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Physical therapy exercises for improving intermittent exotropia control post-strabismus surgery: A randomized controlled study

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Background: Exotropia control is deteriorated by post-strabismus surgery in many cases. Improving this control is considered as an important factor for success of the strabismus surgery like ocular motor alignment.
Objective: To determine the therapeutic effect of postoperative eye exercises on exodeviation eye control after the strabismus surgery.
Methods: Forty patients suffering from intermittent exotropia after strabismus surgery were randomly divided into experimental group and control groups. Both groups received the usual medical care, while the experimental group received different types of eye exercises using physiotherapy modalities in 24 sessions over three months (two sessions a week). The measurement of exotropia control for near target and far target using the office-based scale was done before and after the treatment.

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Results: There was a significant improvement in near eye control post-treatment (0.45 ± 0.61) in the experimental group compared with control group (3.65 ± 0.88) as the mean difference was -3.20 and 95% CI of the difference between them was -3.645–-2.755 with $P < 0.01$. Also, far eye control improved post-treatment in the experimental group (0.75 ± 0.64) compared with control group (4.00 ± 0.86) with mean difference of -3.250 and 95% CI of the difference between them was -3.727–-2.773 with $P < 0.01$.
Conclusions: For patients with intermittent exotropia who had undergone strabismus surgery, the addition of physiotherapy exercises for the eye provided significant improvements in exotropia control for near target and far target.

Keywords: Physical therapy; eye exercises; strabismus; exotropia control.

Introduction

Intermittent exotropia ($X(T)$) is one of the most common type of strabismus.[1,2] Intermittent exotropia is a disorder of binocular eye movement control in which one eye intermittently turns outwards when the oculomotor convergence drive is weakest and occurs most often under stress.[1] With time, intermittent exotropia becomes constant and worsens.[3] The poorest control in intermittent exotropia, the most deterioration in binocular vision, and binocular function relates to long-term control and stability.[1] Strabismus surgery is a common treatment approach for patients with intermittent exotropia to reduce the size of deviation.[1] The long-standing surgical effects were less satisfying because there is a recurrence of the deviation post-surgery in high percentage of patients. Some studies found that more than 50% of the total amount of exodeviation occurred within the first post-operation year, and other studies have concluded that the exodeviation recurrence occurred through the first two years post-surgery.[1]

Many patients require more operations or additional rehabilitation after strabismus surgery to manage worse eye control to avoid further deterioration with the loss of fusion and stereopsis.[3] For more improvement of surgical outcomes, strabismus control must be improved in addition to motor alignment.[4] Opposite to surgery, exercises that depend on training eye movement may contribute to the control of exodeviation rather than decrease the amount of deviation.[1] Also, it can remove suppression, improve sensory fusion, and reduce the deviation.[5]

Ma *et al.* showed that vergence-accommodative exercises significantly improved the control of exodeviation with the recommendation of more studies into the effect of vision therapy (VT) on intermittent exotropia. Also, the influence of post-operative eye exercises on the long-term improvement of intermittent exotropia and avoidance of its recurrence should be studied in detail.[1] Abdel-Rehim *et al.* compared between the surgical treatment and non-surgical treatment of intermittent exotropia as occlusion and pencil push-up exercise concluded that surgical process was more effective than non-surgical one in the treatment of intermittent exotropia with recommendation to use non-surgical modalities with younger children.[6] Scheiman and coworkers compared the efficacy of office-based VT and pencil push-ups in cases with symptomatic convergence insufficiency. The conclusion was that office-based VT was more effective than pencil push-ups only.[7] Clark *et al.* studied the effect of oculomotor control in children with special educational needs who often have impaired eye movement control using app-based training and concluded that many children may benefit from an effective eye training app with detected variation among the patients according to their clinical conditions, so further research is needed.[8] From the previous studies, there was recommendation for more studies to cover more conditions and variations about the effect of exercises and apps on eye problems.

The methodology in this paper was strengthened by using novelty modalities in the field of VT such as proprioceptive neuromuscular facilitation (PNF) and balance board exercises. They are considered as the most recognised treatment modalities in physiotherapy.[9] PNF was introduced as a treatment approach for neuromuscular rehabilitation using spiral and diagonal movement patterns in nature to facilitate weaker movement and to improve motor and sensory awareness.[9] Also, in this study balance board exercises were added to stimulate vision input massage to maintain balance. Maintaining balance is a complex mechanism

between peripheral and central factors such as vision, somatosensation, vestibular sensation, motor output, and musculature.[10]

The effect of these exercises on exotropia and its control on pre-surgery and post-surgery needs more study. So, the purpose of this study was to evaluate the effect of physical therapy exercises on improving eye control in intermittent exotropia post-surgery as a complementary therapy to avoid recurrence of this deviation and reoperation.

Subjects and Methods

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Research Ethics Committee (Approval No.: P.T.REC/012/003505). The study was registered with ClinicalTrials.gov (Registration No.: NCT05303779). Informed consent has been obtained from all individuals included in this study and their legal guardians.

Sample size

The sample size was calculated by G*power 3.1.9.7 program. The office-based scale was the primary outcome. The effect size was 0.82 according to previous studies. The power was 0.8 and the 1-B error prob. was 0.05. The sample size was 40 patients; 20 for each group.

Study design

The randomized interventional clinical trial was conducted on 40 patients with intermittent exotropia after strabismus surgery. They were randomly assigned to the experimental group and the control group of equal numbers of participants using sealed envelopes. Complete clinical evaluation was performed before and after 12 weeks of treatment. The evaluation included visual acuity, the level of intermittent exotropia control and cover tests for near and far distances.

Inclusion criteria

The criteria included patients of both genders with ages from 5 to 15 years, a history of strabismus surgery from 6 months, presence of intermittent exotropia, normal sensory and motor fusion, equal visual acuity, good general health condition, and ability to understand and do the exercises at home.[1]

Exclusion criteria

Exclusion criteria included systemic diseases as myasthenia gravis, multiple sclerosis, diabetes,[11] any organic ocular disease, optic nerve injury, mental disorders,[12] and attention disorder, as well as a learning disability.[11]

Evaluation of intermittent exotropia control

The assessment of the severity of intermittent exotropia included measuring the patient's ability to control the exodeviation.[1] The level of control was evaluated at both distances and near fixation using the office-based scale.

The office-based scale

The scale is described as scores from 0 to 5, where 0 grade considers phoria, the best control and 5 grade considers constant exotropia, the worst control.[3] The fixation target for distance fixation was at 3 m and was at 40 cm for near fixation. Scores will be determined according to Table 1.[1] Also, the near and far strabismus angles were measured by using prisms of different powers.[13]

The measurement procedure was applied by an ophthalmologist for all participants. The measurement was applied by the same ophthalmologist before the treatment and after three months of the treatment. The ophthalmologist was blind to the treatment condition of each patient.

Table 1. The office-based scale.

Score	Description
5	is constant exotropia
4	is exotropia >50% of the 30 s period before dissociation,
3	is exotropia <50% of the 30 s period before dissociation,
2	is no exotropia unless dissociated; recovers in >5 s,
1	is no exotropia unless dissociated; recovers in 1–5 s
0	is no exotropia unless dissociated; recovers in <1 s (phoria)

Interventions

The patients within the control group received traditional care post-strabismus operation as eye glasses and eye drops. While the participants within the experimental group received physiotherapy exercises besides traditional care post-surgery. The therapeutic tools used for applying the exercises were a computer to play therapeutic video games, a pencil for push-up exercises, coloured balls fixed in a string with equal interval distance in between, a balance board, and red/blue 3D glasses.

The physical therapy exercises were applied in the office and at home. Office exercises were performed for two sessions per week for three months. Each session takes about 1 h. Office exercises involved palming exercises, eye exercises, pencil push-ups, brock string exercises, thumb exercises (near-distance jump), balance board exercises, PNF exercises, and computer therapy. Exercises performed at home from the first session included eye exercises in all directions, pencil push-ups, and thumb exercise (near-distance jump). Besides this, the patient was asked to perform dominant eye occlusion for 1 h daily.

First, the training program started with palming exercise as it warmed up and enabled mobility of the extraocular muscles.[14] Then, the training was completed with the following:

For eye exercises, the patient was asked to follow the target movement in all directions. The exercise was repeated 10 times for each direction. Also, there was another eye movement program that depended on using saccadic eye movements, pursuit eye movements, and adapting eye movements. The movements in each type were performed 10 times.[14] This program depends on the relationship between eye and head movement. During locomotion, the relationship between head and eye movements is complex and influences saccades, smooth pursuit eye movements, and the vestibulo-ocular reflex.[15]

Pencil push-up exercise is performed to improve the near point of convergence (NPC)[16] and to allow easy convergence maintaining by the patient and facilitate binocular function, especially for near objects.[11] This exercise was recommended to apply several times throughout the day.

Brock string exercise was applied using a string with three beads with different colours. The patient looked at each coloured bead in turn with concentration to see only one image of the bead. This exercise improves eye coordination and encourages both eyes to work together.

Near-distance jump exercises were done to improve convergence and accommodation. The duration of the exercise was 1–2 min, and it was repeated 5–10 times per day.

Balance board exercise was also used to train the patient to maintain his balance while tracing movable targets with both eyes. The patient was pushed toward unexpected directions while standing over the board and instructed to keep his balance. Activity depending on eye–hand coordination was done over the balance board.

PNF exercise acts by stimulating proprioception receptors and pathways.[17] The combination of head and eye movements through PNF training reinforces the movement of both. The patterns of PNF used in this study were the neck extensor pattern and neck flexor pattern.[14] The patient was asked to move the head against resistance combined with eye movement toward the ending position. As resistance to the stronger muscle groups of diagonal patterns facilitates the reaction of the weaker muscle groups.[18] The movements were repeated 10 times for each group.

Computer games encouraged the patient to utilize his eyes. The procedure was done with a binocular to improve the positive vergence amplitude.[16] Other computer games were done with a monocular to reduce eye suppression. The patients also participated in a computer game wearing red/blue 3D glasses to separate the view between the two eyes and activate the suppressed eye. The distance was 1–2 feet between the patient and the computer screen. The duration of the computer therapy was about 15 min per session.

Eye–hand coordination was improved through many activities using paper and pencil, colouring, tracing activity and computer games. During eye–hand coordination tasks, the target was fixated by eyes movement providing adequate information about physical properties and location of the target, which can aid completion of the activity.[19]

Patient Safety

According to patients' rights, all participants or their parents must be informed of the potential benefits or any possible risk of the study before they enrolled.[1] The participant and their parents

were informed separately. In this study, all modalities were safe non-invasive modalities mainly in the form of functional training so there was not any harmful effect.[20]

Due to the nature of therapy, it was difficult to blind the participant or the therapist to the patient's status. The therapist must explain the methods of treatment and its benefit to the patient. Also, the management styles were different in both groups which made the full blinding often impossible.[21] The blinding of participants and therapists is not possible for most trials in physical therapy.[12] This study considered a single blind study as the assessor was blind to the management type of each patient.

Statistical Analysis

Descriptive statistics and an unpaired *t*-test were applied for the comparison of age between the groups. A chi-squared test was carried out to compare sex distribution in the groups. The normal distribution of data was checked by using the Shapiro–Wilk test for all variables. Also, the Shapiro–Wilk test is a more appropriate method for small sample sizes (<50 samples).[22] Levene's test for homogeneity of variances was conducted to test the homogeneity between the groups. An unpaired *t*-test served to compare the mean values of near and far eye control between the groups. A paired *t*-test was applied for comparison between pre-treatment and post-treatment status in each group. The level of significance for all statistical tests was set at $P < 0.05$. All statistical analyses were conducted with the Statistical Package for the Social Sciences (SPSS), version 25 for Windows (IBM SPSS, Chicago, IL, USA).

Results

Table 2 shows the subject characteristics of the study and control groups. There was no significant difference between the groups in the mean age or sex distribution ($P > 0.05$).

In the within-group comparison, there was a significant increase in near and far eye control after the treatment compared with the pre-treatment values in the study group ($P < 0.05$). The increase in near-eye control was more than the increase in far-eye control in the study group which equalled 88.2%

Table 2. Comparison of subject characteristics between the groups.

	$\bar{x} \pm$ SD		*P*-value
	Study group	Control group	
Age (years)	10.75 ± 2.93	10.2 ± 2.58	0.53
Sex			
Females	9 (45%)	9 (45%)	1
Males	11 (55%)	11 (55%)	

Notes: SD: standard deviation and *P*-value: probability value.

Table 3. Mean Near eye control level and far eye control level pre-treatment and post-treatment of the study and control groups.

	Study group $\bar{x} \pm$ SD	Control group $\bar{x} \pm$ SD	MD	*t*-value	*P*-value
Near eye control (levels)					
Pre-treatment	3.80 ± 0.77	3.80 ± 0.89	0	0	1
Post-treatment	0.45 ± 0.61	3.65 ± 0.88	–3.2	–15.04	0.000*
MD	3.35	0.15			
% of change	88.20%	3.95%			
t-value	20.11	0.83			
	$P = 0.000$*	$P = 0.419$			
Far eye control (levels)					
Pre-treatment	4.10 ± 0.91	4.15 ± 0.99	–0.05	–0.2	0.84
Post-treatment	0.75 ± 0.64	4.00 ± 0.86	–3.25	–14.26	0.000*
MD	3.35	0.15			
% of change	81.70%	3.61%			
t-value	14.41	1.37			
	$P = 0.000$*	$P = .186$			

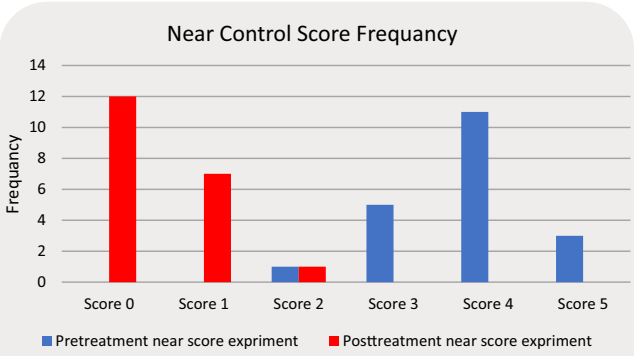

Fig. 1. Comparison between frequency of near-eye control score pre-treatment and post-treatment for the experimental group.

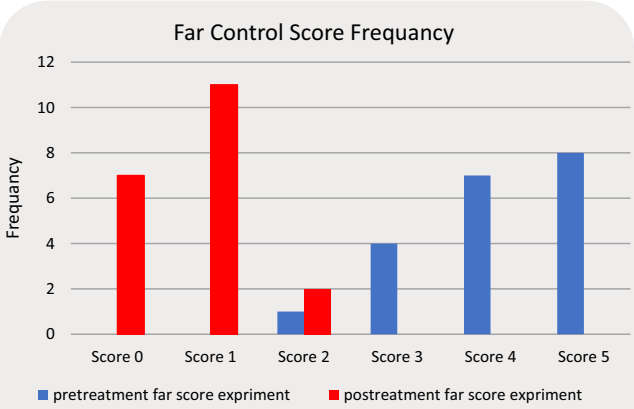

Fig. 2. Comparison between frequency of far eye control score pre-treatment and post-treatment for the experimental group.

and 81.7%, respectively (Table 3). The frequency of near eye control scores and far eye control scores in the experimental group were changed after the application of eye exercises as there is no case with score 3 or 4 or 5 observed post-exercise application which refers to more eye control achieved for near and distance. The frequency of each score among the groups is represented using a bar chart. Bar chart has a better visual impact[23] and is suitable for representing the frequency distribution[24,25] as shown in Figs. 1 and 2. Regarding the control group, there was no significant difference in near strabismus eye control or far strabismus eye control between the pre-treatment and post-treatment status ($P > 0.05$) (Table 2).

In the between-group comparison, there was no significant difference in pre-treatment near-eye control or pre-treatment far-eye control ($P > 0.05$). A comparison between the groups after the treatment revealed a significant increase in near-eye control and far-eye control in the study group compared with the control group ($P < 0.05$) (Table 2).

Discussion

Strabismus surgery is potentially associated with some significant medical problems post-surgery as deterioration of eye control and recurrent strabismus.[26] Limited reports suggest that vision training before or after surgery is beneficial.[27] The main purpose of this paper was to evaluate the effect of physical therapy in the form of several types of eye exercises on eye control in patients with intermittent exotropia after strabismus surgery with adding to PNF and balance board exercises as new modalities for rehabilitation of exodeviation.

Based on the findings, a statistically significant difference was noted in eye control between the experimental and control groups. There was insignificant improvement in the control group as the mean near-eye control score changed from 3.8 ± 0.89 to 3.65 ± 0.88 and from 4.15 ± 0.99 to 4.0 ± 0.86 in the far-eye control score according to the office-based scale score. While in the experimental group, there was significant improvement as the mean near-eye control score improved from 3.8 ± 0.77 to 0.45 ± 0.61 and from 4.10 ± 0.91 to 0.75 ± 0.64 in the far-eye control score according to the office-based scale score. Also, it was observed that all cases' scores ranged from grade 2 to grade 0 (the best eye control) for near and far eye control after eye exercise treatment which means more improvement of eye control from poor to excellent eye control. It was also obvious that the percent of improvement was greater on the near eye control than on the far eye control in the study group after the treatment period, this is because that part of the exercises used to improve eye control concentrated on near vision and eye–hand coordination which depend more on near eye control. Eye–hand coordination tasks help in the development of visuomotor integration and sensorimotor process. These activities improve the delay in the process of collecting visual information about the place and velocity to the target. As spatial distortions and positional uncertainty are present in strabismus,[19] the symptoms, like double vision, fatigue, and deviation, were reduced with the end of the treatment. The patients experienced no

discomfort or difficulties during the physiotherapy exercises. These exercises are considered simple, cheap, obtainable, and safe for the patient.[20] The study proved that exercise interventions were more beneficial than common medical care only in increasing near and far exotropia control.

The strengths of this study are using new modalities for vision training which were using balance board exercises and PNF exercises. These methods are considered basic methods in physiotherapy rehabilitation and adding them to the vision training program can strengthen the therapy outcomes.

PNF exercises activate multiaxial movement which improves coordination and harmony rather than a uniaxial movement. It also facilitates the control of neuromuscular system. This agrees with Park *et al.* who reported that those who mention that eye movement with PNF training brought about better results than eye movements alone.[28] Also, balance board training can strengthen the outcome of physiotherapy rehabilitation of the eye as the eye is responsible for giving the body sensory information that is important for maintaining body balance.[29]

By agreeing with our findings, Aki *et al.* also found a significant improvement in motor skills after vision training in children with low vision.[30] The study by Ma *et al.* showed significant improvements in the Office Control Score in both the operated and unoperated intermittent exotropia at distance and near after application of VT.[27] Coetzee *et al.* concluded that visual therapy contributed to a significant improvement of 75–100% in visual pursuit, fixation, ocular alignment, and convergence, with significant lasting effects for children with developmental coordination disorder (DCD).[31]

Abdel-Rehim *et al.* found that non-surgical modalities in the form of over minus glasses, part-time occlusion (PTO) and pencil push-up exercise succeeded in 55% of the cases after 12 months of treatment in reducing the exodeviation.[6] While this study covered many types of exercises as mentioned in the methodology, using the PNF and balance exercise allows more strengthening to the effect of physical exercises for improving the control of exodeviation.

Limitations

Limitations of this study were patient's cooperation which varied among the individuals. Patient's cooperation can influence the outcome of the study as the study outcome depends on the performance of patients to home-based exercises which may be different from one patient to another. The more active a patient was in applying the home exercises, the more enrichment of the treatment outcome was achieved. Another limitation was the small sample size. A large sample size may ensure the result of the study, so further studies are recommended.

Clinical Recommendations

It is recommended to carry out more studies to evaluate the effect of each group of exercises separately to determine the most effective one. There is a need for more studies to determine and confirm the effect of PNF and balance exercises only on strabismus as they are novated modalities used in this study.

Conclusion

Physical therapy exercises can improve exotropia control after strabismus surgery. Good eye control is useful for improving ocular alignment and binocular function therefore improving self-confidence, social contact, and cosmetic appearance.

Conflict of Interest

No potential conflict of interest related to this paper was reported.

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References

1. Xu M et al., Effects of orthoptic therapy in children with intermittent exotropia after surgery: study protocol for a randomized controlled trial. Trials 2022;23(1):289.
2. Hwang JM. How to better treat patients with intermittent exotropia: A review of surgical treatment of intermittent exotropia. Korean J Ophthalmol 2022;36(6):550–64.
3. Mohney BG, Holmes JM. An office-based scale for assessing control in intermittent exotropia. Strabismus 2006;14(3):147–50.
4. Chew FL, Gesite-de Leon BU, Quah BL. Postoperative strabismus control and motor alignment for basic intermittent exotropia. Int J Ophthalmol 2016;9(7): 1011–15.
5. Akbari MR et al., The effect of alternate occlusion on control of intermittent exotropia in children. Eur J Ophthalmol 2019;30(2):275–79.
6. Abdel-Rehim AS et al., Management of intermittent exotropia in children. Egypt J Hospital Med 2019;76(1):3282–90.
7. Scheiman M et al., A randomized clinical trial of vision therapy/orthoptics versus pencil pushups for the treatment of convergence insufficiency in young adults. Optom Vis Sci 2005; 82(7):E583–95.
8. Clark R, Williams C, Gilchrist ID. Oculomotor control in children with Special Educational Needs (SEN): The development and piloting of a novel app-based therapeutic intervention. Health Technol 2021;11(4):919–28.
9. Shrestha Y. A systematic literature review on the use of proprioceptive neuromuscular facilitation in neuromuscular rehabilitation. MsC, Satakunta University, Finland, 2013.
10. Khot A, Hande D. Effect of conventional balance exercises and electronic balance board on elderly individuals. Int J Multidiscip Res Dev 2017;4 (7):505–08.
11. Pandey R, Bihari R, Pandey A. Effect of eye exercise on myopia in children aged between 10–15 years. Int J Adv Res Develop 2017;2(1):1–6.
12. Horwood AM, Toor SS, Riddell PM. Change in convergence and accommodation after two weeks of eye exercises in typical young adults. J AAPOS 2014;18(2):162–8.
13. Irsch K. Optical issues in measuring strabismus. Middle East Afr J Ophthalmol 2015;22(3): 265–70.
14. Wahid A et al., Physical therapy interventions for reduction of ocular deviation after strabismus surgery. Physiother Q 2022;30(1):33–38.
15. Foulsham T. Eye movements and their functions in everyday tasks. Eye (Lond) 2015;29(2): 196–9.
16. Limbachia C. Neural correlates of convergence eye movements in convergence insufficiency patients vs normal binocular vision controls: An FMRI study, Thesis, Wright State University, 2015.
17. Barati A et al., The effect of neck proprioception neuromuscular facilitation exercises program on dynamic balance and performance of female basketball players. J Nov Physiother Phys Rehabil 2020;5(2): 41–45.
18. Mesaniya TM, Sutaria J. Effect of proprioceptive neuromuscular facilitation neck pattern exercises on balance in stroke — An evidence based study. Int J Sci Healthc Res 2021;6(3):48–53.
19. Kelly KR et al., Temporal eye-hand coordination during visually guided reaching in 7- to 12-year-old children with strabismus. Invest Ophthalmol Vis Sci 2022;63(12):10.
20. Christoff A. Why do simple, inexpensive convergence training exercises continue to perform as well as more expensive computer-based home therapies?: Uncoupling your expectations. Aust Orthop J 2020;52:4–13.
21. Day SJ, Altman DG. Statistics notes: blinding in clinical trials and other studies. BMJ 2000;321 (7259):504.
22. Mishra P et al., Descriptive statistics and normality tests for statistical data. Ann Card Anaesth 2019;22(1):67–72.
23. Kannan S et al., Describing and displaying numerical and categorical data. Airway 2019; 2(2): 64.
24. Mishra P et al., Scales of measurement and presentation of statistical data. Ann Card Anaesth 2018; 21(4):419–22.
25. Marshall G, Jonker L, An introduction to descriptive statistics: A review and practical guide. Radiography 2010; 16(4):e1–e7.
26. Koklanis K, Georgievski Z, Recurrence of intermittent exotropia: Factors associated with surgical outcomes. Strabismus 2009;17(1):37–40.
27. Ma MM-L et al., Vision therapy for intermittent exotropia: A case series. J Optom 2021;14 (3):247–253.
28. Park SE et al., Effect of eye movements and proprioceptive neuromuscular facilitation on balance and head alignment in stroke patients with neglect syndrome. J Phys Ther Sci 2016;28(2): 596–601.

29. Gaerlan MG. The role of visual, vestibular, and somatosensory systems in postural balance. Thesis, University of Nevada, Las Vegas, 2010.
30. Shandiz JH et al., Impact of vision therapy on eye-hand coordination skills in students with visual impairment. J Ophthalmic Vis Res 2018;13 (3):301–06.
31. Coetzee D, Pienaar AE. The effect of visual therapy on the ocular motor control of seven- to eight-year-old children with Developmental Coordination Disorder (DCD). Res Dev Disabil 2013;34 (11):4073–84.