



# XCELLENCE IN EYE CARE

## THE EYE INSTITUTE

### *Convergence Insufficiency*

#### **What is Convergence Insufficiency?**

Convergence insufficiency (CI) is a common eye muscle coordination problem. When reading or doing close work, a person's eyes must turn in (converge) for the words to be clear and single. This usually happens easily, without thinking. In CI, the eyes do not turn in easily, and as a result, extra convergence effort must be used to force the eyes to turn in. This additional effort can cause a number of symptoms such as eyestrain, headaches, blurred vision, double vision, difficulty concentrating, loss of place and concentration, and reading slowly. CI has no obvious signs and is only detected through an eye examination.

Virtually all people that have convergence insufficiency have 20/20 vision. However, it is not enough to have 20/20 vision and be able to see clearly. For the visual system to function properly, we must use our two eyes together in a very precise and coordinated fashion. This ability is referred to as eye teaming or eye coordination. The technical term for this ability is *BINOCULAR VISION*.

Every time we look at something we must accurately aim the two eyes directly at the object of interest. Each eye sends an image to the part of the brain that is involved in the process of seeing. This part of the brain, called the visual cortex, then attempts to combine these two images to form one "**fused**" image. If these images are identical, the result is normal, clear, single vision and a perception of depth. If, however, the two eyes are not performing in a coordinated manner the visual cortex will receive two different images and will experience double vision.

There are many types of eye teaming or binocular vision problems. The eyes may tend to drift in, out, up, down, or a combination of these variations. The most common eye teaming problem is convergence insufficiency, in which the eyes tend to drift outward when reading or when engaged in any near distance visual activity.

#### **How is convergence insufficiency treated?**

Most eye care professionals treat CI using a home-based therapy called "pencil push-ups." With his eyes, the child follows a small letter on a pencil as the pencil is moved toward the bridge of his nose. His goal is to keep the letter clear and single, but to stop if the letter becomes double. The child is told to try and get the pencil closer and closer each day. Pencil push-ups are practiced for 15 minutes, five days per week.

The Convergence Insufficiency Treatment Trial (CITT) was conducted because

there was no consensus regarding the most effective treatment for CI. Additionally, a well-designed study had not been conducted comparing the various treatments. The CITT study compared three forms of vision therapy (orthoptics). Two of these were performed at home (home-based therapy) and one was performed in the office (office-based therapy by a trained therapist). The study also included an office-based placebo therapy.

The study was designed as a randomized clinical trial. It included 221 children from nine to 17-year-olds who had symptomatic CI.

Participants were assigned to one of four groups:

- Office-based vergence/accommodative therapy with a trained therapist along with home reinforcement
- Home-based pencil push-up therapy
- Home-based computer vergence/accommodative therapy and pencil push-ups
- Office-based placebo therapy

Nine clinical centers from around the country participated in the study. After 12 weeks of therapy, the children were re-examined by eye care professionals who were unaware of which treatment the children received. Researchers then compared the effectiveness of each of the three forms of vision therapy and the placebo therapy option for decreasing symptoms and improving the physical measurements of the convergence problem.

**Office-based vergence/accommodative therapy with a trained therapist along with home reinforcement.** Children in this group came to the office once per week for a 60-minute therapy session with a trained therapist. During these sessions, the children worked on four to six procedures designed to improve the ability to converge the eyes. The children in this group also did home therapy for 15 minutes, five days per week to practice the procedures learned during the office visits.

**Home-based pencil push-ups therapy.** In this group, the child had to follow a small letter on a pencil as the pencil was moved toward the bridge of his nose. His goal was to keep the letter clear and single, but to stop if the letter became double. The child was told to try and get the pencil closer and closer to the bridge of his nose each day. This was practiced for 15 minutes, five days per week.

**Home-based computer vergence/accommodative therapy and pencil push-ups.** In this group, the child was given complex exercises using a computer program plus pencil push-ups.

**Office-based placebo therapy.** This group was given placebo vision activities designed to simulate office-based therapy.

The 12-week study, known as the Convergence Insufficiency Treatment Trial (CITT), found approximately 75 percent of those who received in-office therapy by a trained therapist plus at-home treatment reported fewer and less severe symptoms related to reading and other near work. Symptoms of CI include loss of place, loss of concentration, reading slowly, eyestrain, headaches, blurry vision and double vision.

There are two important messages:

- Parents should know CI is a common vision problem in school-age children. Children with this problem may experience numerous symptoms that can make it more difficult to read.
- We now have quality evidence showing office-based vision therapy with a trained therapist plus at-home reinforcement can effectively treat CI in children nine to 17-year-olds. This treatment can improve symptoms and physical measurements of the condition.

The results of this study demonstrate that a 12-week program of office-based therapy by a trained therapist along with additional home reinforcement is more effective than a 12-week program of home-based treatment for CI. The study results apply to children who have symptomatic CI and are nine to 17-years-old. The CITT will provide eye care professionals with research to assist children who have this condition.

### Signs and Symptoms of Convergence Insufficiency

Difficulty converging while engaged in a reading task causes misalignment of the eyes, resulting in double vision unless the individual exerts additional convergence effort to re-align the eyes. As the visual system attempts to eliminate this double vision by using additional convergence effort, a number of significant symptoms can occur. These symptoms include: frequent loss of place, loss of concentration, having to re-read, reading slowly, trouble remembering what was read, sleepiness, blurred vision, diplopia, headaches, and/or eyestrain during reading or other near work.

The Convergence Insufficiency Treatment Trial Investigator Group recently gathered important data about the symptoms of convergence insufficiency in a series of studies (REF). These were the first studies that used a scientifically valid and reliable symptom questionnaire.

These studies found children with convergence insufficiency reported the following symptoms occurred “fairly often” or “always” while reading or doing close work:

Loss of place:	50%
Loss of concentration:	45%
Re-reading the same line:	45%
Reading slowly:	40%
Trouble remembering what was read:	38%
Feeling sleepy:	37%
Words blurring:	36%
Headache:	32%
Double vision:	32%
Eyes hurt:	31%
Eyes feel tired:	30%
Eyes feel uncomfortable:	29%
Eyes feel sore:	21%
Words move/jump/swim:	20%
Pulling feeling:	11%

An interesting finding from these studies was performance related symptoms

(i.e., loss of place, loss of concentration, re-reading the same line, reading slowly, trouble remembering what was read or feeling sleepy) occurred more frequently than eye related symptoms (i.e., blur, headache, diplopia, or asthenopia). This finding is important because it demonstrates children and adults with convergence insufficiency are likely to experience performance problems when reading.

It is also important to note the second most common symptom was loss of concentration with almost half of the children reporting this symptom “fairly often” or “always” when reading. This potential link between convergence insufficiency and attention disorders has important practical implications for educators, physicians, psychologists other professionals involved in the detection, diagnosis, and treatment of attention deficit hyperactivity disorder. It suggests a comprehensive vision examination should be mandatory for any child with a suspected attention problem to rule out convergence insufficiency.