Eye Tracking Technology Applications for Post-Stroke Hemispatial Neglect: A Systematic Review

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Research Question

Does the use of eye-tracking technology improve spatial neglect post-stroke?

Introduction

With the growing advancements of technology, it is becoming a more viable option for use in healthcare systems. A recent development is in eye tracking technology for spatial neglect in patients post-stroke. Before this advanced technology, standardized assessment of spatial neglect included paper and pen tests, or behavior tests as seen in Figure 1. With current advancements, researchers can assess eye movement / hemispatial neglect with accuracy, as well as implement eye tracking technology into treatment to decrease the neglect experienced by patients. By reviewing current publications on the use of eye-tracking and virtual reality technology, the review highlighted potential benefits and gaps in the research that may be filled by further studies.

Method

Out of 29 eligible articles, six met the inclusion criteria for the systematic review. The articles were assessed for quality through a review team and risk of bias table while including PRISMA standards (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

Multiple databases were searched through Hawaii Pacific University online database including PubMed, Academic Search Complete, EBSCO, Health Source and Medline. The inclusion criteria was the following: peer-reviewed, published in English, and published between 2020-2025. The search terms were "eye tracking" OR "eye-tracking technology"; "spatial neglect" OR "hemispatial neglect" OR "unilateral neglect"; "stroke" OR "post-stroke", as well as combinations of these terms.

Results

This systematic review concluded that eye-tracking systems are feasible, well-tolerated, and can replicate findings of established hemineglect assessments.

Virtual reality systems utilizing eye-tracking were shown to be moderately effective in retraining eye movement towards the affected side, thus helping patients acknowledge what they previously couldn't.

Figure 1
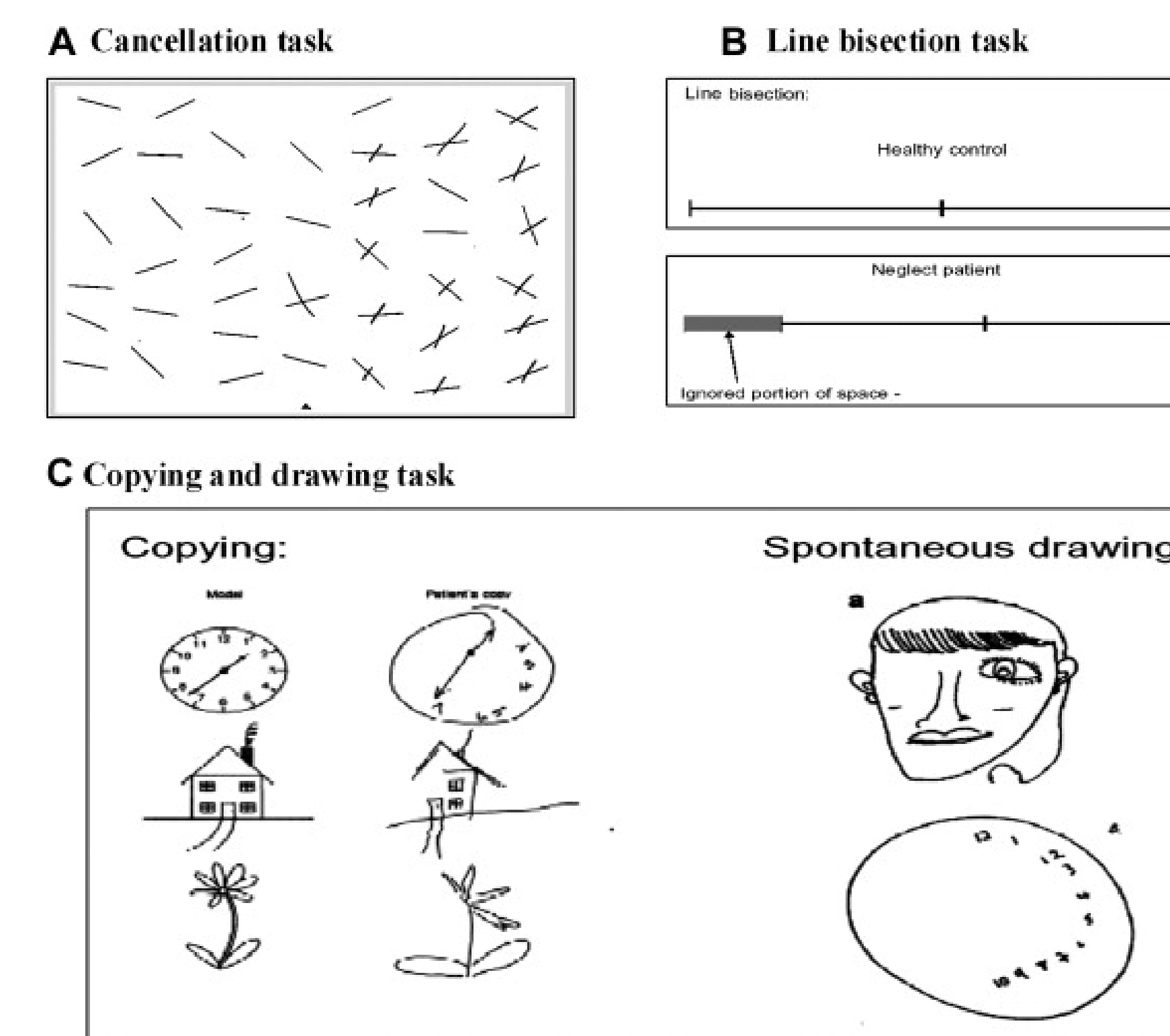
Paper-and-pencil manifestations of neglect.
Textbook of Clinical Neurology:Neuropsychological Testing, 2007

Figure 2

Source: photo from Adobe Stock Photos

Figure 3

Source: photo from Adobe Stock Photos

Discussion

Virtual eye-tracking systems may soon suggest metrics to detect neglect earlier and detect more subtle dysfunction missed in traditional tests. Some systems have already suggested entirely novel metrics that cannot be assessed with existing tests.
Virtual reality environments utilizing eye-tracking combined with immersive stimuli can bolster clinician-directed neglect re-training. Systems can simulate home or public environments not accessible from medical facilities.

Conclusion

Studies included within this systematic review provide initial evidence on the effectiveness of eye-tracking technologies for assessment and treatment of hemineglect in post-stroke patients. Additional research is necessary to understand differences in stroke subtypes, standardize eye movement protocols, associate protocols to functional outcomes, and understand real-world barriers to implementation. These technologies have the potential to inform and expand the sensitivity, specificity, and efficacy of future rehabilitation protocols.

Implications for Occupational Therapy

- Eye-tracking technology is a new modality for assessment and intervention for individuals with visual deficits post-stroke.
- Using eye-tracking technology, occupational therapists can tailor interventions based upon location of spatial neglect/lesion.
- Occupational therapists can incorporate stimulus attention (detection of movement in peripheral vision) with goal directed attention (selective focus and visual searching) through technology to improve performance on ADLs and IADLs.
- Eye-tracking technology is a safe, customizable, immersive environment but more research is needed to demonstrate its impact on spatial neglect.

References