

Neglect (personal, peri- personal, external)

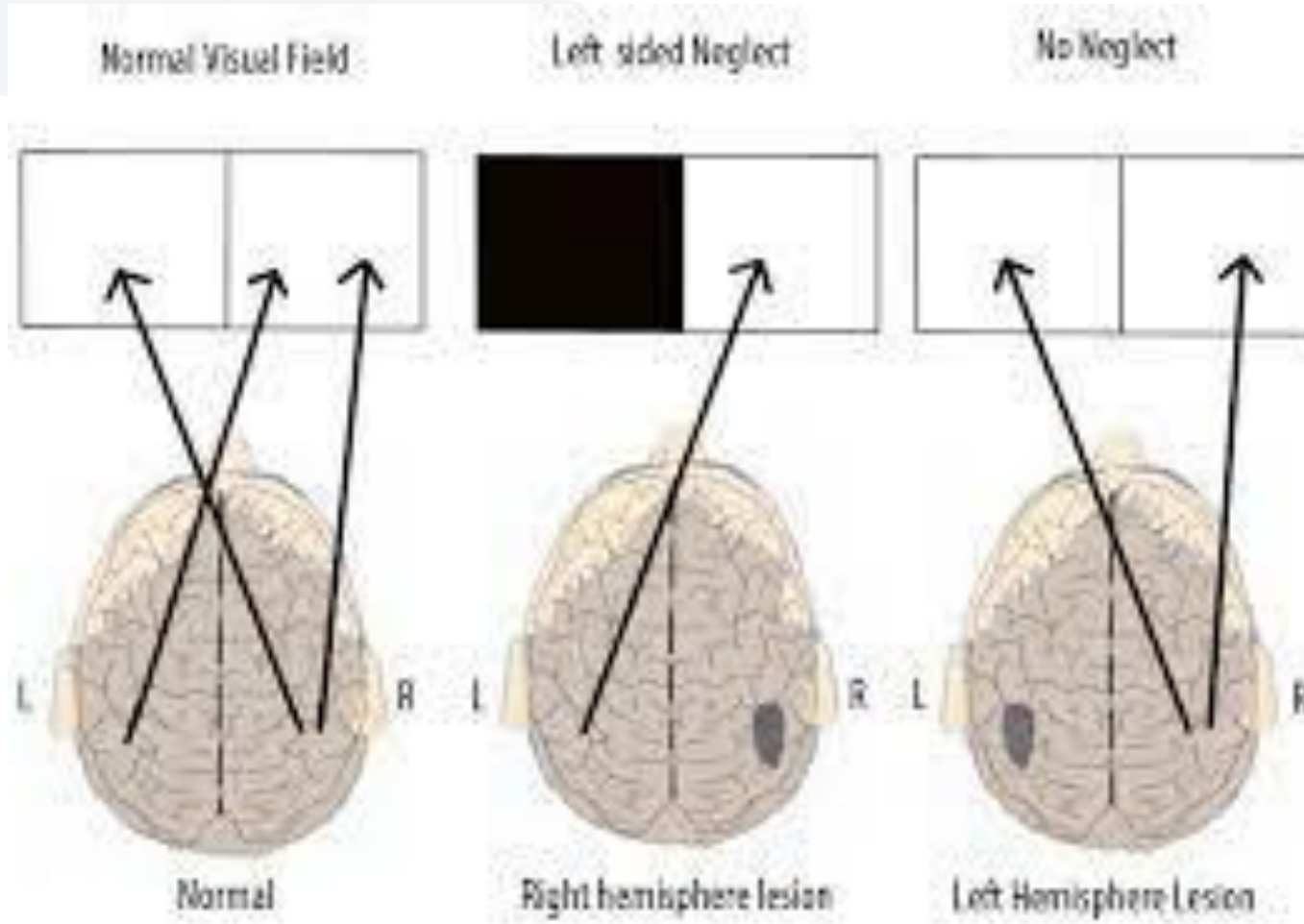
Unilateral Neglect

- Is an attention disorder as a result of injury to the cerebral cortex.
- Patients fail to report, respond or orient to meaningful stimuli presented on the affected side.
- In most cases, the right parietal cortex is injured and the left side of the body and/or space is/are ignored.
- May involve various modalities, including visual, auditory, somatosensory or kinetic.

- The main feature of hemispatial neglect is a general lack of awareness and attention to stimuli located in the contralesional side of space and not due to elementary sensory or motor disorders.
- Unilateral neglect is generally classified in one of two ways: by the modality that is affected or by the space that is affected (i.e. personal or extrapersonal space).

Etiology/Pathology

- Unilateral neglect usually results from damage to the right parietal area, often the posterior parietal cortex.
- Normally, neurons in the right parietal cortex strongly attend to both the left and the right side of the space, while neurons in the left parietal cortex weakly attend to the right side of the space only.
- Therefore, in right parietal lesions, attention to the right side of the space is maintained by the left parietal cortex, but attention to the left side of the space ceases. In left parietal lesions, attention is typically maintained on both sides of the space by the right parietal cortex.



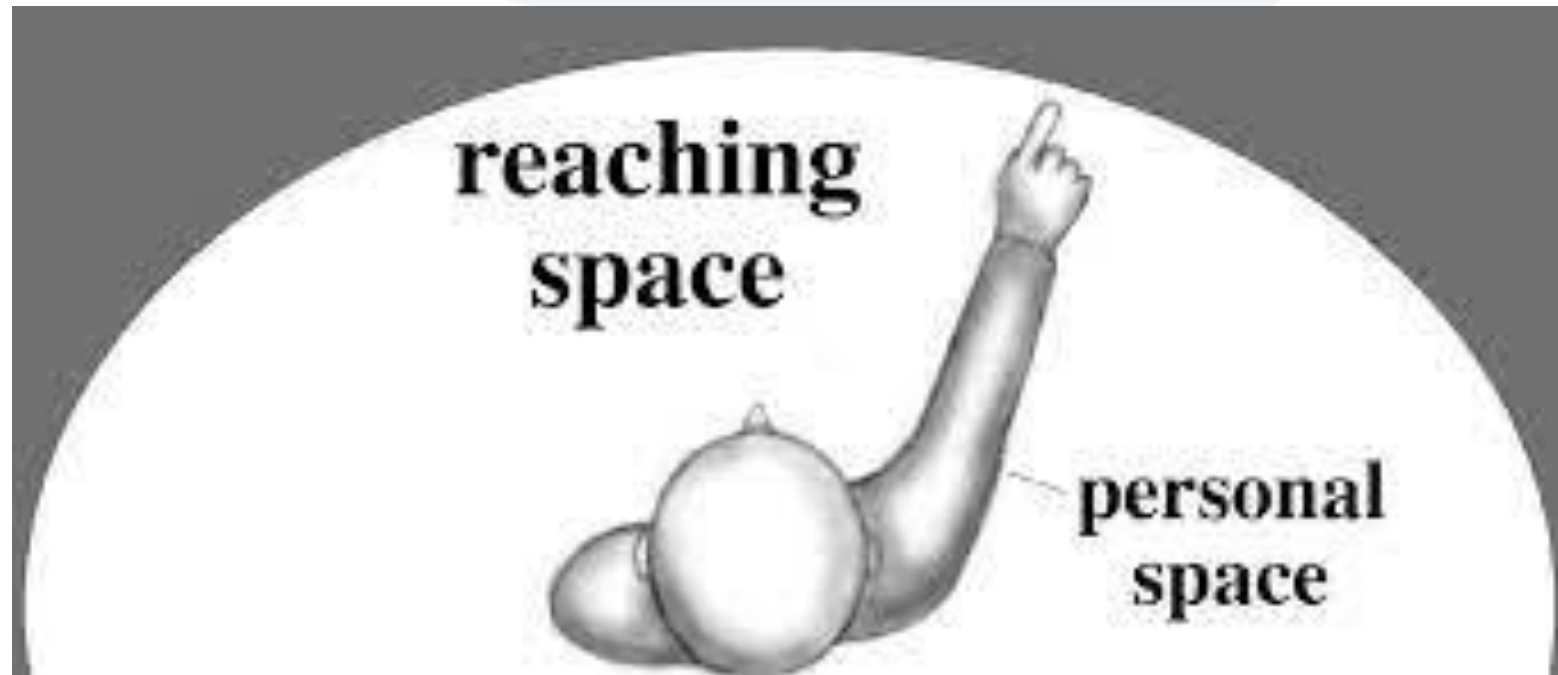
Personal neglect

- “deficit relative to the side of the body contralateral to the lesion”
- fail to spontaneously attend to the left side of their own body.
- the patient “never drew his attention to it”
- the patient did not use his left arm at all for spontaneous movements.
- The term motor neglect (Laplane & Degos, 1983) refers to patients that show a considerable reduction in spontaneous use of their contralesional limbs (as in Zingerle’s case 3), which is not explained by their associated motor impairments.

- Personal neglect **defined as** a set of spatially asymmetrical symptoms occurring in personal space including: defective awareness of the contralesional side of the body, a lack of awareness of contralesional tactile or proprioceptive stimuli and defective motor programming towards targets in the neglected sector of space.
- Patients tend to neglect the contralesional side of their body, for example, they may forget to shave the left side of their face or fail to properly dress the left side of their body (e.g. not put the left arm in the left sleeve of a shirt).

Neglect in Peripersonal Space and Extrapersonal Space

- Healthy people are able to look around their space and attend to both the right and left sides. These normal perceptions in peripersonal and extrapersonal spaces are bilateral.
- Unilateral spatial neglect (USN) describes the failure to attend to one side of space. USN is regarded as a higher brain dysfunction that most commonly follows right hemisphere damage; the frequency of USN is high in these patients, approximately 40%. Most USN cases improve within six months, however, USN persists in 25% of patients. This can severely affect the ability to carry out activities of daily living (ADL).
- Patients with left USN may not eat food on the left side of their plate, or may forget to use the brake on a wheelchair if it is located on the left-hand side.

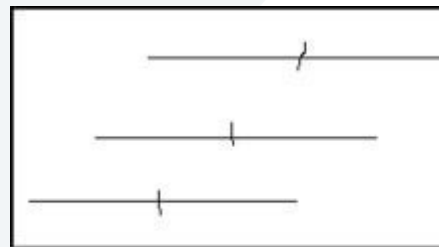


- USN is commonly evaluated using desk evaluations, which include, for example, the line cancellation and line bisection tasks.
- A correlation has been reported between desk evaluation results and ability to perform ADL. However, desk evaluation results can be improved by using the compensation strategy that aims attention to the left side, however, behavior may be unadaptable in daily living.

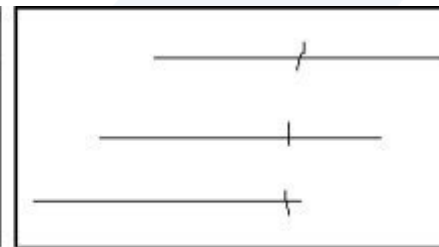
- The human brain has a standard perception of space. The range of the hand is called peripersonal space, and the space outside this is called extrapersonal space. USN is often characterized by neglect in both peripersonal and extrapersonal space. For instance, we can reported the onset of neglect in peripersonal space in one case, but without neglect in extrapersonal space, but in another case, the opposite was true.
- Thus, even now, there is no consistent opinion about neglect in these different spaces. This could explain the disparity between ADL results and desk evaluation results, and suggests that separate evaluations for peripersonal and extrapersonal space are required for the true evaluation of USN.

Line Bisection Test

- Patients are asked to place a mark with a pencil (with their preferred or unaffected hand) through the center of a series of 18 horizontal lines on an 11x 8.5-inch page.
- The test is scored by measuring the deviation of the bisection from the true center of the line. A deviation of more than 6 mm from the midpoint indicates USN. Omission of two or more lines on one half of the page indicates USN.

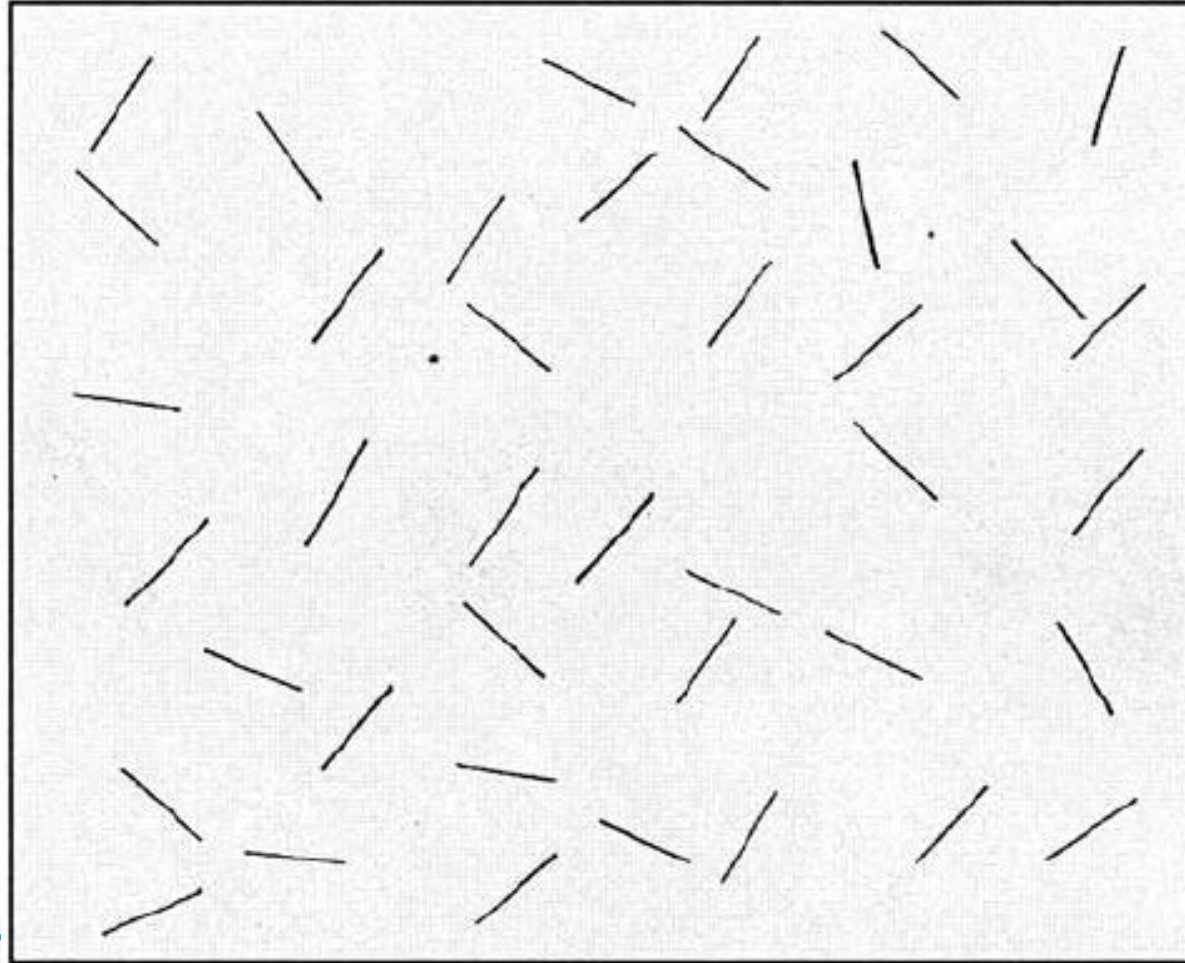


A. Normal line bisection



B. Highly impaired line bisection

the line cancellation test



- More recently there has been a shift towards more functional assessment, allowing the evaluator to determine which tasks of daily living the patient may struggle with.
- Catherine Bergego Scale (CBS): The CBS is comprised of 10 everyday tasks that the therapist observes during performance of self-care activities. The therapist scores the patient on the following items:

Catherine Bergego Scale (CBS)

1. Forgets to groom or shave the left part of his/her face
2. Experiences difficulty in adjusting his/her left sleeve or slipper
3. Forgets to eat food on the left side of his/her plate
4. Forgets to clean the left side of his/her mouth after eating
5. Experiences difficulty in looking towards the left
6. Forgets about a left part of his/her body (e.g. forgets to put his/her upper limb on the armrest, or his/her left foot on the wheelchair rest, or forgets to use his/her left hand when he/she needs to)
7. Has difficulty in paying attention to noise or people addressing him/her from the left
8. Collides with people or objects on the left side, such as doors or furniture (either while walking or driving a wheelchair)
9. Experiences difficulty in finding his/her way towards the left when traveling in familiar places or in the rehabilitation unit
10. Experiences difficulty finding his/her personal belongings in the room or bathroom when they are on the left side

- There is a corresponding patient/carer questionnaire that can be used to assess **anosognosia** (i.e. self-awareness of neglect).
- The questionnaire is comprised of 10 questions that correspond with CBS items. For instance, in accordance with the first item the clinician would ask the patient: “do you sometimes forget to groom or shave the left side of your face?” If the patient identifies that the difficulty is present, the clinician asks: “do you find this difficulty mild, moderate or severe?”

Scoring:

The CBS uses a 4-point rating scale to indicate the severity of neglect for each item:

- 0 = no neglect
- 1 = mild neglect (patient always explores the right hemispace first and slowly or hesitantly explores the left side)
- 2 = moderate neglect (patient demonstrates constant and clear left-sided omissions or collisions)
- 3 = severe neglect (patient is only able to explore the right hemispace)
- This results in a total score out of 30.

Azouvi et al. (2002, 2003) have reported arbitrary ratings of neglect severity according to total scores:

- 0 = No behavioral neglect
- 1-10 = Mild behavioral neglect
- 11-20 = Moderate behavioral neglect
- 21-30 = Severe behavioral neglect

- The patient questionnaire also uses a 4-point rating scale according to the following levels of difficulty experienced by the patient:
- 0 = no difficulty
- 1 = mild difficulty
- 2 = moderate difficulty
- 3 = severe difficulty

- The anosognosia score is then calculated as the difference between the clinician's total score and the patient's self-assessment score:
- Anosognosia score = clinician's CBS score – patient's self-assessment score.
- The CBS takes approximately 30 minutes to administer.

Management / Interventions

- There are two types of rehabilitation interventions used to improve neglect.
- The first one aims at improving the patient's attention to the neglected space; the second one aims at addressing the proprioceptive and kinesthetic deficits.

- These interventions may include the following methods: visual scanning/exploration training, neck muscle vibration, transcranial magnetic stimulation (TMS), optokinetic stimulation (OKS), cold water (caloric) vestibular stimulation (CVS), galvanic-vestibular stimulation (GVS), prism adaptation, limb activation training, mental imagery training, sustained attention training, eye patching, virtual reality training, trunk rotation training, transcutaneous electrical nerve stimulation (TENS), mirror therapy, and feedback training.
- Traditionally, treatment often also includes adapting the environment so that stimuli are constantly presented on the neglected side although there does not seem to be a lot of scientific evidence to support this

Visual Exploration Training

- Visual exploration training can be conducted by training both smooth pursuit and saccadic eye movements.
- Patients performed smooth pursuit eye movements by following slow pencil movements performed by a therapist. Saccadic eye movement training can be achieved by using a computer program. In the program used by Schindler et al., patients had to identify whether the square that appeared on their screen was red or green as one task and read the word that appeared on their screen as a second task. A potential benefit from this type of treatment is the acquisition of compensatory strategies.

Neck Muscle Vibration

- Neck muscle vibration has a proprioceptive effect whereby it creates the illusion that these muscles are being lengthened (i.e. the neck is turning to one side).
- Vibration of contralesional posterior neck muscles when combined with visual exploration training results in lasting improvement in neglect symptoms specifically when measured by visual straight ahead, cancellation, tactile exploration, and text reading and also reduces difficulties that a patient may have with activities of daily living (ADL's).

Transcranial Magnetic Stimulation

- TMS is a non-invasive method of stimulating the nerve cells in the brain with the use of short magnetic pulses. Repetitive TMS can be used to create significant, long-lasting decreases in unilateral neglect.



Optokinetic Stimulation

- OKS uses movement on a large visual display to change a patient's perception of where their body is in space with the assumption that they will try to reorient themselves based on this visual information.

Cold Water Vestibular Stimulation

- CVS stimulates the horizontal ear canal of the vestibular system using cold water for the contralesional ear or warm water for the ipsilesional ear, thereby inducing nystagmus. Multimodal positive effects can be seen with CVS including improved visual scanning, improved subjective straight ahead, and reduced somatosensory neglect.
- However, the effects of CVS **are short-term** (sometimes limited to 10-15 minutes), and repetitive CVS is not thought to produce long-term effects due to the adaptation of the vestibular system

Galvanic-Vestibular Stimulation

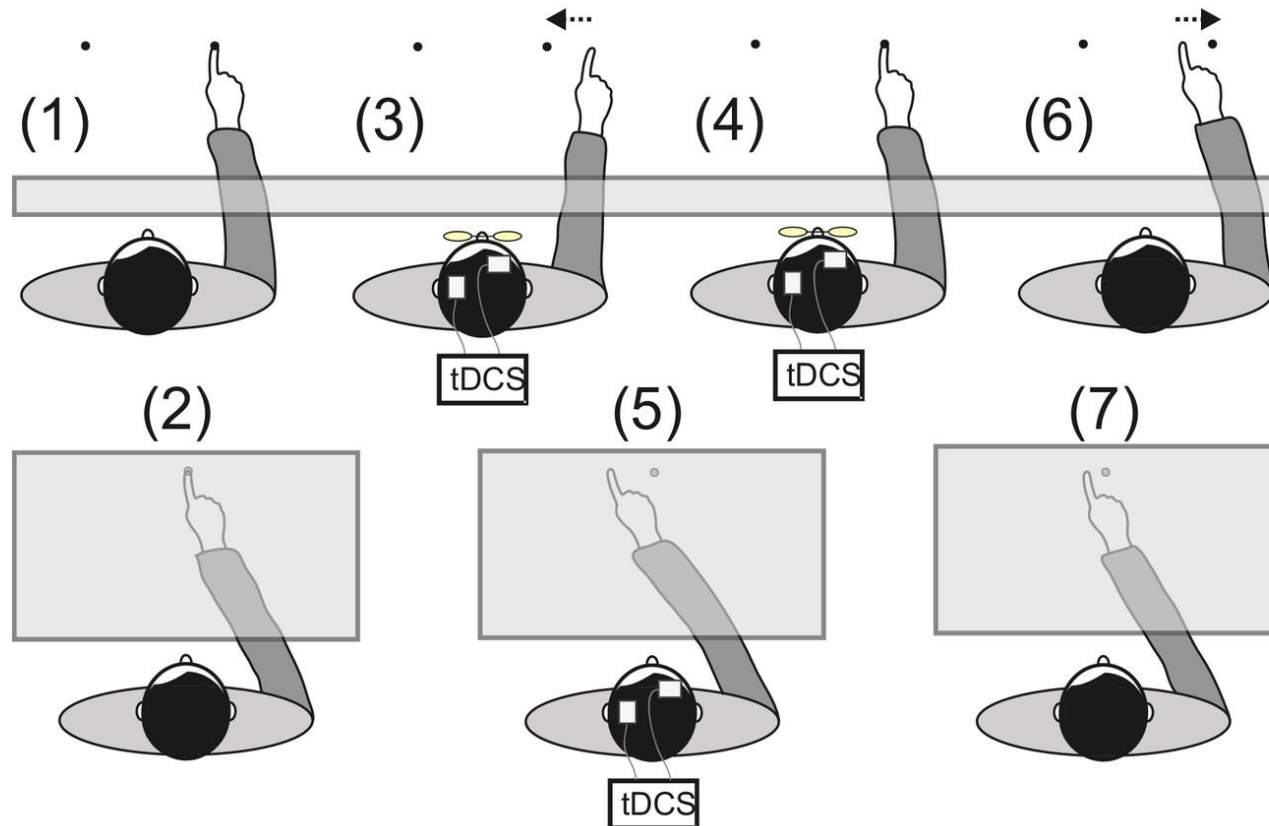
- GVS is the electrical stimulation of the vestibular system achieved by placing electrodes on a patient's mastoid processes.
- Similar to CVS, GVS appears to have a positive, yet **short-term** effect. More research is needed to determine if repetitive stimulation would have a long-term effect

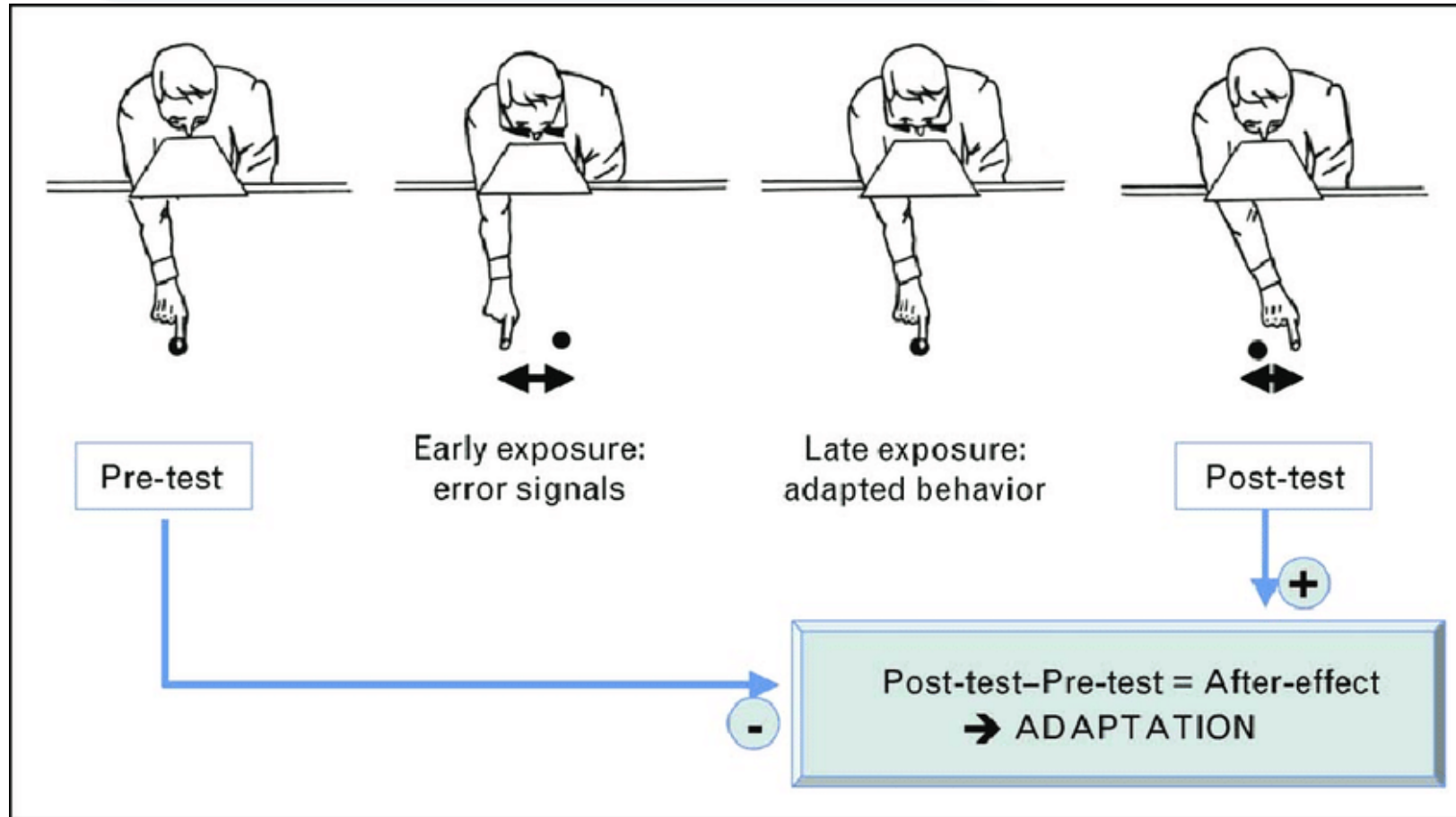
Prism Adaptation

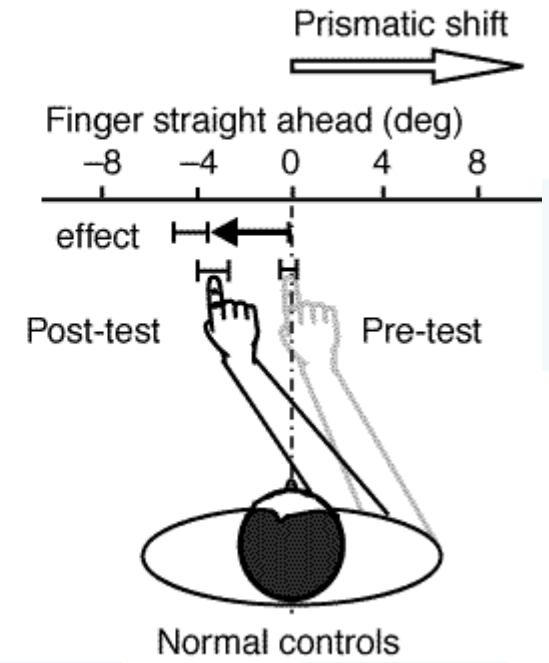
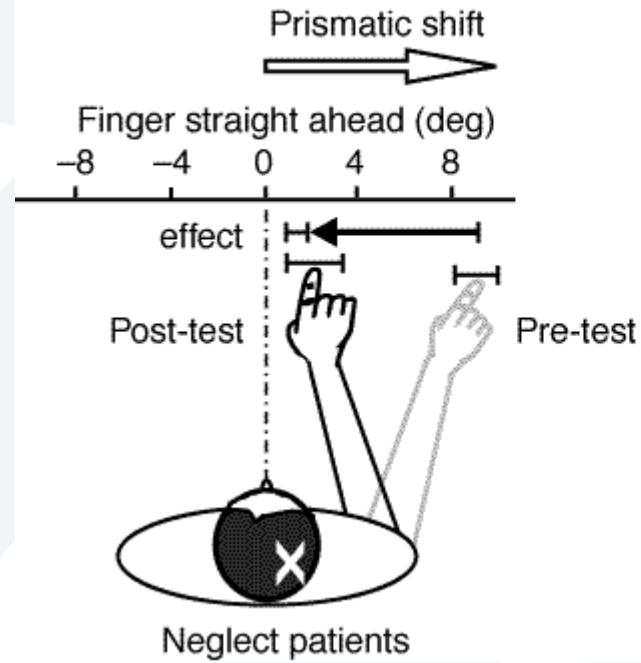
- This treatment requires patients to wear right-shift wedge prism glasses/goggles. With the use of successive perceptual motor pointing tasks, adaptation to the prisms will occur. This adaptation results in a shift of a patient's perceived straight ahead towards the contralesional side, thereby correcting the ipsilesional shift exhibited by neglect patients.
- The evidence suggests that a single session will not result in lasting benefits, but multiple sessions (i.e. >10) could lead to longer-lasting benefits (i.e. 5 weeks). However, the benefits of prism adaptation treatment are not greater than other forms of neglect treatment, neither is the process less time consuming.

D)

Prism Adaptation procedure







Limb Activation Training

- Limb activation training involves getting the patient to perform active limb movements on the contralesional side of the body in an attempt to bring more attention to that side of the body. This has been shown to significantly reduce visual neglect.



EXERCISE: the aim is to improve attention towards the left side

Cancellation tasks: find numbers, letters, forms... with or without cues

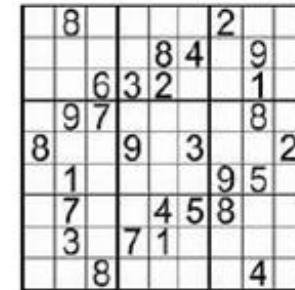
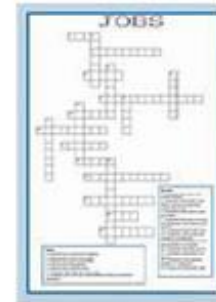
CROSS OUT ALL OF THE "T"s AND "R"s.

V	F	T	E	R	G	C	B	T	R	F	E	D
T	V	D	F	R	T	V	F	R	T	C	D	G
G	F	C	R	T	F	V	G	F	R	C	D	S
R	T	R	T	G	V	T	V	F	D	R	G	E

Reading with or without a red line on the left (cue)

My father's family name being Pirrip, and my Christian name Philip, my infant tongue could make of both names nothing longer or more explicit than Pip.

Mazes, crosswords, sudoku....



Mental Imagery Training

- Visual and motor imagery exercises can be used in individuals with neglect to improve contralesional space exploration as well as arm sensation and copying/drawing performance on neglect tests.
- This can be achieved by having patients mentally practice positions and movements of the contralesional upper limb

Sustained Attention Training

- Sustained attention training increases a patient's arousal through the presence of external alerting stimuli produced by the therapist and results in significant improvements in cancellation tests.

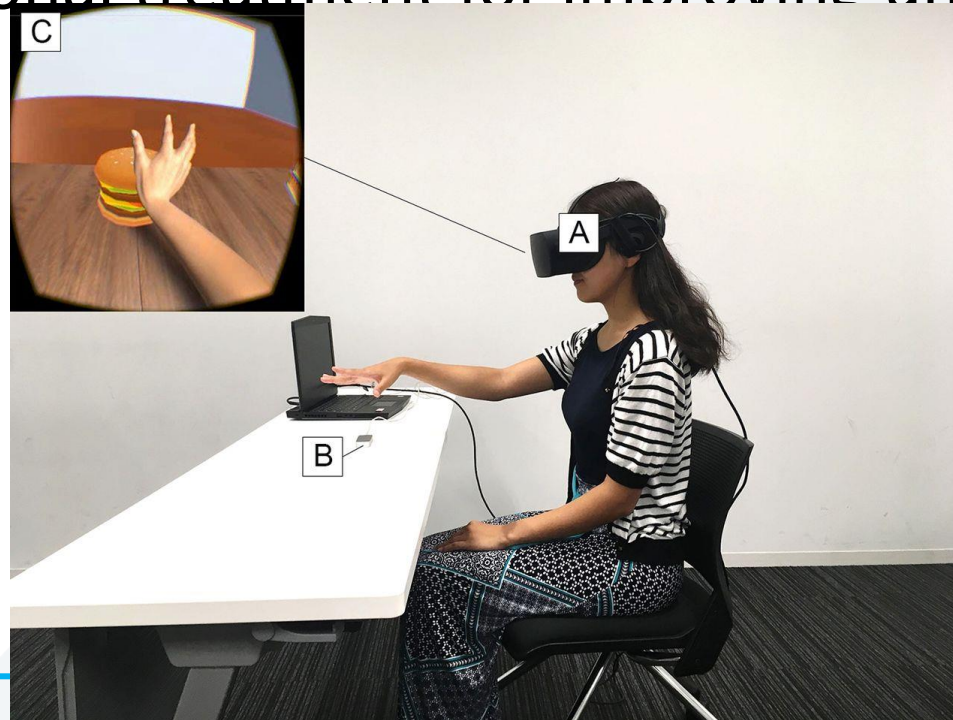
Eye Patching

- An eye patch over the patient's ipsilesional eye can improve symptoms of visuospatial neglect.



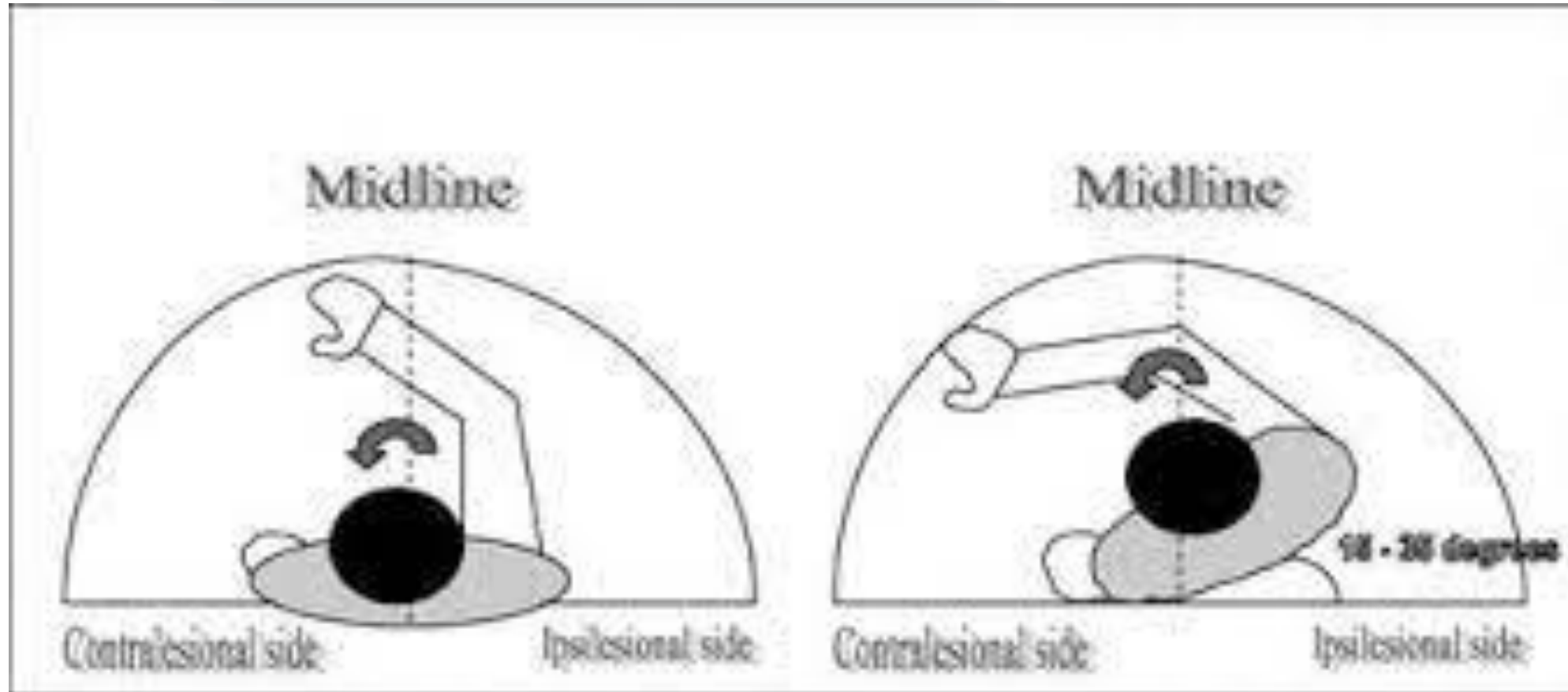
Virtual Reality Training

- Virtual reality training can be performed through the use of a variety of different programs and has been shown to be more effective than conventional treatment for improving unilateral spatial neglect.



Trunk Rotation Training

- Trunk rotation training leads to improved visual exploration on the contralesional side and improved cancellation and line bisection tests.
- Schindler and Kerkhoff achieved this training by having a patient sit in a chair and orienting them with their head and trunk fixated straight forward, head or trunk fixated 20 degrees to the left, and head or trunk fixated 20 degrees to the right. The results were that an orientation of the head or trunk 20 degrees to the left had a significant effect.



Transcutaneous Electrical Nerve Stimulation

- TENS of the posterior aspect of the sternocleidomastoid muscle can be used to improve postural control in patients with neglect.
- Pérennou et al. set their TENS parameters to a frequency of 100Hz and a pulse width of 200us and noticed a significantly larger decrease in postural instability in stroke patients with neglect compared to stroke patients without neglect [10].
- TENS treatment combined with visual scanning training leads to significant improvements on neglect tests lasting less than a week and significant improvements on reading and writing tasks lasting more than a week

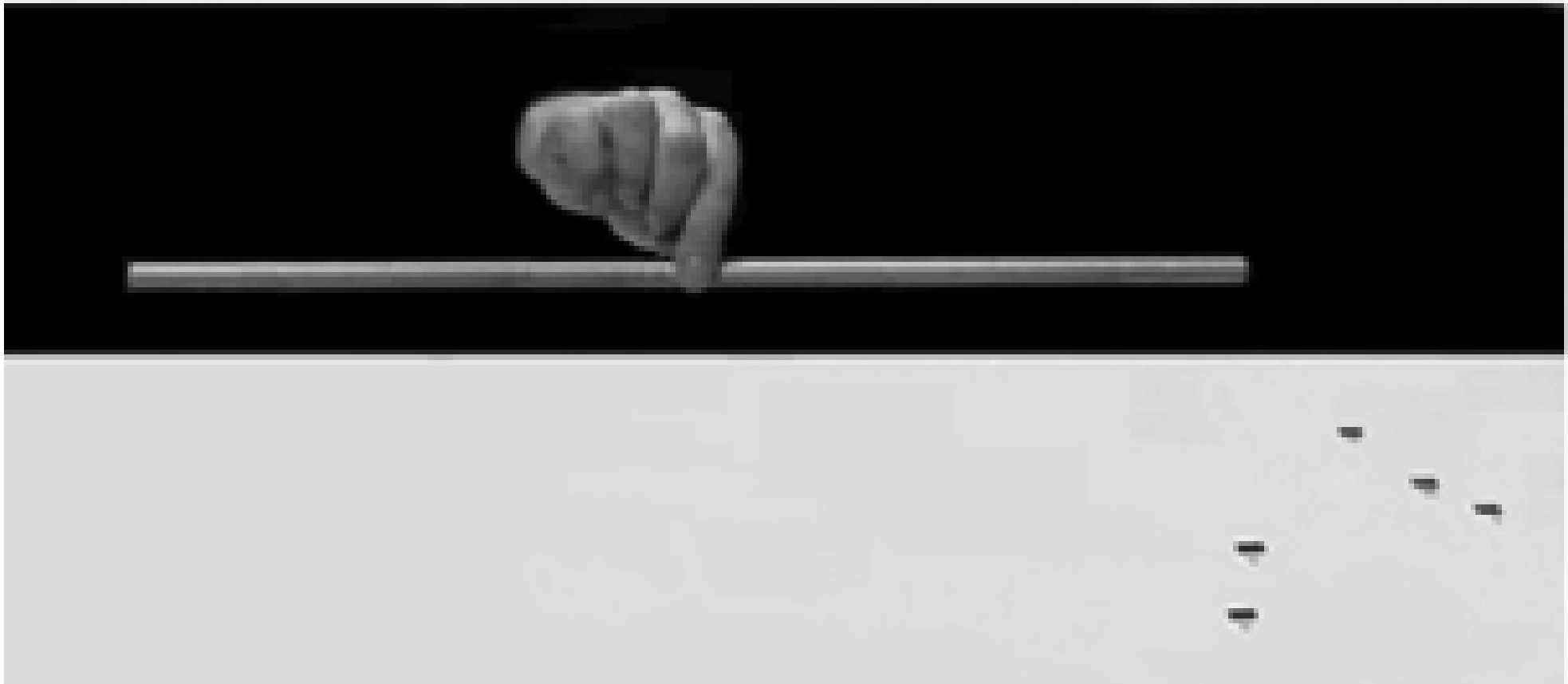
Mirror Therapy

- can be carried out, as was done by Thieme et al. by having the patient place both of their arms on a table with a mirror placed between their arms [1]. They are then required to look in the mirror while moving both arms. The reflecting side of the mirror faces the non-affected arm. Mirror therapy has been shown to have a significant effect on spatial neglect



Feedback Training

- Feedback training can be achieved through verbal, video, and visual feedback.
- Simply pointing out a patient's neglect behaviour (verbal feedback) or showing them a video of their performance can lead to an increase in self-awareness and a decrease in neglect symptoms.
- Significant improvements in neglect symptoms were also seen in a study that used rod lifting as a form of visuomotor feedback. The intervention simply consisted of having patients lift and balance rods with a central grip; the rod provides immediate feedback as to whether or not their grip is actually central



Thank you