

# EFFICIENCY OF VISION THERAPY FOR CONVERGENCE INSUFFICIENCY IN CHILDREN

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## ABSTRACT

Convergence Insufficiency affects around one in six schoolchildren (CI). The CI refers to one's ability to focus inward and comfortably for an extended amount of time. Convergence exercises, a type of vision treatment, can be used to address insufficient convergence. In many cases, this entails working with a specialist to practise paying attention to objects at varying distances. PubMed search parameters were used to narrow down the final list of publications for the literature reviews. All the information gathered was thoroughly reviewed before being used. Only humans were allowed to participate in the study, and it had to be written in English. A database search yielded 77493 results, of which 77450 were subsequently discarded. So far, the list has been whittled down to just 43 entries. Second, we screened solely for studies involving children and adolescents aged 4 to 17 and that contained full-text publications as a component of their content. This literature review was based on the following ten papers. Patients with symptomatic and asymptomatic convergence insufficiency were treated in each of these ten studies, totaling 1760. NPC and vergence/accommodation statistics in the placebo therapy group increased following therapy, according to these investigations. In our research, we found that vision therapy could help youngsters aged 7 to 18 years old who suffer from convergence insufficiency. The individuals were only able to return to their daily routines after four or more months of intensive counselling. In a 12-week office-based vision therapy treatment programme, significant improvements in children's symptoms and clinical assessments were seen. Over the course of a year of follow-up, the majority of children's development was maintained. According to the study, home computer orthoptic programmes have proven effective in 92% of patients with congenital insufficiency

Keywords: Convergence Insufficiency; therapy; counselling; congenital insufficiency; convergence

## 1 INTRODUCTION

According to Jang et al. (2017) study, Convergence Insufficiency (CI) affects up to 15% of all school children, or around 1 in every 6 children. Declines in the capacity to pull the eyes inwards and comfortably sustain this focus for a lengthy amount of time is referred to as CI. The eyes must be turned inwards to read books, complete homework, or stare at a computer screen. Many individuals believe that CI has a substantial impact on a student's ability to focus, pay attention, and perform exceptionally well in school. It can be identified by blurred or double vision, as well as a halo picture surrounding those words or objects (Goering et al., 2022). This condition has a substantial impact on children's grades as well as their emotional well-being, since frequent and recurrent failures can lead to low self-esteem and confidence. CI does not respond to eyeglasses or surgery. As a result, vision therapy has been shown to enhance eye coordination and reduce pain when reading, studying, or performing other tasks that require a lot of concentration.

Convergence insufficiency has several signs and symptoms, like reading below a certain level, failure to reach their potential level at school, dislike doing their homework, double and blurry vision, fatigue, feeling of tiredness when reading, difficulties in concentrating, or they might feel the words are jumping or floating on the page and motion sickness (McGregor, 2014). Vision therapy has been shown to enhance eye coordination and reduce pain when reading, studying, or doing other things that take a lot of concentration. Vision therapy for CI teaches the brain how to manage and coordinate both eyes appropriately, allowing the child to maintain a clear and comfortable focus. The symptoms mentioned above will improve well when the brain-eye connection improves. In order to help patients regain depth perception and 3D stereo vision, vision therapists can focus on convergence insufficiency therapy strategies. Vision therapy treatment is most effective in youngsters because the rapidly developing brain may easily be taught to make permanent changes (Scheiman et al., 2005). Treatment for adult convergence insufficiency is still successful. However, it takes a little longer to notice results and requires a little more patience.

Ophthalmologists, optometrists, and orthoptists diagnose convergence insufficiency after taking a history of the patient's symptoms and testing the patient's ability to converge. A close point of convergence test measures the distance between the patient's eyes at which they can be held together without experiencing double vision, as well as the quantity of prism that can be placed in front of the eyes at a particular distance before the patient experiences double vision (fusional vergence amplitude). The examiner will also make use of prisms to gauge how far out of focus the subject's eyes are at a distance and up close. Problems with the eye's ocular muscles or accommodation (near-focusing) need to be taken into account. Convergence insufficiency should only be addressed if the patient is experiencing symptoms (Nunes et al., 2019). Convergence impairment can be identified during a normal eye exam, even if there are no signs or symptoms present. Despite the fact that certain patients' clinic convergence is poor, they are asymptomatic in nature. Convergence issues can cause this, although it is more likely to occur when the patient is distracted, bashful or unsure of the procedure's proper path. These patients should be retested at a later date or be on the lookout for signs of diplopia or headaches

while working at a close distance. Patients who have no problem with near tasks but test positive for convergence insufficiency in the office do not require therapy but should be observed (Arnoldi & Reynolds, 2007). A child with adequate convergence at the clinic, on the other hand, may occasionally exhibit symptoms of convergence insufficiency at home or at school. A convergence weakness treatment plan can be implemented in these conditions, and the child's symptoms can be tracked for progress.

Adults can help children overcome a lack of convergence by engaging in activities that encourage convergence. An orthoptist (a medical technician specialising in eye muscle function and binocular vision) or an ophthalmologist may propose these activities. Home computers can also be equipped with convergence-enhancing software. Printouts of the results of the computer software are normally taken to your eye care professional's office for review. A few trained practitioners may prescribe exercises for patients with convergence insufficiency during office visits, although at-home treatment usually suffices (Daum, 1988). An orthoptist or a vision therapist may be more appropriate for a younger or more remote patient, and the patient's own preferences may also play a role in the therapy plan. Convenience and affordability are crucial considerations when selecting a treatment plan because scientific studies have yet to definitively prove that one treatment option is better than another. It has been shown that the majority of studies have shown that only a short course of treatment is necessary. The results of long-term therapy are indistinguishable, thus it is usually unnecessary.

According to one study, the patients with convergence insufficiency have an excellent prognosis following the 12 weeks of in-office and home-based therapy, which has been demonstrated a 73% improvement in convergence insufficiency symptoms and measured convergence. The majority of patients were symptom-free after a year without therapy. The prognosis is limited by the lack of therapy offices and the high expense of treatment. After a concussion or trauma, patients with convergence insufficiency may need a long time to recover.

When it comes to improving visual skills like eye movement control and synchronisation through visual training, a combination of highly specialised sensory-motor-perceptual stimulation paradigms is used. A doctor of optometry or orthopaedics should supervise this procedure at all times, whether at home or at work. A wide variety of exercises or treatment regimens have been established for many years because vision therapy is a non-invasive practise with no standard criteria for administering it. As a result, the vision therapy has a negative reputation in the medical world, with many health care professionals, including eye doctors, dismissing it as a means of improving visual performance (Ghadban et al., 2015). However, vision therapy has a scientific foundation<sup>1</sup>, and there are numerous well-conducted research, including controlled clinical trials, that provide scientific backing for the work that many ECPs do every day across the world.

A vision therapy plan will be tailored by a developmental optometrist and vision therapist based on the severity of the convergence problem. The patient will next be guided by the eye doctor and therapist, who will monitor their progress to see what alterations or adaptations are needed throughout their personalised programme. Some specific equipment and instruments, such as prisms, lenses, and digital technologies, may be used in CI therapy exercises to train the brain to better govern the two eyes at the same time. The student's active engagement and compliance with the programme, whether in school or at home, determines the outcome (Barnhardt et al., 2012). The easier and more automated the workouts get over time as people train their brain. Children with symptomatic central auditory processing disorder (CI) can benefit from vision therapy, according to certain research. This therapy is beneficial in addressing both the symptoms and indicators associated with CI. However, the placebo effect does not explain its effectiveness in children with CI. According to the findings of the study by Scheiman et.al (2010), a similar multicenter, randomised trial with a larger sample size and a longer follow-up is required to learn more about CI therapy (Scheiman et al., 2010).

A new study by the National Institutes of Health shows that vision therapy in an office setting is the only treatment for convergence insufficiency (CI) that works, as well as other methods often employed by doctors to address the condition. Convergence insufficiency is a public health issue because of its high prevalence among children. According to research, convergence insufficiency affects 5-18% of elementary school pupils in the United States. Four alternative strategies for addressing Convergence Insufficiency were tested by the CITT researchers. Pencil push-up therapy is a common recommendation from eye doctors to parents of children with CI, and it involves looking at letters on a pencil while lowering the pencil to the child's nose. The goal is to maintain the patient's attention on the pencil as the target gets closer. PPT is a home-based treatment for CI that uses eye exercises (Antona et al., 2008). Convergence and eye concentration can be improved at home with computer-based programmes and pencil push-up therapy (HBCVAT+). This group was the next one to participate in the study, and they "thought" they were receiving regular vision therapy as well as home reinforcement activities. Thus, they were the "control group," which was receiving what the patient thought was vision therapy, but was actually receiving a series of drills that appeared to be vision therapy. This group also got weekly 60-minute in-office therapy sessions and home reinforcement assignments that were done the same way each week. OBVT was the last treatment group (Clark & Clark, 2015).

## 2. METHODOLOGY

Published papers in PubMed had been used to isolate the final set of papers through advanced searching terms to conduct literature reviews. We used some variety of searching terms that shown below (“convergence insufficiency” OR “CI”) AND (“vision therapy” OR “VT” OR “treatment” OR “therapy”). These studies that were extracted were carefully screened. The studies were limited to humans and had to be written in English. Duplicated studies, books, case reports, letters, studies that written other than English were excluded. Below provides the diagram of the selection criteria for the studies papers in this literature review. Initially, 77493 were found and after putting additional filters for titles, full papers, and limited ages, 10 records were used in this literature review.

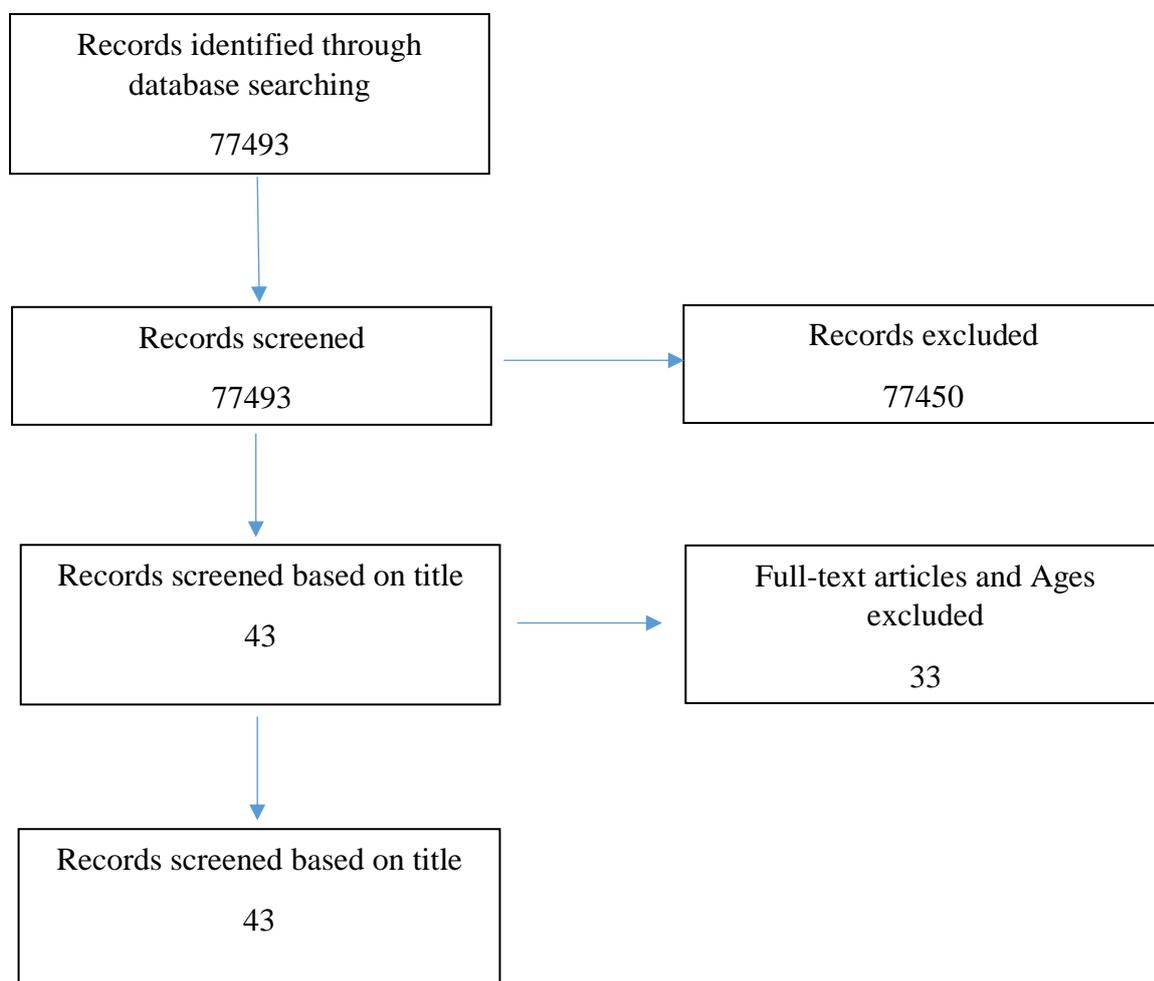


Figure 1. Selection criteria for the studies papers

### 3. RESULTS

#### Literature Search Result

The literature search yielded 77493 relevant results in PubMed. After screening based on title, 77450 research articles were excluded. In the second screening, we only included studies including patients with ages ranging from 4 to 17 years old, and with full-text articles. This resulted in 10 articles for this literature review.

#### Clinical Characteristics Categorized by Therapy Type:

<b>Publication</b>	<b>Study Type</b>	<b>Patient No.</b>	<b>Age</b>	<b>Therapy Type</b>
Mitchell et al (2019)	Prospective Trial	10	12-17	OBVAT
Tarek (2018)	Clinical Trial	102	7-13	OBVT, HTS
Mitchell et al (2019)	Clinical Trial	311	9-14	OBVAT
Mitchell et al (2019)	Clinical Trial	310	9-14	OBVAT
Mitchell et al (2010)	Clinical Trial	221	9-17	HBPP, HBCVAT+, OBVAT, OBPT
Wolfgang (2011)	Clinical Research	134	7-14	HTS, Base-in Reading Glasses
Scheiman (2020)	Clinical Testing	12	12-17	OBVAT
Carmen et al (2012)	Clinical Trial	221	9-18	CITT
Jang et al (2017)	Clinical Research	235	10-13	School Clinic Based VT, Home VT
Mitchell et al (2016)	Clinical Trial	204	9-18	HTS, CVAT

Each of these 10 studies had a total of 1760 individuals who underwent therapy for symptomatic and asymptomatic convergence insufficiency. The therapy was not completed by all subjects, however. Office-Based Vergence Accommodation Therapy and OBVT (Office-Based Vision Therapy) were the therapy types employed in these investigations, as were the HTS, HBPP, and HBCVAT (Home-Based Computer Vergence Accommodation Therapy and OBPT (Office-Based Placebo Therapy), respectively (Computer Vergence Accommodation Therapy).

In those researches, treatment group comparison for adjusted changes in near Point of Convergence (NPC), Positive Fusional Vergence (PFV), and CISS score who completed their vision therapy program are listed and shown below. After full treatment of VT program, it was found that CI symptoms and clinical measurement to be significantly improved.

Mean data of each research:

Publication	Age (Mean)	Mean NPC Before (cm)	Mean NPC After (cm)	Mean PFV Before ( $\Delta$ D)	Mean PFV After ( $\Delta$ D)	Mean CISS Score Before	Mean CISS Score After
Mitchell et al (2019)	13.7	16.5	3.6	11.8	38.3	35.8	11.2
Tarek (2018)	9.2	9.8	5	4.2	14.7	27.8	15.3
Mitchell et al (2019)	10.8	14.0	3.9	11.5	34.5	28.9	17.8
Mitchell et al (2019)	10.8	13.8	NA	11.6	NA	29.1	NA
Mitchell et al (2010)	13	14.2	7.2	11	22.6	29.9	20.8
Wolfgang (2011)	10.5	NA	NA	NA	NA	NA	NA
Scheiman (2020)	14.5	16.5	3.6	11.8	38.3	35.8	11.2
Carmen et al (2012)	11.8	NA	NA	NA	NA	36.3	8.8
Jang et al (2017)	10.1	10.6	5.5	10	11.7	NA	NA
Mitchell et al (2016)	12.4	14.0	4.6	12.1	10	29.9	10.6

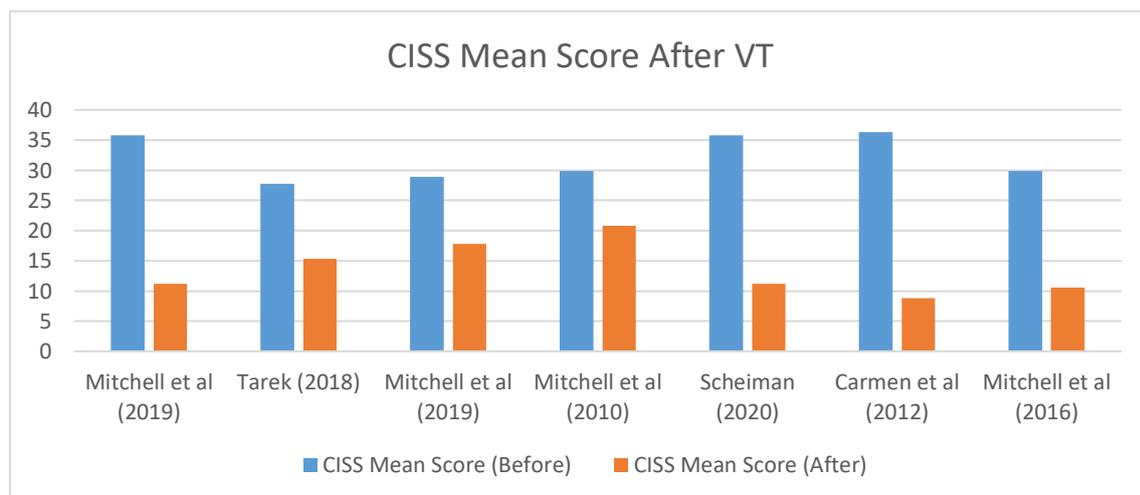


Figure 2 CISS Mean Score comparison before and after VT

Average data in these articles shows that NPC and vergence/accommodation data in placebo therapy group had increased after therapy. One of the studies concludes that OBVAT have more rapid movement in

symptoms and clinical measurements (Scheiman et al., 2010). But one study also shows that the improvement was not that significant or insufficient in some patients (Nehad et al., 2018).

The population as a whole ( $M = 19.22$ ,  $SD = 3.45$ ) was young. The pupils' median age was 19.22 years (standard deviation: 3.45 years). When expressed as a percentage, the most readable format is in parentheses, with no additional decimal points. The percentage of individuals who were married was not affected by gender,  $2(1, N = 90) = 0.89$ ,  $p = .35$ . We found that gender had a statistically significant impact, with males scoring higher than women ( $t(54) = 5.43$ ,  $p.001$ ). We found that the main impact of treatment was significant at 5.43 and the interaction was significant at 3.24 ( $F(1 \text{ and } 145): p 0.02$ ). For example: An  $r(55) = .49$  was found to be a strong correlation between the two variables.

In the study by Wolfgang (2011), they used different data in the research such as Amplitude of Accommodation (AA), Accommodative Facility, and Vergence Facility for their main data. After treatment, the result came out to be that it was highly effective treatment for patients having CI. The Mean Amplitude of Accommodation (D) increased from 12.66 to 12.97, the Accommodative Facility (cycles per minute) increased from 5.59 to 6.38, and the Vergence Facility (cycles per minute) increased from 5.44 to 6.63. In other studies, such as Carmen et al. (2012), that used only CISS in their methodology, also concluded that patients reported a decrease in symptoms in CI. The above bar graph of CISS score comparison, shows that in those studies which included CISS score the score decreased after a whole session of therapy.

But not only binocular vision measurement had improved, some of the studies also show that reading difficulties and reading speed can be improved and they also conclude that HTS and prismatic correction are a highly effective treatment for convergence insufficiency. The above table states that each study uses different duration of vision therapy session in their treatment. They used only HTS as their primary treatment in Wolfgang's (2011) study, and Carmen et al. (2012) used CITT for their treatment, including Home-based Pencil Pushup Therapy and Home-based Pencil Pushups with Computer Vision Therapy/Orthoptics, Office Vision Therapy/Orthoptics or Placebo Office Vision Therapy/Orthoptics, but they didn't state the duration of those therapy sessions.

All of the studies that used HBVT for 15 minutes a day and five days a week had the same techniques adopted from previous CITT trials. There were two primary tools utilised in this experiment: the Brock string and a loose stick prism. There was a therapist in the office for the first two home training sessions to ensure that the subject was able to perform each task alone.

#### 4. DISCUSSION

Convergence insufficiency symptoms can be treated and improved for youngsters 7-18 years old using vision therapy, according to the results of our research. As a result of a therapy programme that lasted between four and a year, those participants were able to return to their normal activities (Shin et al., 2009). Children's  
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symptoms and clinical measurements improved significantly following 12 weeks of office-based vision therapy treatment. One-year follow-ups showed that most children sustained these improvements. A Home-Based Computer Orthoptic Program can improve NPV and PFC in 92.8 percent of the entire patient list when treating symptomatic CI patients in adults.

The therapy combining OBVT and HTS significantly increased the successful rate (50%) and improvement (36%) compared to OBVT alone that had only a 32.7% improvement and 36.5% of success rate. All these findings by Scheiman et al. (2010), NPC and PFV clinical data in children had rapid improvement using OBVAT with home therapy fortification. They also had a higher CISS score in children with ADHD than those without ADHD. The disorder's abbreviation is Attention Deficit Hyperactivity Disorder (ADHD). ADHD is a disorder that affects a person's ability to concentrate and control their impulses because of abnormal brain development and activity. This condition can adversely affect a child's educational and social development. In order to focus, hear and follow instructions and sit quiet or wait their time in line, children often struggle. It's a lot more challenging for those with attention deficit hyperactivity disorder (ADHD) (Scheiman et al., 2010). Attention deficit hyperactivity disorder (ADHD) symptoms such as inattentiveness can appear in any or all of these areas. It's difficult for children who are easily distracted to concentrate and maintain focus. It's possible that they'll ignore instructions, fail to notice crucial details, and so on. Procrastination and/or daydreaming may be a problem for them. As a result, their stuff may be misplaced and they will appear careless or absent-minded. As a final option, there is the issue of being extremely busy. Fidgety, restless, and easily bored are all symptoms of hyperactive childhood behaviour. They may have trouble sitting still or remaining silent when necessary. These people tend to speed through tasks and jump to conclusions without thinking things through fully. When they shouldn't, they might do things like climb, jump, or roughhouse. Their actions could go unnoticed, causing discomfort to others. Finally, impulsive kids act without thinking through their actions. They interrupt constantly, may push or grab, and have a hard time waiting. They may do things without asking permission, take things that aren't theirs, or act in a dangerous manner. They may have irrational emotional outbursts in response to the issue. Parents and teachers may notice signs of ADHD in a child when he or she is very young. However, being distracted, restless, irritable, or impulsive is common in young children; these qualities may not necessarily imply that a child has ADHD (Scheiman et al., 2019).

Learning and reading errors increased as a result of this. Symptoms of learning impairments, such as a lack of focus and difficulty recalling information, are comparable to those of ADHD. Many of the children who took part in the VT programme saw improvements in their eye health as well as academic performance (Barnhardt et al., 2012). They also reported that performance-related complaints have remained stable over time, whereas eye issues have gotten worse. Treatment effects on reading performance and attention should be studied extensively in children with symptoms of convergence insufficiency. More study is needed (Barnhardt et al., 2012).

According to a study in our literature review, NPC was considerably improved after 8 weeks of treatment. Additionally, accommodative ability, exophoria severity and the PFV all improved as a result of the therapy. Prism glasses with bases proved to be useless, since data indicated no change in clinical or symptomatology when prescribed. Thus, vision therapy has been found to be an effective method of treating CI. The prevalence of nonstrabismic accommodative and vergence dysfunctions varies substantially according on the testing methods, diagnostic criteria, and the characteristics of the study populations studied (Jang et al., 2017). These symptoms are common in schoolchildren, regardless of statistics. Convergence insufficiency (CI) is a binocular condition in which the eyes do not work well together when focusing on something close. It's one of several binocular dysfunctions that aren't strabismic. CI affects around 3–5% of the general population, with corrective spectacle wearers accounting for 26% of those are affected. Asthenopia, headaches, blurriness on occasion, diplopia, excessive exhaustion when reading, a burning feeling, and epiphora are all the symptoms of CI that can worsen over time. Some of the treatment options for CI include correcting refractive issues, prescription prisms, and vision therapy (VT).

Adults and children alike benefit from VT, which is currently one of the few treatments available for CI. It was found that VT worked for 78 patients ranging in age from five to seventy-three. When VT was completed, 65 individuals reported a decrease in symptoms, while 20 reported an improvement in exophoria. The frequency of CI in children between the ages of 8 and 12 was as high as 17.6 percent. The CI Treatment Trial (CITT) is a recent placebo-controlled and randomised multicenter clinical trial that studied 221 children with symptomatic CI. When compared to the control group, the experimental group's symptoms and clinical indicators of NPC and PFV showed significant improvement. A total of 121 youngsters (55 percent) were diagnosed with accommodative insufficiency despite not satisfying the diagnostic criteria (Aletaha et al., 2018).

According to previous research, fusional vergence has improved, with an average treated rate of 72 percent after 9 months of treatment. And, after a long period of observation, the symptoms of individuals who had VT had vanished. According to Daum (1984), a VT programme requires an average of 4.3 times visitation sessions to be completed effectively. According to Jung et al. (2017), the extended treatment (16 sessions of combined therapy) was carried out to increase the effect of therapy efficacy. According to their findings, an intense VT programme appears to be the best option for minimising CI symptoms by decreasing NPC and exophoria while enhancing PFV (Grisham et al., 1991).

Near the convergence (NPC), convergence amplitudes drop, and exodeviation at the near are the most typical symptoms of CI. If the NPC value is less than 10 cm (4 inches) from the bridge of the nose, most typical young patients can maintain fusion even while converging to the tip of the nose. After 10 centimetres out from the nose, patients should be evaluated to rule out CI, according to the American College of Radiology. As the patient focuses their attention on a nearby target, it is gradually brought closer to their nose until the NPC is determined. When the patient's fusion breaks down, this condition is known as exotropia. "Breakpoint" is the term we use to describe it (Convergence Insufficiency Treatment Trial Study Group, 2009). To test the

amplitudes of convergence, base-out prisms are used while the patient concentrates on a small target object. At close range, the amplitude of normal convergence is 38 prism diopters, and at a distance, it is 14 prism diopters. At near-suggested convergence insufficiency, fusional convergence amplitudes of less than 15 to 20 prism diopters. If an eye muscle imbalance causes the exodeviation to be bigger in downgaze, it must be ruled out by examining the exodeviation from all angles of gaze. Close measurements should be taken in both the reading and primary locations. It is possible to perceive a higher exodeviation in downgaze as superior oblique overactivity.

The first large-scale, randomised, placebo-controlled clinical study to explore treatment alternatives focused on convergence insufficiency. The publishing of this study was made possible thanks to the combined efforts of several research institutions. Young adults aged 19 to 30 were found to benefit from OBVT and computer workouts, while the second landmark CITT trial found comparable benefits. When compared to pencil pushups and a placebo, the NPC and PFV increased only with vision therapy/orthoptics. According to a Cochrane review, home vergence exercises and computer vision therapy/orthoptics are less effective than OBVT for children. According to one study, CI patients who received 12 weeks of in-office and home-based therapy saw a 73% improvement in their CI symptoms and convergence measurements (Aletaha et al., 2018). There was no longer any evidence that patients needed treatment at all. Due to a scarcity of therapy offices and hefty treatment costs, the future is bleak. A concussion or other head injury may take a long time to heal if you have convergence insufficiency (DuPrey et al., 2017).

In the future, studies should include include healthy binocular controls who get vision therapy, as well as patients with CI who receive a placebo treatment. When we utilise a placebo therapy, we can determine if the fMRI differences are related to adaptation from visual therapy or a motor learning impact. More people and control interventions should be included in future study to see if the findings described here hold true in a larger population. At the time of testing, the validated CISS should be used to quantify the symptoms of the subjects. Phoria adaption has been found to be lower in CI sufferers than in controls, and it improves with vision therapy (Jang et al., 2017). As a result, measuring eye movement throughout a phoria adaptation trial with fMRI could indicate which brain alterations are connected to increased phoria adaptation capacity. A detailed investigation could also be carried out to understand more about the tactics that a subject utilised to compensate for CI in the beginning. Saccades, for example, could be employed to increase and/or suppress vergence peak velocity. It's also unknown whether these compensatory systems change during therapy or if the adaption is permanent. Convergence insufficiency sufferers might improve their condition permanently with the correct fitness routines. On-the-job training and closeness to one's place of employment can be helpful even after treatment has concluded. Recurring symptoms of convergence insufficiency may be linked to illness, sleep deprivation, or an increase in near-work pressures. It is possible that a second round of treatment could help alleviate recurring issues if the first round was successful. Patients with convergence insufficiency typically have normal refractive error ranges and good vision despite their condition. All converging vision specialists routinely assess an

individual's accommodative amplitude (their ability to focus on one eye at a time). Occasionally, it's shown to be ineffective as well. Prism reading glasses can help patients with weak accommodation and convergence.

## 5. CONCLUSION

Combining Office-Based and Home-Based vision therapy for 12-16 weeks resulted in statistically significant and clinically significant improvements in clinical measures and symptoms recorded by the CISS score in children ages 7 to 18 in the studies reviewed. Treatment with vergence and accommodative therapy has a high proportion of improving both vergence and accommodation function in children with CI in this age range. As a result, activities such as studying and reading will improve. It appears that CI cannot be completely cured, but rather improved clinical assessment can be achieved. Patients with learning disabilities and dyslexia, in particular, may benefit from the services of an eye care professional who specialises in this type of treatment but does not currently provide it. Children with these disorders, particularly those with convergence insufficiency, have more severe symptoms. Other studies have discovered a connection between the two, with accommodation alterations being more symptomatic than convergence changes. In addition, studies examining the relationship between near-work intensity and visual complaints showed a link between cumulative near-work amount, decreased accommodative capacity, and increased asthenopia.

Young children are the best candidates for vision therapy treatment since their brains are still developing, making it easier for them to learn and implement long-term changes. It may take some time and patience for adults with convergence insufficiency to see results from treatment, but the benefits are still worth it. Based on the severity of the convergence problem, a vision therapist will develop a vision therapy plan for children. As the patient progresses, the eye doctor and therapist will monitor the patient's progress and determine what modifications or adaptations are needed. Specialized equipment and instruments, such as prisms, lenses, and digital technologies, can be used in convergence insufficiency therapy exercises to train the brain to better coordinate the two eyes at the same time. The success of the programme relies on students' willingness to participate and pay attention in class and at home. It becomes easier and more automated for the children as their brains mature. You might see results in as little as a week or as long as six months after starting.

In addition to reducing or eliminating the pain associated with vision problems, vision therapy also enhances the eyes' overall performance. It is the most comprehensive therapy option for a wide range of visual disorders, such as lazy eye and visual rehabilitation after brain injury or strokes. When it comes to things like school, reading, and using a computer, being able to retain visual skills is critical, and vision therapy helps with that. These abilities are required both in the classroom and when working on a computer. Athletes that receive vision therapy not only benefit from improved visual processing, but they also maintain or improve their peak performance. Vision rehabilitation and learning issues must be discussed, as well. ' Poor vision skills can make

learning more difficult for people with vision impairments, although this isn't always the case. Vision therapy should be part of an all-encompassing strategy for overcoming academic challenges.

For children with symptomatic CI, this multicenter, randomised clinical research found that vision therapy and orthoptics are beneficial in treating both symptoms and signs, and that the placebo effect cannot account for this. According to this study, a bigger sample size and longer follow-up are needed to better understand the treatment of CI and to account for the probable biases that may arise from disparities in patient compliance and patient/therapist interaction time. The National Eye Institute is funding this large-scale, randomised clinical investigation, which has begun enrolling participants.

Despite the wide variation in prevalence of vergence and accommodation dysfunctions between studies, the testing procedures, diagnostic criteria, and study subjects' individual characteristics all have a major impact on the findings. When trying to focus on something up close, you may have convergence insufficiency (CI), a binocular condition in which the eyes do not work effectively together. Binocular dysfunctions that aren't strabismic include this one. Around 3% to 5% of the overall population is afflicted by CI, with corrective spectacles wearers accounting for 26% of those affected. A burning sensation, headaches, blurry vision, diplopia, extreme fatigue when reading, and epiphora are all symptoms of CI that can get worse over time. CI Correcting refractive errors, prescription prisms, and vision therapy are some of the treatment options for CI (VT). Children and adults can benefit from VT, which has been found to be useful in the treatment of CI. According to Aziz and co-workers, VT was successful in 78 participants aged 5 to 73 years old. A decrease in symptoms was recorded by 65 people, while an improvement in exophoria was noted by 20. Between the ages of 8 and 12, 17.6% of children reported having CI. 221 children with symptoms of CI were evaluated in the CI Treatment Experiment (CITT), a recent placebo-controlled and randomised multicenter clinical trial. The symptoms and clinical signs of NPC and PFV evaluations improved dramatically in the experimental group after 12 weeks of VT. Accommodative insufficiency was seen in 55% of the children despite not satisfying the diagnostic criteria.

Outside of eye care providers, vision is generally referred to as visual acuity. Patients with convergence insufficiency may find it more challenging to be managed and educated as a result of this. Convergence insufficiency is characterised by difficulty reading and other near-related tasks, as well as a lower academic achievement than those without the condition. School nurses and instructors should look into any binocular vision problems rather than blaming a lack of focus on attention deficit disorders like ADHD. People with attention deficit hyperactivity disorder (ADHD) have a three-fold higher frequency of CI than the overall population, according to statistics. These findings are significant because they open the door to interprofessional referrals for patients with ADHD who may benefit from CI therapy if it is discovered. Recent research on the link between ADHD and CI has found that treating CI symptoms with OBVT improves academic performance by lowering negative academic behaviours when compared to baseline. The suggested treatment is another factor to consider while treating patients adequately. Because prescribed treatment procedures differ by occupation, there appears to be a lack of unanimity. Ophthalmologists and optometrists typically propose simple

pencil push-ups for varying periods of time followed by home-based vergence therapy despite the fact that OBVT with home reinforcement is the most effective treatment for CI. In order to achieve the best possible outcomes for their patients, healthcare providers should think about recommending them to an OBVT specialist therapist.

As long as the symptoms of convergence insufficiency (CI) are misdiagnosed and mistreated, they will continue to manifest. The benefits of vision therapy and the normal period of remission should be made clear to patients. When considering management options, keep in mind that most insurance companies do not cover OVT, forcing patients to pay for it out of pocket. Future studies should involve a thorough examination of vergence eye movements during vision rehabilitation. After vision therapy, researchers found an increase in peak velocity that might be attributable to an increase in the preprogrammed transient component. Two components of Vergence are controlled by the Dual Mode Theory: the transient preprogrammed element that facilitates movement speed corresponding to burst cells recorded from the midbrain, and a feedback-controlled element that allows the system to be very accurate corresponding to burst cells recorded from the midbrain. Using step-ramp, double-step, and large-step stimuli in an adaptation experiment with controls with normal binocular vision, our group and others have shown that the peak velocity of vergence can be raised or decreased. Slow ramp stimuli also alter the vergence movement's feedback component, according to our study results. Neuronal control should be studied in future study in order to better understand the brain components that change as vision treatment progresses.. The transitory and long-term effects of vision treatment may change depending on the pace and kind used. CITT found that in children receiving CI treatment, the rate of improvement for NPC and PFV is faster than the rate of improvement for symptoms.

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