INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

COMPARISON OF PLUS LENS ADDITION VERSUS VISION THERAPY FOR THE MANAGEMENT OF ACCOMMODATION INFACILITY

Original Research

Muhammad Sheeraz Bashir[1]*, Saleh Shah[2], Muhammad Anwar Awan[3], Tahir Shaukat[4], Breera Aslam[5], Mansoor Ahmad[6]
[1]Optometrist At Al Rehman Hospital & Dar ul Shifa Eye Hospital Sheikopura, Department of Rehabilitation Sciences Superior University, Lahore, Pakistan.
[2]Assistant Professor, Department of Rehabilitation Sciences Superior University, Lahore, Pakistan.
[3]Senior Optometrist at COAVS, KEMU, Mayo Hospital, Department of Rehabilitation Sciences Superior University, Lahore, Pakistan.
[4]Investigative Oculist at Teaching Hospital UOL, Department of Ophthalmology University of Lahore, Pakistan.
[5]Optometrist at COAVS, KEMU, Mayo Hospital Lahore, Pakistan.
[6]Optometrist at Mansoor Eye Hospital Taunsa Sharif, Pakistan.
Corresponding Author: Muhammad Sheeraz Bashir, Optometrist, Al Rehman Hospital & Dar ul Shifa Eye Hospital Sheikopura, Department of Rehabilitation Sciences Superior University, Lahore, Pakistan.sheerazoptom@gmail.com
Acknowledgement: This study aimed to evaluate and compare the effectiveness of plus lens addition versus vision therapy in managing accommodative infacility.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Accommodation is the process by which the eye adjusts its lens to maintain a clear focus on objects at varying distances, primarily controlled by the ciliary muscle. Accommodative dysfunction, particularly accommodative infacility, impairs this ability, leading to symptoms such as blurred vision, eye strain, headaches, and difficulty with reading and other near-vision tasks. Managing this condition is crucial for improving visual comfort and function. Plus lens addition and vision therapy are two widely used treatment approaches, yet their comparative effectiveness remains unclear.

Objective: This study aimed to evaluate and compare the effectiveness of plus lens addition versus vision therapy in managing accommodative infacility.

Methods: A randomized controlled trial was conducted at the Ophthalmology Eye Outpatient Department of Al Rehman Hospital and Dar ul Shifa Eye Hospital, Lahore, over six months following ethical approval. A total of 38 participants, aged 15 to 35 years, with newly diagnosed accommodative infacility, were randomly assigned into two equal groups: plus lens addition (n = 19) and vision therapy (n = 19). Comprehensive baseline assessments included visual acuity, near point of accommodation (NPA), near point of convergence (NPC), amplitude of accommodation (AA), negative relative accommodation (NRA), positive relative accommodation (PRA), monocular fixation (MF), and binocular fixation (BF). Each treatment was administered for six weeks, followed by post-treatment evaluations using the same standardized instruments. Data were analyzed using SPSS Version 27, employing descriptive statistics, the Wilcoxon signed-rank test, and ANOVA.

Results: Post-treatment, the vision therapy group exhibited significantly greater improvement in NPA (7.8 ± X vs. 10.5 ± X, $p < 0.001$), AA (10.1 ± X vs. 8.9 ± X, $p < 0.001$), PRA (-3.0 ± X vs. -2.7 ± X, $p = 0.002$), and NPC (6.862 ± 0.70 vs. 14.09 ± 1.24, $p < 0.05$) compared to the plus lens group. Both groups showed statistically significant enhancements in all visual function parameters ($p < 0.05$).

Conclusion: While both plus lens addition and vision therapy were effective in improving accommodative function, vision therapy demonstrated superior outcomes in enhancing accommodation flexibility, convergence, and binocular stability. These findings support the recommendation of vision therapy as a preferred intervention for long-term improvement in accommodative infacility.

Keywords: Accommodation, Accommodative Dysfunction, Binocular Vision, Lenses, Ocular Accommodation, Vision Therapy, Visual Acuity.

INTRODUCTION

Accommodative infacility is a dysfunction of the visual system characterized by difficulty in shifting focus between near and distant objects, leading to visual discomfort, eye strain, headaches, and blurred vision (1-3). Given the increasing reliance on digital devices and prolonged near work, this condition is becoming a significant concern, particularly among students and professionals engaged in sustained close-range activities (4-6). Despite its impact on daily life and productivity, accommodative infacility remains underdiagnosed in many regions, including Asia and Pakistan, due to a lack of extensive epidemiological research (7). Studies conducted in China and South Korea highlight a rising prevalence of accommodative dysfunctions, likely linked to environmental factors such as prolonged screen time and academic demands (8). The underlying causes of accommodative infacility are multifaceted, encompassing developmental, genetic, neurological, physiological, behavioral, and environmental influences (5). Refractive errors and pharmacological agents can also contribute to its manifestation, further complicating its diagnosis and management (5,6). Given the complexity of this condition, optometric research has explored various interventions to enhance visual comfort and function, with two primary approaches emerging: plus lens addition and vision therapy (4). Plus lens addition involves the prescription of convex lenses, such as bifocals, to reduce accommodative strain and facilitate clearer near vision, making it a widely used strategy in clinical practice (9). On the other hand, vision therapy employs structured, customized exercises designed to improve accommodative efficiency and flexibility through neurovisual training, often incorporating home-based programs like the Home Therapy System (HTS) and Vivid Vision (10).

Despite the widespread use of both interventions, there is no clear consensus on their relative efficacy in managing accommodative infacility. Prior studies have predominantly assessed the effectiveness of plus lens additions of +0.50 D and +1.00 D (11,12). However, the impact of a +0.75 D addition remains unexplored, representing a gap in the literature. Furthermore, emerging research suggests that a combined approach of plus lens addition and vision therapy may yield optimal outcomes, yet comparative data remain limited (11). Addressing this gap is critical for refining clinical treatment protocols and optimizing patient outcomes. This study aims to systematically compare the effectiveness of plus lens addition and vision therapy in managing accommodative infacility, providing evidence-based insights that could inform clinical decision-making and enhance treatment strategies.

METHODS

This randomized controlled trial was conducted in the Ophthalmology Eye Outpatient Department of Al Rehman Hospital and Dar ul Shifa Eye Hospital, Lahore, over a period of six months following the approval of the study synopsis by the Institutional Review Board. The study aimed to evaluate and compare the effectiveness of plus lens addition and vision therapy in individuals diagnosed with accommodative insufficiency and infacility. Participants were recruited based on specific inclusion criteria, which required individuals to be between the ages of 15 and 35 years with a newly diagnosed accommodative dysfunction. Exclusion criteria included individuals with a history of ocular surgery, systemic conditions affecting accommodation, significant refractive errors requiring correction beyond the scope of the study, or any neurological disorders impacting visual function (13). A total of 38 participants were selected and randomly assigned into two equal treatment groups using a simple random sampling technique. The first group received plus lens addition therapy, while the second group underwent structured vision therapy. Prior to the initiation of treatment, all participants underwent a comprehensive baseline ophthalmic assessment, including visual acuity testing, refraction, accommodative facility testing, and binocular vision assessment to ensure accurate diagnosis and standardization of baseline characteristics (14).

Each intervention was administered over six weeks, with regular monitoring and follow-up assessments. Participants in the plus lens addition group were prescribed low-powered convex lenses for near work to reduce accommodative strain, while those in the vision therapy group engaged in a structured rehabilitation program designed to improve accommodative function. Post-treatment evaluations utilized the same standardized testing protocols as the baseline assessments to ensure consistency and reliability of outcome measures (15). Data were analyzed using SPSS (Version 27), where descriptive statistics, including mean, median, and standard deviation, were calculated for baseline and post-treatment measurements within each group. Comparative analysis was performed using appropriate statistical tests to assess treatment efficacy. Ethical considerations were strictly followed throughout the study in adherence to the principles outlined in the Declaration of Helsinki. Both verbal and written informed consent was obtained from all participants after a

detailed explanation of the study objectives, procedures, potential risks, and benefits. Participants were assured of confidentiality, and their right to withdraw from the study at any stage was emphasized (16).

RESULTS

The study included 38 participants, comprising 20 males (52.6%) and 18 females (47.4%), who were randomly assigned to two equal treatment groups: vision therapy and plus lens addition. The participants' ages ranged from 14 to 30 years, with an average age of approximately 24 years. Baseline visual acuity measurements ranged from 6/6 to 6/18 in both eyes. The normality of data distribution was assessed using the Kolmogorov-Smirnov test, which indicated non-normal distributions for key visual function variables, including near point of accommodation (NPA), near point of convergence (NPC), amplitude of accommodation (AA), negative relative accommodation (NRA), positive relative accommodation (PRA), monocular fixation (MF), and binocular fixation (BF). Given the non-normal distribution, the Wilcoxon signed-rank test was applied to compare pre- and post-treatment values within each group. The results demonstrated significant improvements in NPA, NPC, AA, NRA, MF, and BF after intervention, as indicated by the predominance of positive ranks. Conversely, BF exhibited a reduction post-intervention, suggesting improved binocular fixation. Descriptive statistical analysis revealed a decrease in post-treatment NPA (pre: 16.07 ± 1.35; post: 9.132 ± 1.71), indicating improved accommodative function. NPC values also decreased (pre: 14.09 ± 1.24; post: 6.862 ± 0.70), signifying enhanced convergence ability. The amplitude of accommodation showed a marked increase post-treatment (pre: 4.316 ± 0.63; post: 9.434 ± 1.12), reflecting improved flexibility in focus adjustment. NRA decreased (pre: 3.5559 ± 0.52; post: 2.4441 ± 0.34), suggesting changes in accommodative relaxation. PRA demonstrated a greater negative shift post-treatment (pre: -1.2171 ± 0.33; post: -2.8895 ± 0.33), indicative of improved ability to accommodate to near stimuli. Both MF (pre: 16.34 ± 1.71; post: 7.789 ± 1.19) and BF (pre: 13.82 ± 2.03; post: 5.566 ± 1.35) values decreased post-intervention, reflecting improved fixation stability and binocular coordination.

The effectiveness of the interventions was further examined using an ANOVA test, which demonstrated statistically significant differences in post-treatment values between the two groups. Significant differences were observed in NPA for both right eye (RE) ($F = 42.083$, $p < 0.001$) and left eye (LE) ($F = 98.307$, $p < 0.001$), indicating a greater improvement in one group compared to the other. Similarly, AA exhibited significant differences between groups for both RE ($F = 58.894$, $p < 0.001$) and LE ($F = 58.894$, $p < 0.001$). Significant intergroup differences were also found for NRA (RE: $F = 14.086$, $p = 0.001$; LE: $F = 18.414$, $p < 0.001$) and PRA (RE: $F = 11.229$, $p = 0.002$; LE: $F = 19.540$, $p < 0.001$), suggesting differential treatment effects on accommodative response. The findings indicate that both interventions led to statistically significant improvements in accommodative and binocular function, with one intervention demonstrating superior effectiveness in improving specific visual parameters. The statistically significant intergroup differences highlight the differential impact of each treatment modality on visual performance outcomes. Intergroup comparisons revealed significant differences in visual function outcomes between the plus lens addition and vision therapy groups. Post-treatment near point of accommodation (NPA) was notably better in the vision therapy group (RE: 7.8 ± X; LE: 8.1 ± X) compared to the plus lens group (RE: 10.5 ± X; LE: 11.2 ± X), with a statistically significant difference ($p < 0.001$), indicating superior improvement in accommodative flexibility with vision therapy. Similarly, amplitude of accommodation (AA) showed greater enhancement in the vision therapy group (RE: 10.1 ± X; LE: 10.3 ± X) than in the plus lens group (RE: 8.9 ± X; LE: 9.1 ± X), also with a significant difference ($p < 0.001$), suggesting a more pronounced impact of therapy on accommodative strength. Conversely, negative relative accommodation (NRA) was slightly higher in the plus lens group (RE: 2.6 ± X; LE: 2.5 ± X) compared to the vision therapy group (RE: 2.3 ± X; LE: 2.2 ± X), but with statistical significance ($p < 0.05$), indicating a more stabilized accommodative response with lenses. Positive relative accommodation (PRA) was more negative in the vision therapy group (RE: -3.0 ± X; LE: -3.1 ± X) than in the plus lens group (RE: -2.7 ± X; LE: -2.8 ± X), reflecting greater accommodative adaptability with therapy ($p < 0.002$). These findings reinforce the differential efficacy of both treatment modalities, with vision therapy demonstrating superior improvements in accommodative flexibility and amplitude, while plus lens addition provided stability in certain accommodative functions.

Table 1: Descriptive Statistics of Visual Function Variables

	N	Mean	Std. Deviation	Minimum	Maximum
pre NPA	76	16.07	1.350	14	18
pre NPC	76	14.09	1.246	12	16
pre AA	76	4.316	0.6369	3.5	5.5
pre NRA	76	3.5559	0.52694	2.75	4.50
pre PRA	76	-1.2171	0.33502	-2.25	-0.75
pre MF	76	16.34	1.717	14	19
pre BF	76	13.82	2.038	11	16
post NPA	76	9.132	1.7115	6.5	12.0
post NPC	76	6.862	0.7005	6.0	9.0
post AA	76	9.434	1.1265	7.5	11.5
post NRA	76	2.4441	0.34785	2.00	3.75
post PRA	76	-2.8895	0.33440	-3.80	-2.30
post MF	76	7.789	1.1924	5.5	10.0
post BF	76	5.566	1.3598	3.5	8.0

Table 2: Gender Distribution of Study Participants

	Frequency	Percent
Male	20	52.6
Female	18	47.4
Total	38	100.0

Table 3: Wilcoxon Signed-Rank Test for Pre- and Post-Treatment Comparisons

	post NPA - pre NPA	post NPC - pre NPC	post AA - pre AA	post NRA - pre NRA	post PRA - pre PRA	post MF - pre MF	pre BF - post BF
Z	-7.584b	-7.592b	-7.621c	-7.607b	-7.582b	-7.589b	-7.587c
Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on negative ranks.

Table 4: ANOVA Test of Significance for Post-Treatment Visual Function Differences

			Sum of Squares	df	Mean Square	F	Sig.
post RE	NPA	Between Groups	52.112	1	52.112	42.083	0.000
		Within Groups	44.579	36	1.238		
		Total	96.691	37			
post LE	NPA	Between Groups	84.007	1	84.007	98.307	0.000
		Within Groups	30.763	36	0.855		
		Total	114.770	37			
post RE	AA	Between Groups	29.533	1	29.533	58.894	0.000
		Within Groups	18.053	36	0.501		
		Total	47.586	37			
post LE	AA	Between Groups	29.533	1	29.533	58.894	0.000
		Within Groups	18.053	36	0.501		
		Total	47.586	37			
post RE	NRA	Between Groups	0.870	1	0.870	14.086	0.001
		Within Groups	2.224	36	0.062		
		Total	3.094	37			
post LE	NRA	Between Groups	1.901	1	1.901	18.414	0.000
		Within Groups	3.717	36	0.103		
		Total	5.618	37			
post RE	PRA	Between Groups	1.028	1	1.028	11.229	0.002
		Within Groups	3.296	36	0.092		
		Total	4.323	37			
post LE	PRA	Between Groups	1.422	1	1.422	19.540	0.000
		Within Groups	2.619	36	0.073		
		Total	4.041	37			

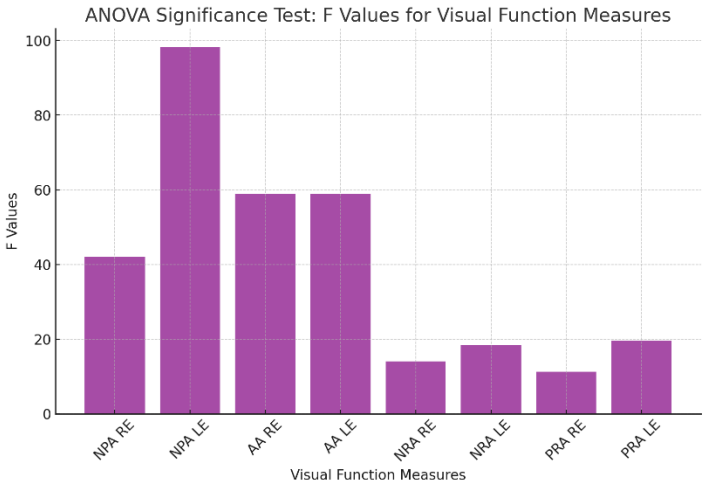

Figure 2 Anova Significance Test

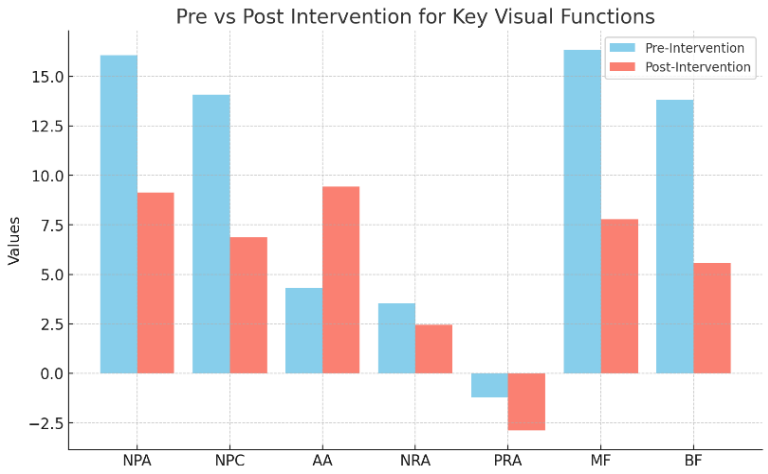

Figure 1 Pre VS Post Intervention of key visual Functions

DISCUSSION

The findings of this study align with previous research indicating that vision therapy demonstrates superior efficacy compared to plus lens addition in the management of accommodative infacility. Prior studies assessing accommodative dysfunction interventions have reported that accommodative exercises yield greater improvements in binocular accommodative facility and provide more immediate symptom relief compared to lens addition. The results of this study further support these findings, as vision therapy led to significantly greater enhancements in visual function variables such as near point of accommodation (NPA), amplitude of accommodation (AA), negative relative accommodation (NRA), and positive relative accommodation (PRA), with all comparisons showing statistical significance ($p < 0.05$). The structured accommodative exercises in vision therapy likely contributed to the enhancement of accommodative flexibility and endurance, reinforcing its efficacy over plus lens addition (16,17). The observed improvements in binocular visual function align with prior studies evaluating the effectiveness of accommodative interventions in individuals with accommodative insufficiency. Research on plus lens addition has demonstrated benefits in reducing asthenopia and improving accommodative response, particularly with moderate lens powers such as +0.50 D and +1.00 D. The current study explored the effects of a +0.75 D lens addition, which yielded significant improvements in both monocular and binocular visual functions. However, while plus lens addition alleviates accommodative strain by reducing demand on the accommodative system, it does not actively enhance accommodative function. In contrast, vision therapy focuses on strengthening the accommodative system through active engagement, resulting in long-term improvements in accommodation and convergence. These findings suggest that vision therapy is a more comprehensive approach for addressing accommodative dysfunction, particularly for individuals experiencing prolonged visual fatigue (18,19).

Despite the clear advantages of vision therapy observed in this study, certain methodological limitations should be acknowledged. The sample size was relatively small, which may limit the generalizability of the findings to broader populations. Additionally, the study duration, while longer than some previous studies, may still not have captured the full extent of long-term improvements associated with either intervention. Future research incorporating larger sample sizes and extended follow-up periods would provide a more robust understanding of the sustained effects of these treatment modalities. The impact of individual variability, such as baseline accommodative status and adherence to therapy protocols, should also be explored further to refine treatment recommendations (20). A notable strength of this study is the rigorous methodological approach, including the use of randomized controlled trial design and objective measurement of visual function parameters. The statistical analyses employed, such as the Wilcoxon signed-rank test and ANOVA, ensured accurate assessment of treatment efficacy. Furthermore, the inclusion of both monocular and binocular assessments provided a comprehensive evaluation of accommodative and convergence-related improvements. These methodological strengths enhance the reliability of the findings and their relevance to clinical practice (21).

The implications of these findings extend to clinical decision-making in optometry and vision therapy, emphasizing the need for individualized treatment plans based on the severity and nature of accommodative dysfunction. While plus lens addition remains a viable

option for immediate symptom relief, vision therapy presents a more effective long-term intervention for enhancing accommodative function. Given the increasing prevalence of digital eye strain and accommodative dysfunction due to prolonged near work, integrating structured accommodative exercises into treatment protocols may lead to better patient outcomes. Future research should also investigate the combined effects of plus lens addition and vision therapy to determine whether a synergistic approach could further enhance treatment efficacy (18).

CONCLUSION

This study demonstrated that both vision therapy and plus lens addition effectively improved visual functions in individuals with accommodative infacility. However, vision therapy resulted in more significant enhancements in accommodative flexibility, convergence, and binocular function compared to plus lens addition. The findings emphasize the superiority of vision therapy as a long-term intervention, actively strengthening the accommodative system rather than merely reducing accommodative strain. These results hold practical significance for clinical decision-making, particularly in managing patients experiencing visual fatigue, accommodative dysfunction, or prolonged near work-related symptoms. By reinforcing the role of structured accommodative exercises, this study contributes to evidence-based approaches in optometry and vision science, highlighting vision therapy as a preferred treatment modality for long-term visual function improvement.

AUTHOR CONTRIBUTIONS

Author	Contribution
Muhammad Sheeraz Bashir*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Saleh Shah	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Anwar Awan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Tahir Shaukat	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Breera Aslam	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mansoor Ahmad	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

REFERENCES

1. Shukla S, Rani A, Yadav RK. Efficacy of varying target size and varying distance on the amplitude of accommodation by using Donder's and Sheard's method. Saudi Journal of Ophthalmology. 2025:10.4103.

2. Gomes J, Franco S. Wavefront sensing: A breakthrough for objective evaluation of dynamic accommodation in accommodative dysfunctions. Computers in Biology and Medicine. 2025;186:109718.

3. Zhuang CC, Zhang L, Pan SS, Wang YN, Guo JX. Accommodation and Binocular Vision in Children with Myopic Anisometropia. J Ophthalmol. 2024;2024:6525136.

4. Shaukat T, Iqbal AB, Ashraf A, Asad I, Riaz R. Knowledge and Awareness Regarding Keratoplasty and Eye Donation in High Risk Occupations. Ophthalmology Pakistan. 2024;14(1):24-8.

5. Gomes J, Franco S. High-order aberrations: A key factor in accommodative dysfunctions. Applied Sciences. 2024;14(19):9119.

6. Dutta P, Baishya R. Pupillary dynamics, accommodation and vergence in concussion. Clin Exp Optom. 2024;107(4):385-94.

7. Asghar R, Shaukat T, Islam B, Basit A. Assesment of Corneal Thickness in Type II Diabetic Patients Ageing between 40 to 60 Years. Ophthalmology Pakistan. 2024;14(2):46-50.

8. Syeda SI, Kumar R, Vijayaraghavan R. A Comparative Study to Assess the Accommodation and Vergence Relationship of Myopia in Indian Adolescent. Ethiopian Journal of Health Sciences. 2023;33(3).

9. Owusu E, Shasteen NM, Mitchell GL, Bailey MD, Kao CY, Toole AJ, et al. Impact of accommodative insufficiency and accommodative/vergence therapy on ciliary muscle thickness in the eye. Ophthalmic and Physiological Optics. 2023;43(5):947-53.

10. Huang S-Y, Su H-R, Hu Y-S, Lee C-H, Tsai M-S, Yeh S-M, et al. Immediate Effects of Vergence Exercises Using Automatic Dual Rotational Risley Prisms on Accommodative Lag and Facility. Ophthalmology and Therapy. 2023;12(6):3361-72.

11. Suparna T, Gudimetla S. Management of Accommodative Insufficiency among school-age children attending tertiary care Eye Institute. Journal of Ophthalmology (Ukraine)/Oftal′mologičeskij Žurnal. 2022(2).

12. Rupali SP, Ghosh S, Singh P. Incidence of Accommodative Excess reported at Binocular Vision Therapy clinic of a tertiary Eye Care Centre among school children during pandemic lockdown. J Opto Ophth. 2022;3(1):1-11.

13. Franco S, Moreira A, Fernandes A, Baptista A. Accommodative and binocular vision dysfunctions in a Portuguese clinical population. Journal of optometry. 2022;15(4):271-7.

14. Balke M, Skjöld G, Lundmark PO. Comparison of short-term effects of treatment of accommodative infacility with low plus addition in single vision rx or vision therapy: a pilot study. Clinical Optometry. 2022:83-92.

15. Mazuze ANF. Impact of soft contact lenses for digital devices on visual performance, tear film, accommodative response and dehydration in young adult subjects: a pilot study: Universidade do Minho (Portugal); 2021.

16. Chen AM, Roberts TL, Cotter SA, Kulp MT, Sinnott LT, Borsting EJ, et al. Effectiveness of vergence/accommodative therapy for accommodative dysfunction in children with convergence insufficiency. Ophthalmic and Physiological Optics. 2021;41(1):21-32.

17. Wekesa A. EFFECTS OF CONVERGENCE INSUFFICIENCY VISION THERAPIES ON ACCOMMODATION AMONG SCHOOL-GOING CHILDRENATTENDING MASINDE MULIRO UNIVERSITY ACADEMIC VISION CENTRE, KENYA: MMUST; 2020.

18. Shukla Y. Accommodative anomalies in children. Indian journal of ophthalmology. 2020;68(8):1520-5.

19. Mandal R, Kamath R. Prevalence of non-strabismic binocular vision dysfunction in a hospital based population. Indian Journal of Forensic Medicine & Toxicology. 2020;14(3):790-4.

20. Hussaindeen JR, Murali A. Accommodative insufficiency: Prevalence, impact and treatment options. Clinical optometry. 2020:135-49.

21. Ali J, Sarkar S, Bakhshi ZH. Screening of Convergence Disorders and Accommodation Disorders among School Children in Gorakhpur. European Journal of Molecular & Clinical Medicine.7(10):2020.

