, 21	F, T	L paresis	L-QUA	26	50	95	95	B	C	C
MP	VST	71, f	H, 33	BG, Thalamus	L plegia	Normal	59	10	10	10	B	B	B
MS	VST	49, f	H, 18	BG	Normal	Normal	25	35	60	65	C	C	C
WP	VST	60, m	I, 17	T, P	L paresis	L-HH	24	20	40	40	B	B	B
PR	VST	53, m	H, 62	BG	L paresis	Normal	30	10	10	10	B	B	B
JF	VST	73, f	I, 47	F, P	L plegia	Normal	28	0	0	0	B	B	B
EH	VST	65, m	I, 66	F, P, T, O	L plegia	L-HH	29	5	10	10	B	B	B
GS	VST	63, m	I, 50	F, T	L plegia	Normal	27	5	5	10	B	B	B
ER	VST	82, m	I, 38	O	L paresis	L-HH	19	30	35	55	B	B	B
KD	VST	58, m	I, 33	F, T	L plegia	Normal	18	15	30	30	B	B	B
MI	VST	69, f	I, 35	F, P, T	L plegia	Normal	18	0	15	35	B	B	B
DW	VST	59, m	I, 21	O, P	L plegia	L-HH	20	0	0	0	B	B	B
Mean		64	37				27	15	26	32			
(SD)		(3)	(5)				(3)	(5)	(8)	(8)			
IK	SPT	61, f	I, 51	F, T	L-plegia	L-QUA	30	20	30	35	B	B	B
WF	SPT	68, m	I, 30	P, F, T	L-plegia	Normal	27	0	15	30	B	B	B
JW	SPT	73, m	I, 44	F, T	L-plegia	Normal	31	5	30	30	A	B	B
WH	SPT	63, m	I, 12	F, T	L-plegia	Normal	36	0	5	10	B	B	B
RW	SPT	59, m	I, 16	P, F, T	L-plegia	Normal	24	0	15	45	B	B	B
ME	SPT	74, f	I, 24	F, T	L-plegia	Normal	46	20	30	30	B	B	B
HS	SPT	60, m	I, 11	P, O	L-paresis	Normal	21	0	25	25	B	B	B
GH	SPT	50, m	H, 44	F, T	L-plegia	Normal	35	0	0	0	B	B	B
PG	SPT	53, m	H, 56	BG	Normal	Normal	29	10	40	45	B	B	C
RA	SPT	61, m	I, 27	F, P	L-paresis	L-QUA	50	35	65	85	B	C	C
SN	SPT	60, f	I, 20	F, P, T	L-plegia	Normal	35	15	45	70	B	B	C
NS	SPT	84, f	I, 25	F,P, T	L-paresis	L-HH	36	30	40	45	C	C	C

RCT-trial 2: Treatments at the patient's bedside

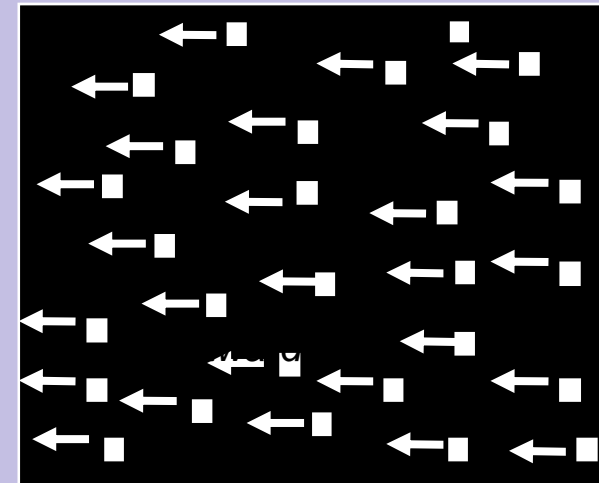
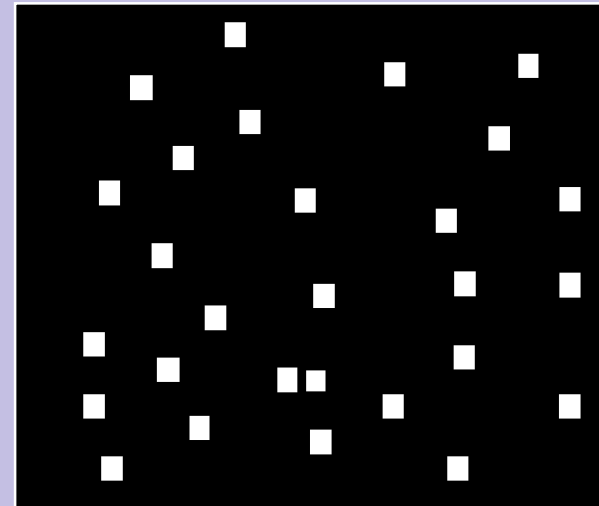
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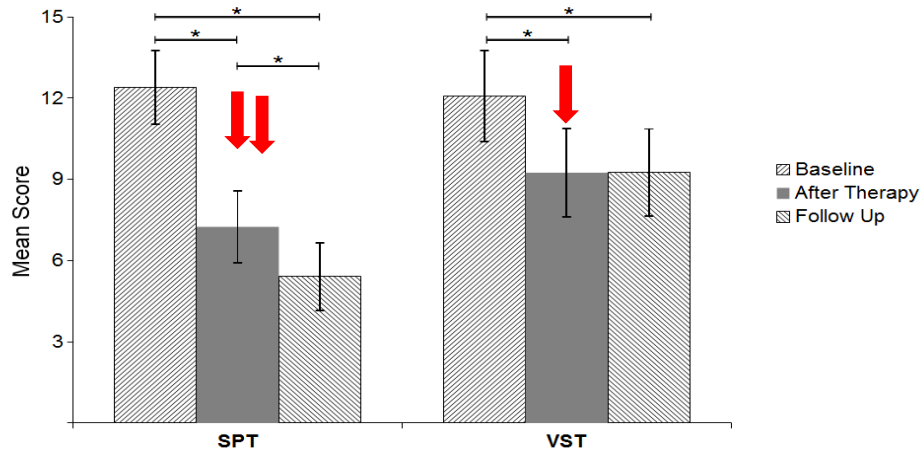
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Smooth Pursuit Therapy with
Leftward Moving displays

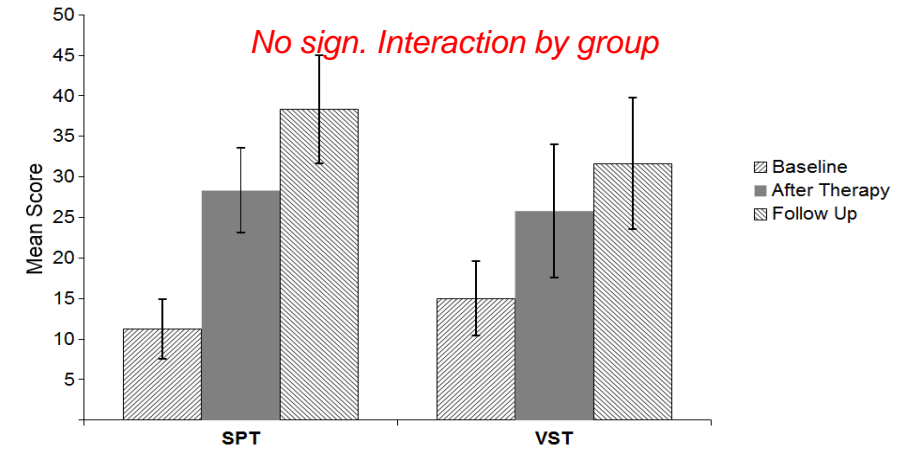
RCT-trial 2: Results on Functional Measures & Unawareness

Functional Neglect Index



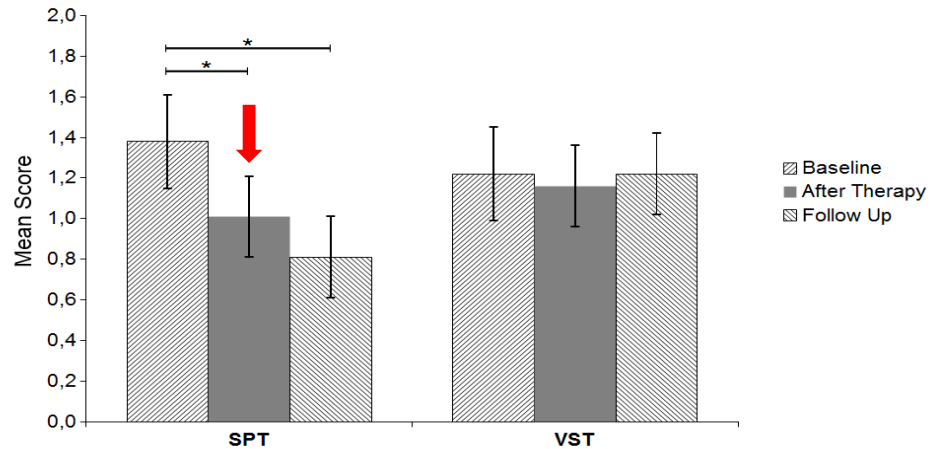
Sign. Interaction by group

Barthel Index



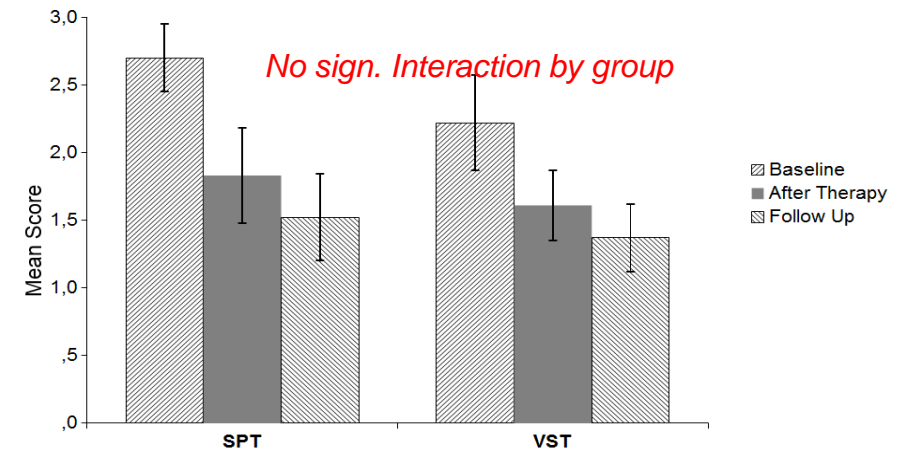
No sign. Interaction by group

Unawareness Behavioral Neglect Scale (UBNI)



Sign. Interaction by group

Help Scale



No sign. Interaction by group

Summary and Take-Home Message

Smooth Pursuit Neglect Therapy....

- *reduces auditory/visual neglect significantly*
- *is much more effective than visual scanning therapy (effect sizes)*
- *is cost-efficient (5-20 treatment sessions yield improvements)*
- *reduces functional neglect (gaze orientation, finding objects)*
- *significantly reduces the unawareness of patients with neglect*
- *is suitable as a bedside therapy for the early treatment of neglect*

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