

Case Study

The effects of prism glasses and intensive upper limb exercise on hemineglect, upper limb function, and activities of daily living in stroke patients: a case series

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Abstract. [Purpose] This study aimed to examine the effects of visual field with prism glasses, and intensive upper limb functional training on reduction of hemineglect and improvement in upper limb function and activities of daily living in three stroke patients with hemineglect. [Subjects] This study included three stroke patients hospitalized in a sanatorium. [Methods] Intervention treatment involving prism glass use for 12 hours and 30 minutes and paretic side upper limb training was conducted 5 days a week for 15 weeks. Three upper limb training tasks (hitting a balloon, passing through a ring, and reading a newspaper) were performed for 10 minutes each session, for a total of 30 minutes. Line by Section, Motor-Free Visual Perception Test-3 (MVPT-3), Manual Function Test (MFT), Box & Block Test (BBT), and Assessment of Motor and Process Skills (AMPS) were conducted before and after intervention. [Results] Subjects' hemineglect decreased and upper limb function on the paretic side improved after intervention, which enhanced activities of daily living. [Conclusion] Prism glass use and paretic upper limb functional training effectively ameliorated stroke patients' hemineglect and improved upper limb function. Future research should focus on prism glasses that provide a wide visual field for use in patients with different conditions.

Key words: Fresnel prism, Unilateral neglect, Visual field

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INTRODUCTION

Hemineglect is the failure to sense stimuli coming into the paretic side and is most commonly seen in patients with left hemiplegia resulting from temporo-parietal lobe damage¹⁾. Because of hemineglect, stroke patients are often hit with objects and fail to find food or objects placed on their left side, consequently experiencing difficulty with daily life^{2, 3)}. There are therapeutic methods that aim to decrease hemineglect, including stimulation methods involving stimulation with a physiotherapy vibrator or functional electrical stimulation on the left side⁴⁾, and use of an eye patch on one eye⁵⁾. However, these methods are difficult to utilize in ordinary life. Recently, to cope with these issues, research on the use of prism glasses in stroke patients was conducted^{6–9)}. Rossetti et al.⁸⁾ and Trudell et al.¹⁰⁾ found that use of prism glasses was effective for reducing hemineglect in stroke patients. However, they observed that visual refraction by

the prism was not the same as actual somatic senses, which restricted daily functional performance¹¹⁾. They noted that in order to address this, intensive task training was required in addition to the use of prism glasses. Accordingly, this study examined the decrease in hemineglect and improvement in activities of daily living (ADL) through intensive task performance training together with the use of prism glasses in stroke patients.

SUBJECTS AND METHODS

The subjects of this study were three hospitalized stroke patients (2 males and 1 female). The criteria for selection were Brunnstrom stage (upper limb functional level) 3 or higher, hemineglect based on Motor-Free Visual Perception Test-3 (MVPT-3) results, ability to follow instructions, and no visual disability on medical records. Before participation the procedures, risks and benefits were explained to the participants, who provided informed consent. The participants' rights were protected according to the guidelines established by the University of Hanseo. This study was conducted for 15 weeks from June to August 2013. The intervention involved the use of prism glasses, based on the research of Keane et al.⁷⁾, and intensive upper limb task training. For prism glasses, Fresnel prism 15 prism diopter, which was utilized in a previous study by Rossi, Kheyfets, and Red-

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ing, was attached to ordinary glasses. The subjects wore the prism glasses for an average of 12 hours a day, except for when they washed their face, showered, and slept. For intensive upper limb task training, three tasks (hitting a balloon, passing through a ring, and reading a newspaper) were conducted while wearing the prism glasses, using the upper limb of the paretic side. Each task was performed for 10 minutes, for a total of 30 minutes, 5 times a week, for 15 weeks. The intervention was applied by an occupational therapist with 6 years of working experience. To examine a decrease in hemineglect and changes in upper limb function and performance of ADL, Line by Section, MVPT-3, Manual Function Test (MFT), Box & Block Test (BBT), and Assessment of Motor and Process Skills (AMPS) were conducted.

RESULTS

Changes in hemineglect were examined by scores of Line by Section and MVPT-3 after the intervention. According to the results of the Line by Section, an average error value was 4 mm in Subject 1, 5.3 mm in Subject 2, and 4.8 mm in Subject 3. According to the results of the MVPT-3, Subject 1's raw score improved by 3 points and their left response behavior score increased by 5 points. Subject 2's raw score and left response behavior score increased by 5 and 6 points, respectively. Subject 3's raw score improved by 2 points and left response behavior score did not change (Table 1).

To examine upper limb function changes after the intervention, MFT and BBT were performed. The subjects' scores improved after the intervention (Table 2).

AMPS was conducted to assess performance of ADL. According to the results, Subject 1's motor and process skills increased by 0.39 logit and 0.28 logit, respectively. Subject 2's motor and process skills increased by 0.43 logit and 0.32 logit, respectively. Subject 3's motor and process skills also increased by 0.17 logit and 0.33 logit, respectively (Table 3).

DISCUSSION

This study examined the changes, caused by the use of prism glasses for 12 hours and upper limb focus training, in hemineglect, upper limb function, and performance of ADL in stroke patients with hemineglect. According to the results, hemineglect decreased and paretic side upper limb functions improved in the 3 subjects. These results are consistent with those of Trudell et al.¹⁰⁾ and Van Peppen et al.¹¹⁾, who used a Fresnel prism. Decrease in hemineglect and improvement in paretic side upper limb function led to changes in ordinary life. These findings are consistent with those of Keane et al.⁷⁾ where the subjects' ADL improved after wearing a Fresnel prism. AMPS was used to examine changes in ordinary life in the present study. In AMPS, changes by 0.5 logit after the intervention is statistically significant and changes by 0.3 to 0.49 logit are clinically significant.¹²⁾ Based on this, Subject 1 and Subject 2 showed significant changes in motor skills and Subject 2 and Subject 3 exhibited clinically significant outcomes in process skills.

This study was limited by the small number of subjects, making it difficult to generalize the results. The aim of this

Table 1. MVPT-3 results before and after the intervention

| | MVPT-3 raw score | | Left response behavior score | |
|-----------|------------------|------|------------------------------|------|
| | Intervention | | | |
| | Pre | Post | Pre | Post |
| Subject 1 | 16 | 19 | 9 | 14 |
| Subject 2 | 12 | 17 | 7 | 13 |
| Subject 3 | 22 | 24 | 16 | 16 |

MVPT-3: Motor-Free Visual Perception Test-3

Table 2. MFT and BBT results of the paretic side before and after the intervention

| | MFT (score) | | BBT (number of pieces) | |
|-----------|--------------|------|------------------------|------|
| | Intervention | | | |
| | Pre | Post | Pre | Post |
| Subject 1 | 71.9 | 75.0 | 26 | 28 |
| Subject 2 | 65.6 | 68.7 | 22 | 25 |
| Subject 3 | 75.0 | 78.1 | 18 | 21 |

MFT: Manual Function Test; BBT: Box & Block Test

Table 3. AMPS results before and after the intervention

| | AMPS | | | |
|-----------|---------------------|------|-----------------------|------|
| | Motor skill (logit) | | Process skill (logit) | |
| | Intervention | | | |
| | Pre | Post | Pre | Post |
| Subject 1 | 0.64 | 1.03 | 0.68 | 0.96 |
| Subject 2 | 0.81 | 1.24 | 0.57 | 0.89 |
| Subject 3 | 1.24 | 0.98 | 1.41 | 1.31 |

AMPS: Assessment of Motor and Process Skill

study was to decrease stroke patients' hemineglect and improve their upper limb function through two intervention methods, view expansion and improved task performance on the paretic side. The findings indicated an improvement in the visual field and upper limb function on the paretic side, but the cause of the improvement was not specifically verified. Comparative research and research on correlation are necessary.

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