

The impact of vision therapy on visual parameters in school children with neurodevelopmental disorders

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This study investigated the impact of vision therapy on selected visual parameters in primary school children with and without neurodevelopmental disorders, including ADHD, autism spectrum disorder, intellectual disability, and Down syndrome. Visual acuity, eye alignment, accommodative amplitude, near point of convergence, and vergence facility were assessed before and after a five-week program of home-based vision exercises. Outcomes were compared between children who performed the exercises and those who did not. Vision therapy resulted in measurable improvements in visual functions, with the most pronounced effects observed in children with neurodevelopmental disorders. The findings highlight vision therapy as an effective, accessible, and supportive intervention for visual development in school-aged children.

Keywords: vision therapy, school-aged children, neurodevelopmental disorders, visual acuity, accommodation, convergence

INTRODUCTION

In recent years, the number of children with visual problems such as myopia, accommodative disorders, and convergence insufficiency has been increasing [1–4]. These difficulties may interfere with learning, reading, and concentration, thereby affecting academic performance and everyday functioning. Children with neurodevelopmental disorders are particularly vulnerable, as they more frequently present deficits in binocular vision and accommodation [5,6]. Although the effectiveness of vision therapy has been confirmed in numerous studies [7–11], its effects in this specific population are less frequently analyzed. The aim of this study was to evaluate the impact of a five-week vision therapy program on visual functions in children with neurodevelopmental disorders compared to neurotypical children.

METHODS

The study included primary school students: neurotypical children and children with various neurodevelopmental disorders. Volunteers participated in a five-week vision therapy program conducted as home-based exercises. Visual examinations were performed twice—before and after the program. Five aspects of visual function were assessed: ocular dominance, visual acuity, phoria, accommodation, and convergence. Parents provided written informed consent and completed a questionnaire on vision correction and quality of life (COVD).

The program, developed in collaboration with a vision therapist, consisted of 13 tasks targeting accommodation, convergence, eye movements, oculomotor coordination, and reaction speed. Exercises lasted 3–5 minutes daily for five weeks, with the final week focused on the most challenging tasks. Parents received detailed instructions, exercise planners, and materials enabling individual adjustment.

The study was conducted in two primary schools (Primary School No. 6 in Międzyrzecz and Special Needs School Complex No. 14 in Gorzów Wielkopolski). A total of 109 children (mean age $10.5 \pm$

3.0 years) were included. Fifty-three children performed vision exercises (24 neurotypical, 29 with neurodevelopmental disorders), while 56 did not (29 neurotypical, 27 with disorders).

RESULTS

In children who did not participate in the training, no significant changes in visual function parameters were observed over the five-week interval, and a deterioration was even noted in the group with neurodevelopmental disorders. In contrast, children who performed the exercises showed improvements, particularly in the near point of accommodation and convergence, as well as in vergence facility. The greatest effects of the program were observed in children with neurodevelopmental disorders, who also demonstrated improved visual acuity. A summary of the changes is presented in Table 1, with statistically significant differences highlighted in bold. Changes in the near point of convergence are shown in Figure 1.

Table 1. Differences in visual parameters before and after the five-week exercise program in individual groups

Parameter	Non-exercising, without disorders (n = 29)	Exercising, without disorders (n = 24)	Non-exercising, with disorders (n = 29)	Exercising, with disorders (n = 29)
V _{CCOP} [symbol]	+0,5	+1,5	+0,5	+2,5
V _{CCOL} [symbol]	-1,5	+1,0	+1,5	+1,0
V _{CCOU} [symbol]	-3,5	+0,0	-1,5	+2,0
VF [cycles/min]	+0,5	+2,0	+0,5	+5,0
NPA _{OP} [cm]	+0,2	-1,7	+1,0	-1,0
NPA _{OL} [cm]	+0,0	-1,9	+1,0	-1,5
NPA _{OU} [cm]	+0,3	-1,4	+1,0	-1,0
NPC [cm]	+1,0	-3,0	+1,0	-1,7

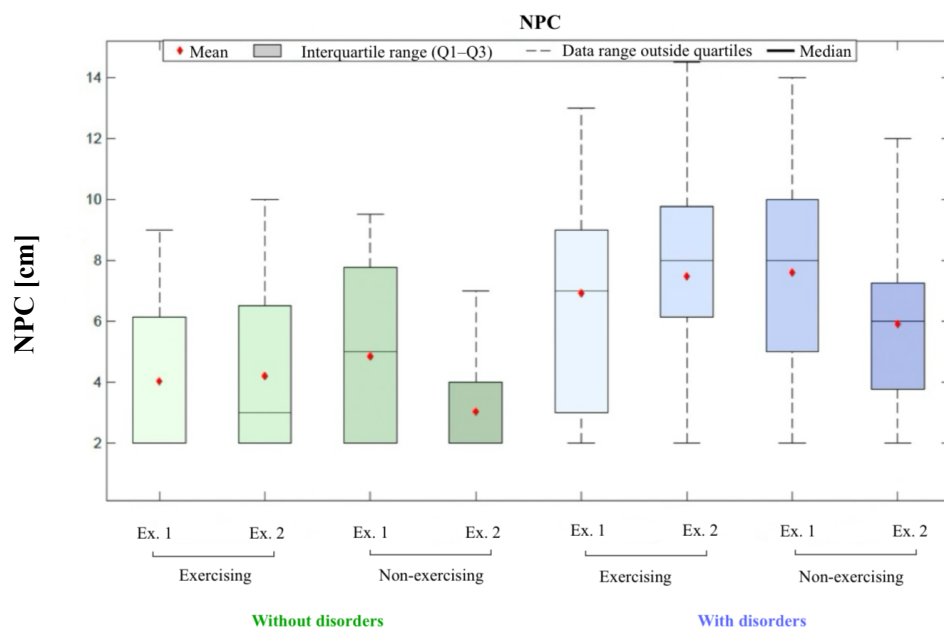


Figure 1. Box plots comparing the near point of convergence (NPC [cm]) in children without and with disorders in Eye Examination 1 and 2, depending on participation in vision exercises.

CONCLUSIONS

The results confirm the effectiveness of a home-based vision exercise program in both neurotypical children and those with neurodevelopmental disorders. The greatest improvements were observed in vergence facility (VF), near point of convergence (NPC), and near point of accommodation (NPA), indicating enhanced visual system efficiency in these functions. Improved VF may support better text tracking, visual concentration, and reduced eye fatigue, as reported in other studies [7,9]. Children with neurodevelopmental disorders also showed improved visual acuity, highlighting the potential of vision therapy to compensate for developmental difficulties and support sensory-motor integration [10,12].

Stability in non-exercising groups indicates that visual functions remain unchanged without stimulation over a short period. Although visual acuity was less responsive to short-term training, the results align with literature demonstrating the effectiveness of vision therapy for accommodative and binocular functions [7]. The study supports the inclusion of vision exercises in therapeutic practice, particularly for children with neurodevelopmental disorders. Combining home exercises with in-office therapy could further enhance effectiveness and allow better individualization of the program.

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