Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

Original Research Article

To Compare the Effectiveness of Treatment in Symptomatic Patient of Convergence Insufficiency with Home Based Pencil Push Up Therapy and Office Based Orthoptic Therapy

Dr. Shubham Gupta[1], Dr. Harpal Singh[2], Dr. Purva Lal[3], Dr. Pragyil Chaturvedi[4], Dr. Swinal Patel[5], Dr. Raj Kumar Dejwar[6]

[1]Third year Postgraduate Resident, Department of Ophthalmology, Peoples College of Medical Sciences and Research Centre Bhopal, Madhya Pradesh, India.
[2]Professor & HOD, Department of Ophthalmology, Peoples College of Medical Sciences and Research Centre Bhopal, Madhya Pradesh, India.
[3]Third year Postgraduate Resident, Department of Ophthalmology, Peoples College of Medical Sciences and Research Centre Bhopal, Madhya Pradesh, India.
[4]Third year Postgraduate Resident, Department of Ophthalmology, Peoples College of Medical Sciences and Research Centre Bhopal, Madhya Pradesh, India.
[5]Second year Postgraduate Resident, Department of Ophthalmology, Peoples College of Medical Sciences and Research Centre Bhopal, Madhya Pradesh, India.
[6]First year Postgraduate Resident, Department of Ophthalmology, Peoples College of Medical Sciences and Research Centre, Bhopal, Madhya Pradesh, India.

Corresponding Author
Dr. Harpal Singh, Professor & HOD, Department of Ophthalmology, Peoples College of Medical Sciences and Research Centre Bhopal, Madhya Pradesh, India.

Received: 13-07-2024 / Revised: 23-07-2024 / Accepted: 31-08-2024

ABSTRACT

Background
In this study, we aimed to compare the efficacy of office-based orthoptic therapy and home pencil push-up therapy for patients with symptoms of convergence insufficiency.

Methods
This was a hospital based observational study conducted among 460 patients, in the age group of 8 to 35 years who visited the OPD of the Department of Ophthalmology, People's College of Medical Sciences and Research Center, Bhopal, over a period of one year from December 2022 to December 2023 after obtaining clearance from institutional ethics committee and written informed consent from the study participants.

Results
In comparison of mean NPC at different time intervals among subjects of two groups of group A (home based pencil push up therapy) and group B (office based orthoptic therapy), results revealed that in the 8-20 years' age group, the mean NPC at baseline and at 4 weeks was found to be statistically significant. In comparison of mean NPC at different time intervals among subjects of two groups of group A and group B, results revealed that in the 21-35 years' age group, the mean NPC at baseline and at 4 weeks was found to be statistically significant. In comparison of mean CISS at different time intervals among subjects of two groups of group A and group B results revealed that in the 8-20 years' age group, the mean CISS at 4 weeks was found to be statistically significant. In comparison of mean CISS at different time intervals among subjects of two groups of group A and group B

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

results revealed that in the 21-35 years' age group, the mean CISS at 4 weeks was found to be statistically significant.

Conclusion

Home-based PPT can be considered an effective alternative to office-based orthoptic therapy for convergence insufficiency treatment, offering patients a convenient and accessible option without compromising efficacy. Although office-based therapy may be considered more effective, its practicality is often limited by factors such as cost, accessibility, and local availability. In contrast, home-based PPT offers a cost-effective and reasonable alternative, providing patients with a convenient and accessible treatment option without compromising outcomes.

Keywords: Convergence insufficiency, home based pencil push up therapy, office based orthoptic therapy

INTRODUCTION

Low positive fusional vergence (PFV), low AC/A ratio, strong exophoria at near, orthophoria or low exophoria at far, remote near point of convergence (NPC) are the hallmarks of convergence insufficiency (CI), a common binocular vision condition.[1] Compared to other non-strabismic binocular vision anomalies, CI is more common. According to reports, between three and five percent of people have CI. Higher prevalence rates of 5.3% in subjects aged 6 to 18, 6% in children aged 8 to 12, 4.2% in children aged 9 to 12, and 7.7% in university students have been found in studies.[2-4] The prevalence of CI in south Indian urban and rural areas was found to be 16.5% and 17.6%, respectively, according to the Binocular Vision Anomalies and Normative Data (BAND 2) study.[5] The presbyopic adult population may have a higher prevalence because of decompensated accommodative convergence. It is frequently the source of headaches, eyestrain, blurriness, diplopia, drowsiness, loss of understanding over time, and perception of letter movement during reading.[6–9] However, some people may not have any symptoms at all from CI as a result of suppression, avoiding close work, having a high pain tolerance, or blocking one eye when reading.[7] Recessed NPC, insufficient PFV at close, exophoria larger at near than far, poor AC/A ratio, and convergence insufficiency symptom survey (CISS) scores of >16 are clinical characteristics of CI.[10] Using an RAF ruler, the nearest point of convergence is measured to diagnose CI. A 6 to 10 cm near the point of convergence is regarded as usual.[11] Glasses, pencil push-up exercises, prisms, and physiological diplopia training are used to manage CI.[12,13] The literature has described a variety of active and passive therapy techniques for CI. Using base-in-prism reading glasses is an example of passive treatment. Computer-based vision therapy, office-based orthoptic therapy, and pencil push-up therapy (PPT) are examples of active treatment.[6,14–22] A physiological diplopia workout called pencil push-ups involves the patient trying to maintain the target single as long as they can. For the treatment of patients with CI, it is one of the most popular solutions available to optometrists and ophthalmologists.[7,23] The synoptophore, an equipment used in in-office orthoptic therapy, steadily converges the arms starting at the angle where the patient fused the picture. then, for four weeks, the patient must do convergence fusional exercises on a synoptophore for twenty minutes each day, three days a week. Orthoptic therapy administered in-office usually consists of one or two 45- to 60-minute sessions each week, supplemented with 15–30 minutes of home therapy. As a point of reference, the Convergence insufficiency treatment trail (CITT) protocol consists of twelve weeks of in-office sessions lasting sixty minutes each, supplemented by fifteen minutes of reinforcement at home each weekday.[24] In order to offer a suppression check employing physiological diplopia awareness, the pencil push-ups procedure comprised utilising a pencil with 20/60 decreased Snellen letters and a white index card put in the background. The aim of the

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

exercise was to keep the target single and clear during each push-up by moving the pencil to within 2 to 3 cm of the brow, just above the nose. Pencil push-ups are prescribed to patients to be done for fifteen minutes, five days a week. After every five minutes of therapy, they recorded in their home therapy records the closest distance at which they could keep their fusion.[25] The two primary methods of vision treatment are home-based therapy and office-based therapy, either with or without home reinforcement. Even in adult patients, these activities are beneficial for improving convergence function and curing asthenopia. Research has demonstrated that the combination of office-based therapy with home-based therapy yields greater benefits than either approach alone.[21] A straightforward and affordable choice, home-based therapy has been used as the first training method with good outcomes. If the patient follows the therapy regimen appropriately, home-based therapy can be beneficial.[4,22]

AIMS AND OBJECTIVES

- To compare the effectiveness of home based pencil push up therapy and office based orthoptic therapy in symptomatic patient of convergence insufficiency.
- To determine prevalence of convergence insufficiency in age group of 8-35years.
- To study the effectiveness of treatment with home based pencil push up therapy.
- To study the effectiveness of treatment with office based orthoptic therapy.

MATERIALS & METHODS

This was a hospital based observational study conducted among 460 patients, age group of 8 to 35 years coming to eye OPD to the Department of Ophthalmology, People's College of Medical Science and Research Center, Bhopal, over a period of one year from December 2022 to December 2023 after obtaining clearance from institutional ethics committee and written informed consent from the study participants. Group A (PPT) patients were instructed to hold a pencil at arm's length distance along the midline and a clock on the wall behind the pencil was used for suppression control by using physiological diplopia. Patients were asked to look at the tip of the pencil and to try and keep the pencil point single while moving it toward their nose. When they perceived double vision of the target even with maximum effort, the pencil was moved back slowly until they regained fusion. When one of the physiologic diplopia images disappeared, the subjects were asked to blink or shake the pencil as an anti-suppression technique. If patients were able to regain a single vision, they were asked to continue moving the pencil closer up to 5 cm from their nose. All patients were asked to do this exercise for 15 min per day, 5 days a week for 6 weeks, preferably in the morning. In group B (OBOT), patients were instructed to perform convergence fusional exercises on a synoptophore for 20 min per day, 3 days a week, for 4 weeks. Patients were followed up after 2 and 4 weeks. At these follow-up visits, an examiner who was masked to the patient's treatment group performed the CISS score, the cover test (distance and near), and measured the NPC. Adherence to treatment in group A was assessed by logbook entries done by patients under the supervision of their guardians. Improvement of NPC was the primary outcome measure. It was measured with a royal air force (RAF) ruler. Reduction of NPC by 4 cm or more from the baseline was considered as improvement, and a reduction to any value <7.5 cm was considered cure. The secondary outcome measure was improvement in CISS score. The CISS questionnaire consisted of 15 items, read aloud to the patients by the examiner. The examiner read the questions while the patients looked at a card with five answer options and was instructed to choose one of those possible answers. The15 items were summed to obtain the total CISS score. The lowest possible score (least symptomatic) was 0 and the highest was 60 (most symptomatic). A CISS score of less than 16 was considered asymptomatic and a decrease of at least 10 or more points from the baseline reading was

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

considered improved. For measuring AC/A ratio in this study we used Heterophoria Method. For measuring positive fusional vergence the patient was shown a vertical row of 0.4/0.6 line (0.2 logMAR) letters, and the positive fusional vergence (PFV) was measured at 40 cm while the demand on fusional vergence was gradually increased by using a prism bar (Base in) until either diplopia was reported, or a shift of the eyes to the base of the prism noticed. If the patient noticed the letters as blurred when the fusion was lost, the blur value was noted.

Inclusion Criteria

- People of 8-35 years attending eye OPD.

Exclusion Criteria

- Patient with constant strabismus
- History of strabismus surgery
- Prior refractive surgery
- Vertical phoria of >1 prism diopter
- Manifest and latent nystagmus

Statistical Methods

The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS version 17, IBM Corp., New York, NY, USA). P < 0.05 denoted statistical significance in each and every test.

RESULTS

Age Group (Years)	Time point	Group	Mean	Std. deviation	t value	p value
8-20	Baseline	A	12.42	1.69	-4.334	<0.01*
		B	13.88	2.15		
	2 weeks	A	10.32	0.68	0.265	0.792
		B	10.26	1.93		
	4 weeks	A	6.08	1.47	-6.787	<0.01*
		B	7.67	1.20		

Table 1: Comparison of mean near point convergence (NPC) at different time intervals among subjects of two groups according to age group

Comparison of mean NPC at different time intervals among subjects of two groups, results revealed that in the 8-20 years' age group, the mean NPC at baseline was 12.42 (SD = 1.69) in Group A and 13.88 (SD = 2.15) in Group B The p- value was <0.01 indicating significant differences. At 2 weeks, the mean NPC was10.32 (SD = 0.68) in Group A and 10.26 (SD = 1.93) in Group B with a p-value of 0.792 indicating not significant differences. At 4 weeks, the mean NPC was 6.08 (SD = 1.47) in Group A and 7.67 (SD = 1.20) in Group B with a p-value of <0.01 indicating significant differences.

Age Group (Years)	Time point	Group	Mean	Std. Deviation	t value	p value
21-35	Baseline	A	12.67	1.66	-3.518	.001*
		B	13.73	2.19		
	2 weeks	A	10.12	0.68	-0.66	0.511
		B	10.26	1.78		
	4 weeks	A	6.18	1.31	-8.149	<0.01*

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

		B	7.70	1.09		

Table 2: Comparison of mean NPC at different time intervals among subjects of two groups according to age group

Comparison of mean NPC at different time intervals among subjects of two groups, results revealed that in the 21-35 years age group, the mean NPC at baseline was 12.67 (SD = 1.66) in Group A and 13.73 (SD = 2.19) in Group B with a p-value of <0.01 indicating significant differences. At 2 weeks, the mean NPC was 10.12 (SD = 0.68) in Group A and 10.26 (SD = 1.78 in Group B with a p-value of 0.792 indicating not significant differences. At 4 weeks, the mean NPC was 6.18 (SD = 1.31) in Group A and 7.70 (SD = 1.09) in Group B with a p-value of <0.01 indicating significant differences.

Age Group (Years)	Time point	Group	Mean	Std. deviation	t value	p value
8-20	Baseline	A	31.95	3.34	-1.840	.068
		B	32.93	2.71		
	2 weeks	A	19.60	3.37	1.028	.306
		B	19.01	3.19		
	4 weeks	A	19.40	3.65	15.265	<0.01*
		B	11.96	1.50		

Table 3: Comparison of mean CISS at different time intervals among subjects of two groups according to age group

Comparison of mean CISS at different time intervals among subjects of two groups according to age group results revealed that in the 8-20 years age group, the mean CISS at baseline was 31.95 (SD = 3.34) in Group A and 32.93 (SD = 2.71)in Group B The p-value was 0.068 at baseline, the mean CISS was 19.40 (SD = 3.65) in Group A and 11.96 (SD = 1.50) in Group B with a p-value of <0.01 at 4 weeks.

Age Group (Years)	Time point	Group	Mean	Std. deviation	t value	p value
21-35	Baseline	A	31.51	3.47	-2.674	.008*
		B	32.78	2.64		
	2 weeks	A	19.36	3.11	.171	.865
		B	19.28	3.26		
	4 weeks	A	17.64	3.22	15.063	<0.01*
		B	**11.90**	**1.37**		

Table 4: Comparison of mean CISS at different time intervals among subjects of two groups according to age group

Comparison of mean CISS at different time intervals among subjects of two groups according to age group results revealed that in the 21-35 years age group, the mean CISS at baseline was 31.51(SD=3.47) IN group A and 17.64 (SD=-3.22) in Group B the P value was 0.008 at baseline, the mean CISS was 17.64 (SD=3.22) in Group A and 11.90 (SD=1.37) in Group B with a p-value of <0.01 at 4 weeks.

DISCUSSION

Our study is comparable to study carried by Scheiman M et al.[12] conducted a study comparing the effectiveness of office-based therapy and PPT for convergence insufficiency

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

(CI) in young adults and reported that all treatment groups experienced a statistically significant decrease in symptoms. A study by Patwardhan SD et al[23] revealed that majority of ophthalmic practitioners suggested pencil push-up therapy (PPT) as the first-line treatment for convergence insufficiency (CI) and their patients achieved satisfactory outcomes.

The present study enrolled a total of 460 patients, out of which 160 dropped the study. Group A comprised of patients who underwent home-based pencil push up therapy (PPT) and group B comprised of office-based therapy with 150 subjects in each group. The present study examined the demographics of two groups receiving different treatments for convergence insufficiency. The age distribution was similar between Group A (home-based therapy) and Group B (office-based therapy), with the majority of subjects in both groups falling within the 21-35 years age range.

Additionally, the gender distribution was comparable, with a slight majority of females in Group A (56.7%) and a nearly equal split in Group B (49.3% female, 50.7% male). The socioeconomic status (SES) distribution also showed no significant difference between the groups, with a relatively even split between high, medium, andlow SES in both groups. These similarities in demographics allow for a fair comparison of treatment outcomes between the two groups.

The cover and uncover test findings revealed that both treatment groups were comparable in terms of binocular vision status. In Group A, 89.2% of subjects aged 8-20 years and 89.4% of subjects aged 21-35 years had orthophoria, while in Group B, 91.9% of subjects aged 8-20 years and 90.2% of subjects aged 21-35 years had orthophoria. Exophoria, was present in a small percentage of subjects in both groups, ranging from 8.9% to 10.8%.

When near work, convergence insufficiency (CI) occurs when the eyes' normal fusional capacity to maintain a single binocular image is compromised. Among young people between the ages of 9 and 35, it is one of the main causes of asthenopic symptoms. Retracted NPC, a CISS score of greater than 16, inadequate PFV at near, exophoria at near, and a low AC/A ratio are its defining characteristics.[10] In the present study, the comparison of mean near pointconvergence (NPC) between Group A (home-based therapy) and Group B (office- based therapy) revealed significant differences at baseline and 4 weeks, but not at 2 weeks, in both age groups (8-20 years and 21-35 years). In the 8-20 years age group, Group A had a mean NPC of 12.42 at baseline, which decreased to 10.32 at 2 weeks and 6.08 at 4 weeks, while Group B had a mean NPC of 13.88 at baseline, which decreased to 10.26 at 2 weeks and 7.67 at 4 weeks. Similarly, in the 21-35 years age group, Group A had a mean NPC of 12.67 at baseline, which decreased to 10.12 at 2 weeks and 6.18 at 4 weeks, while Group B had a mean NPC of 13.73 at baseline, which decreased to 10.26 at 2 weeks and 7.70 at 4 weeks. Significant differences were observed between the groups at baseline and 4 weeks, but not at 2 weeks, in both age groups. Thus, it was found that at baseline, Group B showed higher NPC values than Group A, with significant differences (p-value <0.01). At 2 weeks, the mean NPC decreased in both groups, but the difference between Group A and Group B was not significant (p-value 0.792). However, at 4 weeks, the mean NPC decreased further in both groups, with Group A showing significantly lower NPC values than Group B (p- value <0.01). While both groups showed significant improvement over time, Group A exhibited greater improvement in NPC at 4 weeks, suggesting that home-based therapy may be a more effective treatment approach. The findings also highlight the importance of continued treatment, as significant differences between the groups were not apparent at 2 weeks. Overall, the study suggests that home-based therapy can be a valuable alternative to office-based therapy for improving NPC in patients with convergence insufficiency. Our findings are consistent with a study conducted by Momeni-Moghaddam H et al;[6] in both the

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

office-based and home-based therapy groups, near point convergence (NPC) significantly improved following intervention. The mean NPC showed a significant difference between before and 4 weeks after therapy, and also between before and after 8 weeks therapy ($P < 0.05$ for all comparisons) which suggested that the NPC improved significantly after therapy, with the eyes becoming closer together, and that this improvement was maintained over time, with no significant difference based on the length of therapy. In evaluating the efficacy of PPT, Arnoldi K et al.[26] found that following treatment, the NPC was less than 10 cm in 98.9% of patients, less than 8.5 cm in 95.7% of patients, and less than 6.5 cm in 80.4% of patients. They also showed a similar decline in the mean NPC among the PPT group, going from 13.0 cm to 8.5 cm. Another study by Yadav S et al.[27] showed that both groups' NPC and symptoms had improved statistically significantly. However, when it came to treating CI in people with normal vision, there was no discernible difference between the efficacy of office-based optometric therapy (OBOT) and home-based pencil push-up therapy (PPT). In group A, 80% of the patients attained an NPC of 7.5 cm, while in group B, 65% of the patients obtained the same NPC. Serna A et al[13] conducted a study to assess the effectiveness of a home based orthoptic program for treating symptomatic convergence insufficiency (CI) and discovered that after the treatment, the average near point of convergence (NPC) improved from 24.2 to 5.6 cm. Additionally, 92.8% of patients achieved an NPC of 6 cm or less.

The study revealed significant improvements in Convergence Insufficiency Symptom Survey (CISS) scores over time in both Group A (home-based therapy) and Group B (office-based therapy), across different age groups. Initially, the mean CISS scores were similar in both groups, with scores of 31.95 and 32.93 for Group A and Group B, respectively, in the 8-20 years age group, and 31.51 and 17.64 for Group A and Group B, respectively, in the 21-35 years age group. However, at 4 weeks, the mean CISS scores decreased substantially in both groups, with Group B showing a more pronounced decrease, scoring 11.96 and 11.90 in the 8-20 years and 21-35 years age groups, respectively, compared to Group A's scores of 19.40 and 17.64. While the baseline scores showed no significant differences, the 4-week follow-up demonstrated a substantial decrease in CISS scores, indicating a reduction in symptoms. Notably, Group B showed a more pronounced decrease in CISS scores compared to Group A, suggesting a potentially more effective treatment approach. Hence, findings suggest that both treatments are effective in alleviating convergence insufficiency symptoms, with Group B (office-based therapy) showing a more significant improvement. The mean CISS score for the two groups was not substantially different prior to intervention using the independent- samples t-test ($P = 0.308$) in a comparable study by Momeni-Moghaddam H et al;[6] nevertheless, this difference was statistically significant by the end of the therapy sessions ($P < 0.001$). The pencil push-up exercise was found to be helpful in treating convergence insufficiency in the study by Sapkota K et al.[28] while all participants exhibited some improvement in convergence, 52% showed improvement by 6–10 cm, with a mean value of 8.5 cm that is clinically meaningful.. In another study by Hassan LI et al,[29] evaluation using CISS score showed 12.38 points improvement in pencil push-up therapy. Another study by Suner A et al found that after 8 weeks of pencil push up therapy, there was a significant decrease of Convergence Insufficiency Symptom Survey (CISS) value from 25.2±3.72 to 15.7±5.64 ($p=0.000$).

There were no significant differences in mean positive fusional vergence (PFV) at baseline 2 weeks and 4 weeks among subjects aged 8-20 years and 21-35 years revealing both treatment showing comparable benefits of both therapies. A similar study by Momeni-Moghaddam H et al[6] found there was a significant improvement in positive fusional vergence (PFV) across all three time periods tested (before and 4 weeks after, before and 8 weeks after, and 4 and 8 weeks after) in both groups ($P < 0.05$ for all comparisons).

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

Another study conducted by Brautaset RL et al[30] also demonstrated the effectiveness of PFV therapy in reducing asthenopia in patients with CI. Serna A et al[13] found that 92.8% of these patients experienced an improvement in their positive fusional convergence (PFC), and 64.2% of the total 27 patients reported a resolution of their symptoms after the Home orthoptic treatment.

The comparison of mean AC/A ratio at different time intervals among subjects of two groups according to age group results revealed that there were no significant differences in mean AC/A ratio at baseline 2 weeks and 4 weeks in age group of 8-20 years; the comparison of mean AC/A ratio at different time intervals among subjects of two groups according to age group results revealed that there were no significant differences in mean AC/A ratio at baseline 2 weeks and 4 weeks in both age group of 21-35 years. In a comparable study, home orthoptic treatment (HTS) has been assessed in a study by Brautaset RL et al[30] to determine its impact on the AC/A in individuals with convergence insufficiency (CI). There was no statistically significant change in the AC/A ($P>0.05$) after orthoptic therapy, as reported in study.

The study found no significant differences in treatment outcomes between males and females, or among different socioeconomic status (SES) groups. At baseline and 4 weeks, there were no significant differences in positive fusional vergence (PFV), and AC/A ratio between males and females, or among low, medium, and high SES groups. These findings suggest that the treatment outcomes were consistent across both genders and socioeconomic backgrounds, and that SES did not impact the effectiveness of the treatment. In the present study, the cover and uncover test with speed of recovery findings showed that in Group A (home-based therapy), 5 out of 7 patients (71%) in the 8-20 years age group and 6 out of 9 patients (67%) in the 21-35 years age group had good recovery, while in Group B (office-based therapy), 3 out of 6 patients (50%) in the 8- 20 years age group and 5 out of 8 patients (63%) in the 21-35 years age group had good recovery. A comparable study by Aletaha M et al[15] reported that all 84 subjects (mean age, 26.8 ± 8.3 years) showed a statistically significant improvement in near exophoria, positive fusional vergence (PFV) at near, near point of convergence (NPC), stereoacuity, and Convergence Insufficiency Symptom Survey (CISS) scores at follow-up. Exophoria decreased by 64% and 68%, home-based vision orthoptic therapy (HBVOT) group and office-based vision orthoptic therapy (OBVOT) groups, respectively. Another study by Suner A et al[13] found that symptoms and signs of CI were improved in 14 samples (73.7%) with home-based pencil push up therapy (PPT). In the contrast to our study, CI treatment trial (CITT) involving children aged 9-18, Scheiman M et al[7] found that the symptoms were considerably decreased in the vision therapy/orthoptic group, but not in the home-based PPT group.

However, in line with our study, a study by Singh A et al[31] reported that home-based PPT is a simple, cost-effective, and comparably effective alternative to OBOT for treating convergence insufficiency, especially when compliance is ensured through log book entries and suggests that patients can benefit from a convenient and affordable home-based therapy option without compromising treatment outcomes. Further, another study by Nehad T et al[32] reported that after 12 weeks of therapy, 47.1% of patients had successful outcomes, 29.4% improved, 12.7% had insufficient improvement, and 10.8% did not respond; notably, patients who received OBVT with home reinforcement (Group II) had a significantly higher frequency of improved outcomes (86%) compared to those who received OBVT alone (Group I, 69.2%).

CONCLUSION

To conclude, Pencil Push-Up Therapy (PPT) and office-based vision therapy demonstrate comparable efficacy in treating convergence insufficiency. It was found that both home-

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

based therapy (Group A) and office-based therapy (Group B) are effective in improving near point convergence (NPC) and alleviating convergence insufficiency symptoms, as measured by the Convergence Insufficiency Symptom Survey (CISS). While both groups showed significant improvement over time, home-based therapy group exhibited greater improvement in NPC at 4 weeks, suggesting that home-based therapy may be a more effective treatment approach. However, office-based therapy group showed a more pronounced decrease in CISS scores, indicating a potentially more effective treatment approach for symptom reduction. Additionally, both treatments showed comparable benefits in improving positive fusional vergence (PFV). The study highlights the importance of continued treatment and suggests that home- based therapy can be a valuable alternative to office-based therapy for improving NPC and alleviating convergence insufficiency symptoms. Overall, the findings provide evidence for the effectiveness of both home-based and office-based therapies in treating convergence insufficiency. Furthermore, no significant differences were observed in outcomes based on gender or socioeconomic status (SES). These findings suggest that home-based PPT can be considered an effective alternative to office-based orthoptic therapy for convergence insufficiency treatment, offering patients a convenient and accessible option without compromising efficacy. Although office-based therapy may be considered more effective, its practicality is often limited by factors such as cost, accessibility, and local availability. In contrast, home-based PPT offers a cost-effective and reasonable alternative, providing patients with a convenient and accessible treatment option without compromising outcomes.

REFERENCES

[1] Dusek WA, Pierscionek BK, McClelland JF. An evaluation of clinical treatment of convergence insufficiency for children with reading difficulties. BMC Ophthalmol 2011;11:21.
[2] Evans BW. Pickwell's binocular vision anomalies: Investigation and treatment. 5th ed. London: Butterworth-Heinemann 2002:124-32.
[3] Griffin JR, Grisham JD. Binocular anomalies: Diagnosis and vision therapy. 4th ed. Boston, Mass: Butterworth-Heinemann 2002:412-27.
[4] Scheiman M, Wick B. Clinical management of binocular vision: Heterophoric, accommodative and eye movement disorders. Philadaephia, Pa: Lippincott Williams and Wilkins 2002:241-60.
[5] Hussaindeen JR, Rakshit A, Singh NK, George R, Swaminathan M, Kapur S et al. Prevalence of non-strabismic anomalies of binocular vision in Tamil Nadu: report 2 of BAND study. Clin Exp Optom 2017;100(6):642–8
[6] Momeni-Moghaddam H, Kundart J, Azimi A, Hassanyani F. The effectiveness of home-based pencil push-up therapy versus office-based therapy for the treatment of symptomatic convergence insufficiency in young adults. Middle East Afr J Ophthalmol 2015;22:97-102.
[7] Scheiman M, Cooper J, Mitchell GL, de Land P, Cotter S, Borsting E et al. A survey of treatment modalities for convergence insufficiency. Optom Vis Sci 2002;79:151–7.
[8] Daum KM. Convergence insufficiency. Am J Optom Physiol Opt 1984;61:16-22.
[9] Borsting EJ, Rouse MW, Mitchell GL, Scheiman M, Cotter SA, Cooper J, et al. Validity and reliability of the revised convergence insufficiency symptom survey in children aged 9 to 18 years. Optom Vis Sci 2003;80:832-8.
[10] Scheiman M, Cotter S, Rouse M, Mitchell GL, Kulp M, Cooper J, et al. Convergence Insufficiency Treatment Trial Study Group. Randomised clinical trial of the effectiveness of base-in prism reading glasses versus placebo reading glasses for symptomatic convergence insufficiency in children. Br J Ophthalmol 2005;89:1318–23.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

[11] Gallaway M, Scheiman M, Malhotra K. The effectiveness of pencil push- ups treatment for convergence in sufficiency: a pilot study. Optom Vis Sci 2002;79:265–7.
[12] Scheiman M, Mitchell GL, Cotter S, Kulp MT, Cooper J, Rouse M, et al. A randomized clinical trial of vision therapy/ orthoptics versus pencil push-ups for the treatment of convergence insufficiency in young adults. Optom Vis Sci 2005;82:583-95.
[13] Serna A, Rogers DL, McGregor ML, Richard PG, Don LB. Treatment of symptomatic convergence insufficiency with a home-based computer orthoptic exercise program. J AAPOS 2011;15:140–3.
[14] Hustan PA, Hoover DL. Treatment of symptomatic convergence insufficiency with home-based computerized vergence system therapy in children. J AAPOS 2015;19:417–21.
[15] Aletaha M, Daneshvar F, Mosallaei M, Bagheri A, Khalili MR. Comparison of three vision therapy approaches for convergence insufficiency. J Ophthalmic Vis Res 2018;13:307–14.
[16] Tiwari N, Paul U, Paritekar P. Retrospective study of effect of therapy on computer vision syndrome patients having convergence insufficiency. Kerala J Ophthalmol 2017;29:97–101.
[17] Hassan LI, Ibrahim SM, Abdu M. Efficacy of homebased vision therapy for convergence insufficiency in secondary schools' students. Sudanese J Ophthalmol 2017;9(1):5–9.
[18] Jang JU, Jang JY, Hyung KT, Moon HW. Effectiveness of vision therapy in school children with symptomatic convergence insufficiency. J Ophthalmic Vis Res 2017;12:187–92.
[19] Passmore JW, Maclean F. Convergence insufficiency and its managements; an evaluation of 100 patients receiving a course of orthoptics. Am J Ophthalmol 1957;43:448-56
[20] Cooper J, Duckman R. Convergence insufficiency: Incidence, diagnosis, and treatment. J Am Optom Assoc 1978;49:673-80.
[21] Birnbaum MH, Soden R, Cohen AH. Efficacy of vision therapy for convergence insufficiency in an adult male population. J Am Optom Assoc 1999;70:225-32.
[22] Kim KM, Chun BY. Effectiveness of home-based pencil push-ups (HBPP) for patients with symptomatic convergence insufficiency. Korean J Ophthalmol 2011;25:185-8.
[23] Patwardhan SD, Sharma P, Saxena R, Khanduja SK. Preferred clinical practice in convergence insufficiency in India: a survey. Indian J Ophthalmol 2008;56:303-6.
[24] Chen DL. Treatment of convergence insufficiency. American Orthoptic Journal 2013:47-52.
[25] Convergence Insufficiency Treatment Trial Study Group. Randomized clinical trial of treatments for symptomatic convergence insufficiency in children. Archives of Ophthalmology 2008;126(10):1336-49.
[26] Arnoldi K, Reynolds JD. A review of convergence insufficiency: what are we really accomplishing with exercises? Am Orthoptic J 2007;57:123-30.
[27] Yadav S, Singh A, Agrawal A, Mittal SK, Panyala R, Kumar B. Pencil push-up therapy vs. office-based orthoptic therapy in emmetropes with asthenopic symptoms due to convergence insufficiency: A randomized controlled trial. Himalayan Journal of Ophthalmology. 2022;16(1):4-8.
[28] Sapkota K, Sah DK, Bhattarai S, Sharma AK, Shrestha JK, Shah DN. Effectiveness of pencil push up therapy in patients with convergence insufficiency: a pilot study. Health Renaissance 2011;9(3):157-61.
[29] Hassan LI, Ibrahim SM, Abdu M. Efficacy of home-based vision therapy for convergence insufficiency in secondary schools' students. Sudanese Journal of Ophthalmology 2017;9(1):5-9.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 10, 2024

[30] Brautaset RL, Jennings AJ. Effects of orthoptic treatment on the CA/C and AC/A ratios in convergence insufficiency. Invest Ophthalmol Vis Sci 2006;47:2876–80.
[31] Singh A, Saxena V, Yadav S, Agrawal A, Ramawat A, Samanta R, et al. Comparison of home-based pencil push-up therapy and office-based orthoptic therapy in symptomatic patients of convergence insufficiency: a randomized controlled trial. Int Ophthalmol 2021;41(4):1327-36.
[32] Nehad T, Salem T, Elmohamady MN. Combined office-based vergence therapy and home therapy system for convergence insufficiency in Egyptian children. Open Ophthalmol J 2018;12:12-8.