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## Diagnostic informational summaries of common learning-related visual conditions

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## **Diagnostic informational summaries of common learning-related visual conditions**

### **Abstract**

Diagnostic Informational Summaries of Common Learning-Related Visual Conditions were designed to aid in the education of patients, parents, and teachers. The project addresses 10 of the most commonly encountered visual problems associated with learning: 1) accommodative insufficiency, 2) convergence insufficiency, 3) convergence excess, 4) divergence insufficiency, 5) divergence excess, 6) strabismus, 7) amblyopia, 8) suppression, 9) oculomotor dysfunction, and 10) binocular dysfunction. Each one-page back-to-back informational summary includes a description of the condition, common causes, signs and symptoms, treatment approaches, and general recommendations to support in the successful management of the condition. Through increased communication between parents, educators, and optometrists, these informational summaries help children benefit the most from their vision therapy programs and assist in identifying others in need of vision care.

### **Degree Type**

Thesis

### **Degree Name**

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### **Committee Chair**

Bradley Coffey

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## **Diagnostic Informational Summaries of Common Learning-Related Visual Conditions**

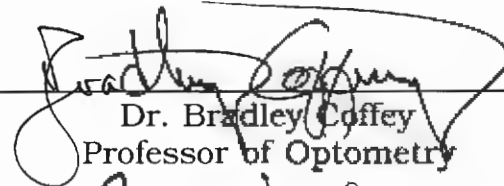
PRESENTED BY:


**Scott R. Melling**

In partial fulfillment for the Master of Education  
Visual Function in Learning  
at Pacific University

September 1999

### **COMMITTEE MEMBERS:**

  
Dr. Bradley Coffey  
Professor of Optometry

  
Dr. Anita McClain  
Coordinator, M.Ed.VFL Program

## **ACKNOWLEDGEMENTS**

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Dr. Anita McClain, my principal advisor and mentor from the School of Education, for her motivation and support of this project and the M.Ed. VFL Program.

## **ABSTRACT**

Diagnostic Informational Summaries of Common Learning-Related Visual Conditions were designed to aid in the education of patients, parents, and teachers. The project addresses 10 of the most commonly encountered visual problems associated with learning: 1) accommodative insufficiency, 2) convergence insufficiency, 3) convergence excess, 4) divergence insufficiency, 5) divergence excess, 6) strabismus, 7) amblyopia, 8) suppression, 9) oculomotor dysfunction, and 10) binocular dysfunction. Each one-page back-to-back informational summary includes a description of the condition, common causes, signs and symptoms, treatment approaches, and general recommendations to support in the successful management of the condition. Through increased communication between parents, educators, and optometrists, these informational summaries help children benefit the most from their vision therapy programs and assist in identifying others in need of vision care.

# TABLE OF CONTENTS

- I. INTRODUCTION
- II. INFORMATIONAL SUMMARIES
  - A. Accommodative Insufficiency
  - B. Convergence Insufficiency
  - C. Convergence Excess
  - D. Divergence Insufficiency
  - E. Divergence Excess
  - F. Strabismus
  - G. Amblyopia
  - H. Suppression
  - I. Oculomotor Dysfunction
  - J. Binocular Dysfunction
- III. REFERENCES

# **DIAGNOSTIC INFORMATIONAL SUMMARIES OF COMMON LEARNING-RELATED VISUAL CONDITIONS**

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## **INTRODUCTION**

Optometrists and educators have been interested in the relationship between visual efficiency and learning for decades. Of all the learning disabilities, found in approximately 5% of all school children, reading disability is the most frequently encountered.<sup>1-3</sup> While visual processing and reading are undoubtedly interconnected, not all children with visual inefficiencies have a reading problem. Some present with signs and symptoms manifested in different ways while others may have no apparent visual or learning problems at all. Some of these children may develop compensatory techniques to adapt, or exhaust excessive energy overcoming their visual condition that otherwise could be spent in accelerated learning. Eventually these children receive a recommendation or referral for an eye examination with an optometrist. Following the evaluation their visual diagnosis is determined and the appropriate treatment begins, putting the child on track for increased visual performance and potential to succeed in the classroom.



In an effort to increase the efficiency and effectiveness of prescribed optometric treatment, this project was created to strengthen communication and teamwork between the optometrist, patients, parents, and educators. Contained in this work are one-page back-to-back informational summaries of common visual conditions often found in children with visually-related learning problems. They are designed to educate the patient, parent, and teacher of the newly diagnosed visual condition and provide important information regarding their role in assisting with the prescribed treatment plan. Following an initial vision evaluation, these informational summaries will be available to interns and doctors at the Pacific University Vision Centers to help reinforce and supplement the verbal education provided or relayed to the parents and teachers until the complete and specific report can be written, sent, and received. This will also aid in educating patients, parents, and educators more about optometry and how vision therapy and other optometric services could potentially aid in helping other children with visually-related learning difficulties.

This project is not intended to be inclusive of all visual problems associated with learning, however, the 10 visual conditions addressed in this work are among the most commonly encountered. They cover the following diagnoses: 1) accommodative insufficiency, 2) convergence insufficiency, 3) convergence excess, 4) divergence insufficiency, 5) divergence excess, 6) strabismus, 7) amblyopia, 8) suppression, 9) oculomotor dysfunction, and 10) binocular dysfunction. For each condition, the one-page back-to-back informational summary will include the description/definition of the condition, common causes, signs and symptoms, treatment/management approaches, and

general information/recommendations for assisting in the successful management of the condition.

This project was developed after rotating through the vision therapy clinic at Pacific University as a 4<sup>th</sup> year intern and discovering a need for more effective communication between optometrists, patients, parents, and educators. Patients and parents who understood the condition being treated and the purpose and importance of visual training activities were more compliant with treatments and enjoyed a greater level of success as compared to others that did not. Investigators have estimated that patients remember approximately 50% to 60% of the information that doctors give them soon after receiving the recommendations, and about 45% to 50% several weeks later.<sup>4</sup> Undoubtedly, understanding and remembering treatment recommendations are key requirements for successful management.

Teachers at school also play an important role in the success of the child's vision therapy and/or treatment plan. Often certain conditions need to be met at school in addition to the training done at home. Teachers, for instance, who understand a child's visual requirement to wear prescribed spectacles may be more cognizant and persistent in encouraging the student to wear them as opposed to a teacher who does not understand. In consideration of a given visual condition, special modifications to the activities and learning environment of the child may be beneficial and necessary as well. Such changes may involve appropriate positioning in the classroom, modifications to the types of assignments given, or increased time allowed to complete certain tasks. Thus, through good communication, teachers can be great assets in implementing optometric

recommendations and facilitating the progress and improvement of the child's visual performance.

With the aid of the informational summaries contained in this work, children with learning-related visual problems and/or visual inefficiencies will gain greater success from their vision therapy and treatment plans. Patients, parents, and teachers will have a better understanding of the visual condition affecting their child's performance and increased awareness of their role in the treatment process. The summaries will also serve to better educate them and others of the value of vision therapy and other optometric services, potentially assisting in the identification of other school children in need of vision care. Working together, parents, teachers, and the optometrist can help children gain the efficient visual skills necessary to perform at their best, increasing their potential for success in school and for the future.

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<sup>1</sup> Beitchman JH, Young AR. Learning disorders with a special emphasis on reading disorders: a review of the past 10 years. *J Am Acad Adolesc Psychiatry* 1997; 36(8):1020-32.

<sup>2</sup> Lyon GR. Learning disabilities. *Future Child* 1996; 6(1):54-76.

<sup>3</sup> Scheiman MM, Rouse MW. *Optometric management of learning-related vision problems*. St. Louis: Mosby, 1994:153.

<sup>4</sup> Ettinger, ER. *Professional communications in eye care*. Boston: Butterworth-Heinemann, 1994:90.

## **INFORMATIONAL SUMMARIES**

# ACCOMMODATIVE INSUFFICIENCY

## *What is accommodative insufficiency?*

Accommodation is the ability to focus one's vision in order to view objects clearly at varying distances. This is done quickly and accurately with instant clarity as one's attention shifts from one distance to another. A child in school changing focus from writing on the chalkboard to a notebook on his or her desk is an example. Good accommodation also allows one to maintain a clear focus for an extended period of time, such as with reading. Accommodative insufficiency is the term used when these focusing skills are inadequate and below expected norms.

## *What causes accommodative insufficiency?*

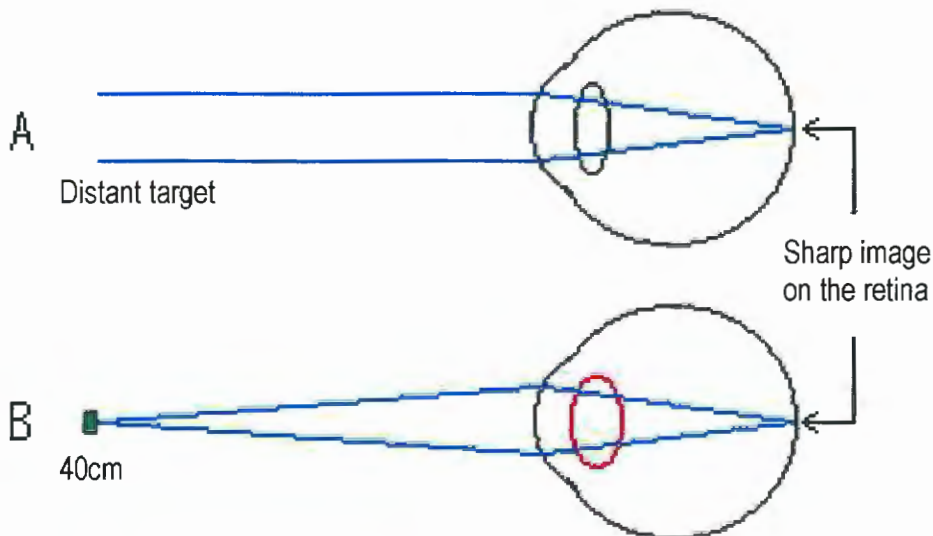
There are many causes for a deficiency of accommodation. Among the most common

affecting school children are general fatigue or stress, uncorrected far or nearsightedness, eye vergence problems, and normal variation in the population. Other causes include excessive near-point work, age, factors related to ocular or systemic disease, drugs, medications, and emotional problems.

Symptoms of a child with a focusing problem may include the following:

- complaints of blurred vision, especially after near work
- headaches
- fatigue and/or eyestrain while reading
- avoidance of near tasks, such as reading

If untreated, accommodative insufficiency can be more than just uncomfortable or visually tiring. Difficulty sustaining clear vision at



near may decrease the time a child is able to perform such tasks, challenging his or her motivation to learn. School performance and achievement potential may be affected.

If you suspect a child is experiencing the symptoms of accommodative insufficiency, a complete vision examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

A. When a normal eye is looking at a distant target, the eye is relaxed and no accommodation is needed to see clearly. B. When focusing on a near target, accommodation is necessary. As one accommodates, a change in the shape of the lens of the eye occurs allowing one to obtain a clear image.

***How is accommodative insufficiency treated?***

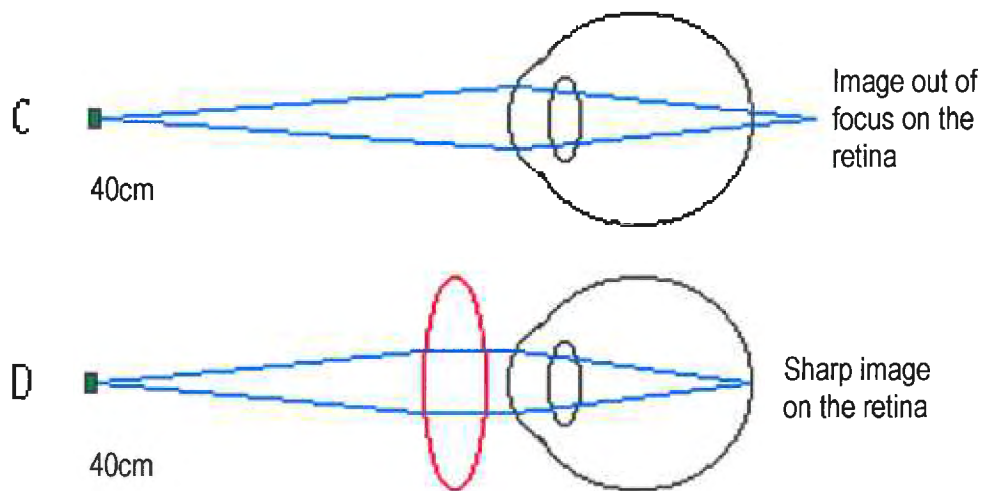
Plus lenses, vision therapy, or a combination of the two often are used to treat accommodative insufficiency. Plus lenses help relax the eyes by decreasing the focusing demand. Vision therapy involves a training program with daily exercises and activities designed to increase and strengthen the child's accommodative ability.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of

optometry. Parents and teachers play a key role in ensuring good compliance with the child by encouraging the following:

- wearing any prescribed lenses
- doing any prescribed vision therapy
- keeping an appropriate distance from reading material and/or near work (33 cm for children, 40 cm for adults)

Working together parents, teachers, and the optometrist can help the child gain strong functional accommodative skills, increasing the child's potential for success in school and for the future.



C. With accommodative insufficiency, there is not an adequate accommodative ability to bring the target to a clear focus. D. With a plus lens, the target is brought to a sharp focus and is seen clearly.

American Optometric Association. Optometric clinical practice guideline: Care of the patient with accommodative and vergence dysfunction. St. Louis: AOA, March 1998.

Dwyer P, Wick B. The influence of refractive correction upon disorders of vergence and accommodation. *Optom Vis Sci* 1995; 72(4):224-32.

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Scheiman M, Wick B. *Clinical management of binocular vision: heterophoric, accommodative, and eye movement disorders*. Philadelphia: JB Lippincott, 1994:339-78.

# CONVERGENCE INSUFFICIENCY

## *What is convergence insufficiency?*

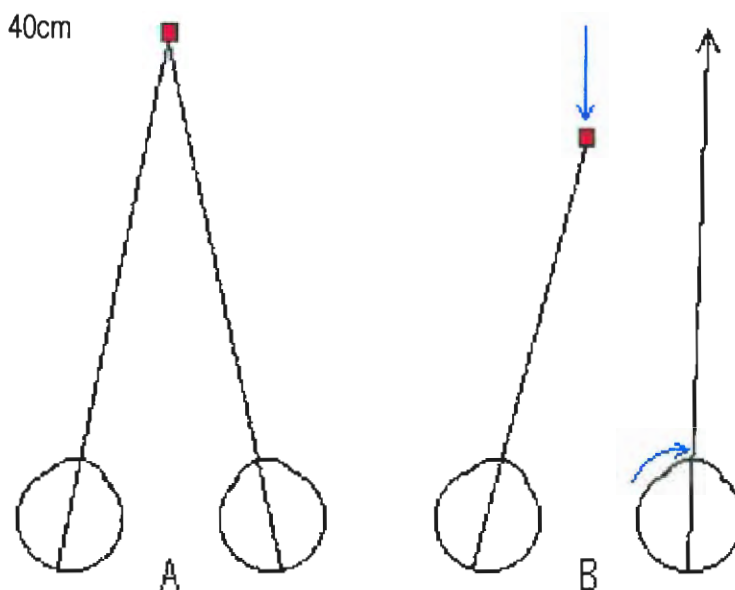
Convergence is the ability of both eyes to turn inward simultaneously in order to view a near object. This skill allows for quick and accurate aiming of the eyes from distant to near targets providing comfortable vision without seeing double. Shifting one's attention from the chalkboard to words in a book is an example. Good convergence skills also help maintain a comfortable visual posture, decreasing fatigue and the effort needed to read or do near work for extended periods of time. Convergence insufficiency is the term used when this inward aiming skill of the eyes is inadequate and below expected norms.

## *What causes convergence insufficiency?*

Some of the causes of convergence insufficiency are visual stress, fatigue, illness, drugs, aging, improperly aligned glasses, and genetic factors. Often the cause of convergence insufficiency is unknown.

Symptoms of an insufficient convergence ability may include the following:

- double vision
- headache or eyeache
- fatigue or eyestrain
- avoidance of near work
- covering one eye or turning one's head while reading
- reduced comprehension



A. At a normal reading distance, one with convergence insufficiency may be able to maintain an appropriate alignment, but often requires additional effort that causes eyestrain with time. B. When the target is moved closer, the eyes are unable to converge and one eye drifts out.

If untreated, convergence insufficiency may decrease the time a child is able to read or do other near work. This may challenge his or her motivation to learn. School performance and achievement, therefore, may be affected.

If you suspect one is experiencing the signs or symptoms of convergence insufficiency, a complete vision examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

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

Near-point exercises designed to increase the individual's convergence ability are very effective. This vision therapy helps the eyes comfortably maintain a single image of targets at increasingly closer distances. For those who are unable to do a vision therapy program, or where there is limited improvement with near-exercises, reading glasses with base-in prism can be helpful.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a

key role in ensuring good compliance with the child by encouraging the following:

- wearing any prescribed lenses
- doing any prescribed vision therapy
- using good lighting when reading
- allowing additional time, if necessary, to complete reading and/or near activities

Working together parents, teachers, and the optometrist can help the child gain a strong convergence ability, increasing the child's potential for success in school and for the future.

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American Optometric Association. Optometric clinical practice guideline: Care of the patient with accommodative and vergence dysfunction. St. Louis: AOA, March 1998.

Griffin JR, Grisham JD. Binocular anomalies: diagnosis and vision therapy, 3rd ed. Newton, MA: Butterworth-Heinemann, 1995:88,431-35.

Rouse MW, Hyman L, Hussein M, Solan H. Frequency of convergence insufficiency in optometry clinic settings. Convergence insufficiency and reading study (CIRS) group. Optom Vis Sci 1998; 75(2):88-96.

Scheiman M, Wick B. Clinical management of binocular vision: heterophoric, accommodative, and eye movement disorders. Philadelphia: JB Lippincott, 1994:225-46.



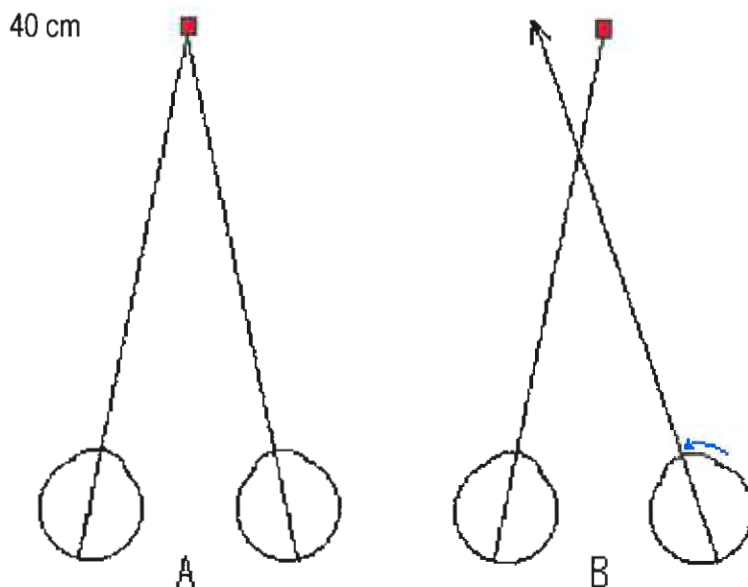
# CONVERGENCE EXCESS

## *What is convergence excess?*

Convergence is the ability of both eyes to turn inward simultaneously in order to view a near object. This skill allows for quick and accurate aiming of the eyes from distant to near targets providing comfortable vision without seeing double. Shifting one's attention from the chalkboard to words in a book is an example. Good convergence skills also help maintain a comfortable visual posture, decreasing fatigue and the effort needed to read or do near work for extended periods of time. Convergence excess (CE) is the term used when the eyes tend to aim inward in an excessive amount in front of the near target on which one is focusing.

## *What causes convergence excess?*

Convergence excess is caused by an imbalance in the relationship between convergence and accommodation (ability to focus). In normal cases, when one focuses on a near target, the eyes naturally aim inward an appropriate amount to see it clearly and single, thus avoiding double vision. In CE, however, the same amount of accommodation to see the near target stimulates the eyes to aim inward to a greater extent, beyond expected norms. Associated factors may be uncorrected farsightedness or visual stress. The latter is represented by the many patients with CE who often are intense individuals that concentrate excessively when doing near tasks.



A. At a normal reading distance, one with convergence excess may be able to maintain an appropriate alignment, but often it requires additional effort that causes eyestrain with time. B. When the target is moved closer or the eyes are fatigued, the eyes may be unable to maintain such an alignment and an eye may turn excessively inward.

Convergence excess can also be caused by a condition called spasm of accommodation or convergence. This may be associated with a more serious underlying condition, such as a local inflammation or central nervous system lesion. Some drugs can also be a causative factor.

Signs and symptoms of excessive convergence may include the following:

- blurred vision at near
- eyestrain
- headaches
- occasional double vision and/or eye turn

- poor reading comprehension
- loss of place when reading
- distance blur, fatigue and/or sleepiness after reading
- avoidance of near work
- tearing
- closing or covering one eye

Note: Acute onset and medical problems or neurological symptoms are usually present when CE is associated with serious underlying disease; otherwise, with CE the health history is typically negative.

With the exception of those cases caused by a serious underlying disease, CE is considered to be a benign condition. If untreated, the consequences are determined by the degree to which the visual symptoms affect the patient. With school children, CE may decrease the time a child is able to read or do other near work comfortably. This may challenge his or her ability and motivation to learn, thus potentially affecting school performance and achievement.

If you suspect one is experiencing the signs or symptoms of convergence excess, a complete eye examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

### *How is convergence excess treated?*

Plus lenses or base-out prism is often prescribed in the spectacles for near to compensate for the excessive convergent posture. Vision therapy can also help improve the relationship between convergence and accommodation but requires high motivation, dedication, and often continual maintenance over time.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance with the child by encouraging the following:

- wearing of any prescribed lenses and/or performing the vision therapy plan
- keeping an appropriate visual distance from reading material (33 cm for children, 40 cm for adults)
- using good lighting when reading or doing near work
- allowing additional time, if necessary, to complete reading and/or near activities

Working together, parents, teachers, and the optometrist can help address the visual needs of the child, increasing the child's potential to be successful in school and for the future.

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American Optometric Association. Optometric clinical practice guideline: Care of the patient with accommodative and vergence dysfunction. St. Louis: AOA, March 1998.

Gallaway M, Scheiman M. The efficacy of vision therapy for convergence excess. J Am Optom Assoc 1997; 68:81-6.

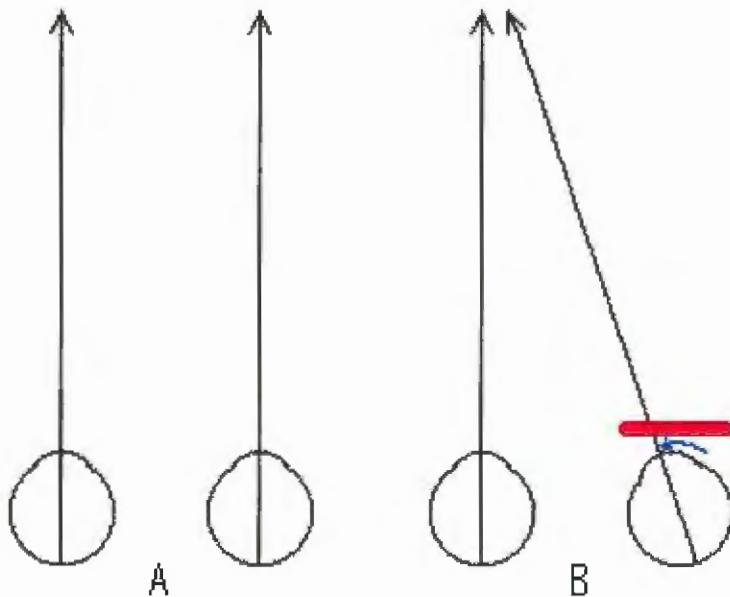
Griffin JR, Grisham JD. Binocular anomalies: diagnosis and vision therapy, 3rd ed. Newton, MA: Butterworth-Heinemann, 1995:91, 214.

Scheiman M, Wick B. Clinical management of binocular vision: heterophoric, accommodative, and eye movement disorders. Philadelphia: JB Lippincott, 1994: 268-84.

# DIVERGENCE INSUFFICIENCY

## *What is divergence insufficiency?*

Divergence is the ability of the eyes to turn outward simultaneously. This skill allows for quick and accurate aiming of the eyes from near to distant targets providing comfortable vision without seeing double. Shifting one's attention from reading a book to the chalkboard is an example. Good divergence skills help maintain a comfortable and appropriate visual posture by decreasing the energy required to keep the eyes aligned. Divergence insufficiency is the term used when this outward aiming skill of the eyes is inadequate and below expected norms. As a result, the eyes aim slightly inward when viewing distantly rather than being aligned appropriately on the target.



A. Appropriate alignment on a distant target. B. When an eye is covered, a normal posture would still be close to alignment. With divergence insufficiency, one eye tends to drift to an inward posture.

## *What causes divergence insufficiency?*

The cause of divergence insufficiency is uncertain. This condition often presents at childhood when the relationship between the accommodation (focusing) and vergence (alignment) skills is developing and fragile.

Signs and symptoms of divergence insufficiency may include the following:

- headaches and/or eyestrain
- blurred vision at far
- occasional double vision, which worsens when tired
- suppression of vision of one eye (mentally ignored so it is not perceived)
- nausea and/or dizziness

- difficulty focusing from near to far
- sensitivity to light
- an occasional noticeable eye turn

If untreated, many with divergence insufficiency function with minimal symptoms. This is because typically the visual posture is good at near and suppression of one eye occurs in the distance. Symptoms, if present, usually are associated with this distance viewing. Optimal distant vision, comfort, and binocularity (depth perception) may be

compromised and increase with fatigue. In addition, a noticeable eye turn may become more apparent and be unacceptable.

If you suspect one is experiencing the signs or symptoms of divergence insufficiency, a complete vision examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

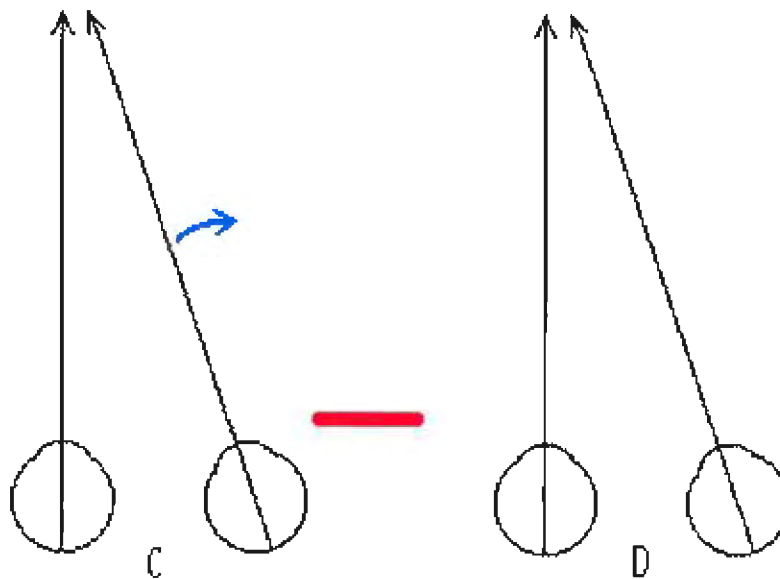
### ***How is divergence insufficiency treated?***

Base-out prism can be prescribed in the distance spectacles to compensate for the insufficient divergence at far. A vision

therapy program designed to increase the divergence ability also can be successful. In some severe cases, surgery is necessary for a satisfactory outcome.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance by encouraging the following:

- wearing any prescribed lenses
- doing any prescribed vision therapy



Working together, parents, teachers, and the doctor can help the child improve his visual performance, increasing the child's potential for success in school and for the future.

C. Under normal conditions, when no cover is present, added energy is required to align the eyes from the resting inward posture. D. If the eyes are fatigued, insufficient energy to regain alignment may result, potentially manifesting as an eye turn.

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American Optometric Association. Optometric clinical practice guideline: Care of the patient with accommodative and vergence dysfunction. St. Louis: AOA, March 1998.

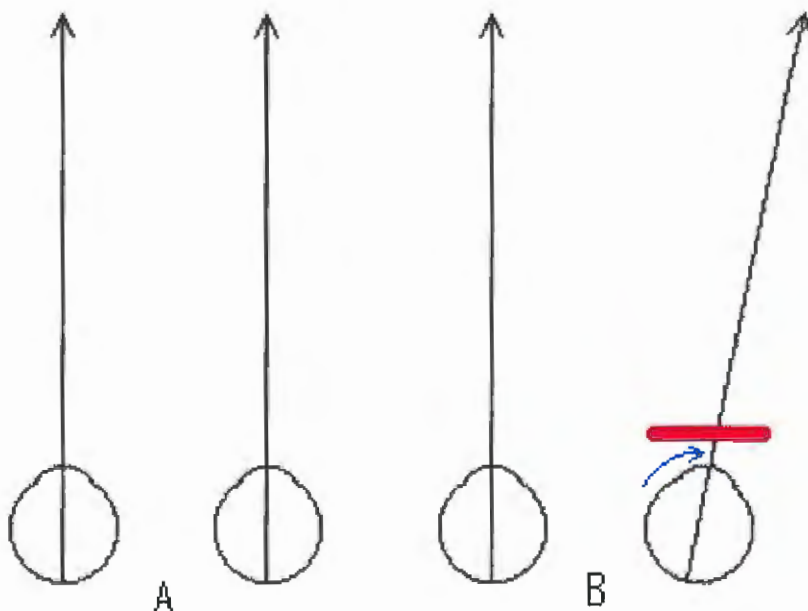
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Scheiman M, Wick B. Clinical management of binocular vision: heterophoric, accommodative, and eye movement disorders. Philadelphia: JB Lippincott, 1994:247-62.

# DIVERGENCE EXCESS

## *What is divergence excess?*

Divergence is the ability of the eyes to turn outward simultaneously. This skill allows for quick and accurate aiming of the eyes from near to distant targets providing comfortable vision without seeing double. Shifting one's attention from reading a book to the chalkboard is an example. Good divergence skills help maintain a comfortable and appropriate visual posture by decreasing the energy required to keep the eyes aligned. Divergence excess is the term used when the eyes tend to aim in an outward posture beyond what is comfortable and in excess of established norms.



A. Appropriate alignment on a distant target. B. When an eye is covered, a normal posture would still be close to alignment. With divergence excess, one eye tends to drift to an outward posture.

## *What causes divergence excess?*

In some cases it is believed that divergence excess may arise from near-point stress during early infancy when a child's world is primarily within a near space. At this time the relationship between the accommodation (focusing) and vergence (alignment) skills is developing and fragile, and the divergence ability may be affected. It can also arise due to genetic factors.

Signs and symptoms of divergence excess may include the following:

- headaches and/or eyestrain
- blurred vision at far
- occasional double vision, with greater difficulty at the end of the day
- suppression of the vision of the deviating eye (mentally ignored so it is not perceived)
- an occasional noticeable eye turn
- occasional covering of one eye while watching television
- light sensitivity

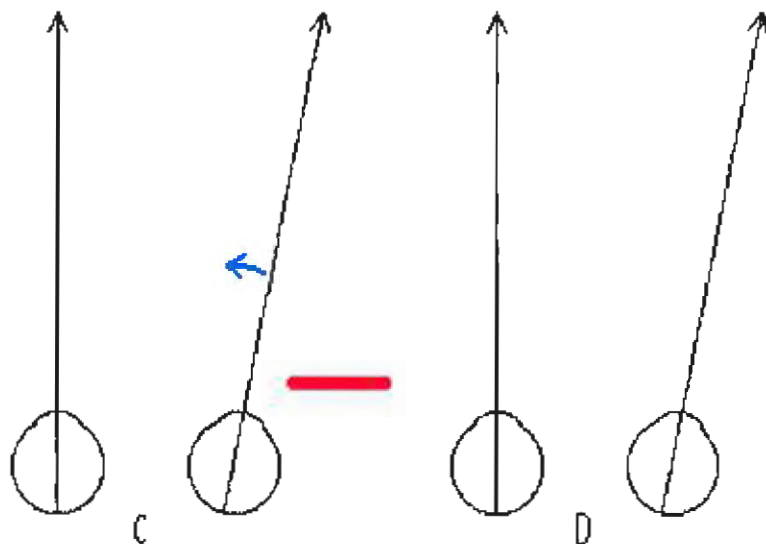
If untreated, visual performance at near is minimally affected. The symptoms occur more often with distant viewing. Optimal distant vision, comfort and

binocularity (depth perception) may be compromised with fatigue. In addition, an occasional noticeable eye turn may be unacceptable.

If you suspect one is experiencing the signs or symptoms of divergence excess, a complete vision examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

### ***How is divergence excess treated?***

In most cases a vision therapy program designed to normalize the relationship



C. Under normal conditions, when no cover is present, added energy is required to align the eyes from the resting outward posture. D. If the eyes are fatigued, insufficient energy to regain alignment may result, potentially manifesting as an eye turn.

between accommodation and vergence is very effective. Other cases may also necessitate added minus power in the distance spectacle prescription or added plus power at near. Compensating base-in prism, and/or extraocular muscle surgery are other available options when indicated.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance by encouraging the following:

- wearing any prescribed lenses
- doing any prescribed vision therapy

Working together, parents, teachers, and the doctor can help the child improve his visual performance, increasing the child's potential for success in school and for the future.

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American Optometric Association. Optometric clinical practice guideline: Care of the patient with accommodative and vergence dysfunction. St. Louis: AOA, March 1998.

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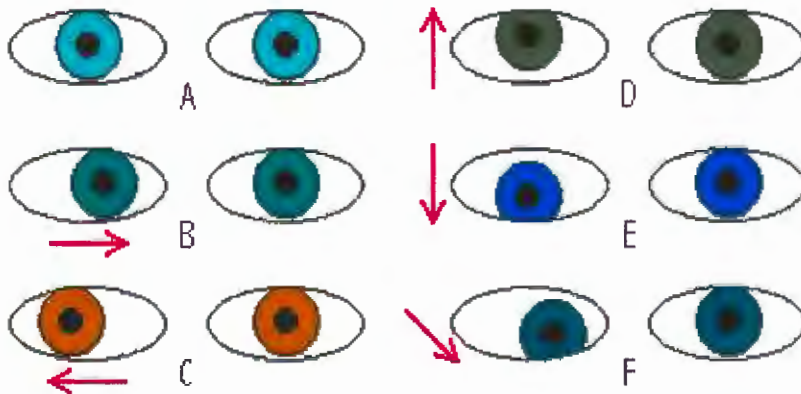
Griffin JR, Grisham JD. Binocular anomalies: diagnosis and vision therapy, 3rd ed. Newton, MA: Butterworth-Heinemann, 1995:89-90,427-9.

Scheiman M, Wick B. Clinical management of binocular vision: heterophoric, accommodative, and eye movement disorders. Philadelphia: JB Lippincott, 1994:284-304.

# STRABISMUS

## *What is strabismus?*

Strabismus is the condition where the eyes do not align properly, such that one eye is “turning” in relation to the other. It may or may not be easily noticeable, depending on the degree and nature of the deviation. The “turning” may be in, out, up, down, or in any combination. The deviation can also be constant, intermittent, and/or alternate from one eye to the other. Proper alignment is essential for good depth perception, binocular function, and in some cases, the development of fine acuity. When an eye is consistently not aligned, the fovea, where the most distinct vision occurs within the eye, may not reach its potential. This results in reduced visual acuity which cannot be improved with glasses or contact lenses and is called amblyopia, commonly known as “lazy eye.”



Strabismus is also called “tropia”, with the prefix indicating the direction of the eye turn. A. Normal alignment with no tropia. B. Esotropia—the deviating eye turns in. C. Exotropia—the deviating eye turns out. D. Hyperopia—the deviating eye turns up. E. Hypotropia—the deviating eye turns down. F. A combination of two—esotropia and hypotropia.

## *What causes strabismus?*

There are many different causes of strabismus. Most often strabismus presents as a result of genetic factors, developmental anomalies, or trauma. Developmental anomalies may be mechanical defects in the positioning of the eyes, irregularities in the innervation to the eyes, or disturbances in other areas of the visual system causing an interference with function. At times, an imbalance in the visual acuity of each eye may also be a cause, making two-eyed fusion impossible or difficult, and thus causing the eye to turn. Vascular disorders, tumors, inflammations and other conditions can also be causative factors.

Signs and symptoms of strabismus may include the following:

- misalignment of one eye
- intermittent double vision
- blurred vision
- suppression of vision in one eye (mentally ignored so it is not perceived)
- eyestrain and/or headaches
- abnormal head posture
- errors in visual judgement

If strabismus goes untreated, the potential for binocular function is impeded and at risk. Depth

perception is decreased and amblyopia and/or suppression of vision in the deviating eye may develop. A noticeable eye turn may also be unacceptable. Often children in school can read and adapt well with just one eye, but the decreased depth perception and peripheral vision may affect the child's ability to excel in certain sports and other activities requiring good eye-hand coordination. Strabismus may prevent one from entering certain occupations as well.

If you suspect one has strabismus, a complete eye examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

#### ***How is strabismus treated?***

Treatment for strabismus depends on the specific type of deviation and its prognosis. Lenses, prisms, occlusion (patching one eye), vision therapy, pharmacological therapy, eye muscle surgery, or a combination of these procedures may be required for treatment. Conservative strategies should

be attempted first, followed by the pharmacological therapy and surgery if necessary.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance with the child by encouraging the following:

- wearing of any prescribed lenses and/or patch, if indicated
- doing any prescribed vision therapy
- taking any prescribed eye drops, if indicated
- being aware of potential dangers/precautions associated with decreased peripheral vision and depth perception

Working together, parents, teachers, and the optometrist can help the child potentially gain functional binocularity and/or the maximum use of his vision, increasing the child's potential for success in school and for the future.

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# AMBLYOPIA

## *What is amblyopia?*

Amblyopia is a condition where the best visual acuity is below normal in one or both eyes in the absence of any apparent structural anomalies or ocular disease. In this condition, visual acuity cannot be immediately normalized with spectacles or contact lenses. With amblyopia, commonly known as “lazy eye,” the loss of visual acuity may range from slightly poorer than normal (20/20) to functionally blind (20/200), or worse.

## *What causes amblyopia?*

Amblyopia is caused by form deprivation, abnormal binocular interaction (i.e., suppression of one eye), or both during early development (before 6-8 years of age). Such occurrences may be attributed to high uncompensated refractive conditions (especially farsightedness), constant uni-

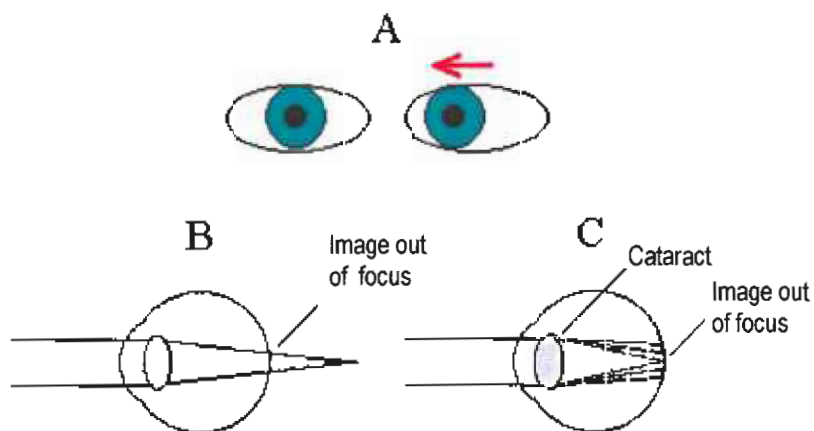
lateral strabismus (an eye turn), a congenital cataract, a corneal opacity, and/or other etiologies. Less common variants of amblyopia may be due to psychogenic or organic causes, such as high stress, malingering, or reduced visual acuity secondary to nutritional deficiencies or drugs.

While signs and symptoms of amblyopia of one eye are relatively few, because the person usually has good vision in the other eye, they may include the following:

- noticeable blur when the better eye is covered
- decreased stereopsis (depth perception)
- less efficient vision performance in certain activities, such as with sports, near eye-hand coordination tasks, and driving

If amblyopia goes untreated, the potential for good binocular function is at risk. Decreased depth perception may not only limit the

efficiency of one’s visual performance but may later contribute to an undesirable strabismus (eye turn). Uncorrected amblyopia may limit one from entering certain occupations as well. Statistics also show that individuals with amblyopia are at higher risk for losing vision in the better eye due to trauma or ocular disease.



Potential causes of amblyopia. A. Constant unilateral strabismus (eye turn). B. High uncompensated refractive conditions. C. A congenital cataract or opacity preventing a clear image from focusing on the retina.

If you suspect one has amblyopia, a complete eye examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

### ***How is amblyopia treated?***

The treatment for amblyopia depends on the specific condition responsible for its development. Generally this includes corrective lenses in conjunction with an active vision therapy program. Patching the better eye (occlusion therapy) is also often prescribed but requires good compliance. For patients who are unwilling to comply with occlusion therapy, eye drops can be used to encourage the amblyopic eye to improve. In addition, for protection of the better eye, polycarbonate lenses are prescribed to be worn full time. Amblyopia treatment is very successful in young children and for some people it can be effective into adulthood. The length of the treatment period increases significantly, however, the longer the condition has existed prior to therapy.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance with the child by encouraging the following:

- wearing prescribed lenses full time and/or other protective eye wear as indicated
- patching the eye as appropriately prescribed, if indicated
- doing any prescribed vision therapy
- being aware of precautions associated with decreased depth perception

Working together, parents, teachers, and the optometrist can help the child gain the maximum vision in the amblyopic eye and improve binocularity and depth perception, increasing the child's potential for success in school and for the future.

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# SUPPRESSION

## *What is suppression?*

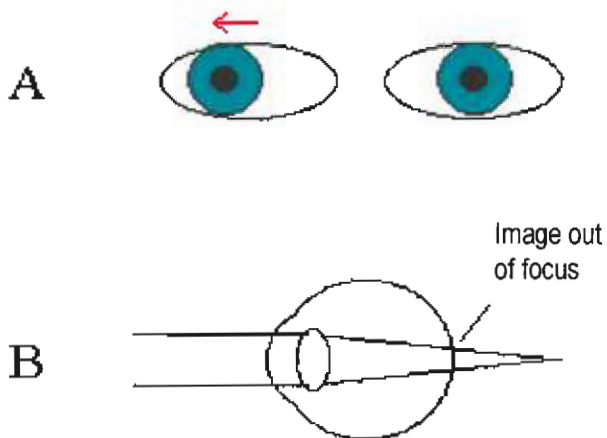
Suppression occurs when one eye does not perceive normally visible objects. It is a means of eliminating conflicting and/or confusing visual information from the two eyes, such as when seeing double. Therefore, suppression occurs only under binocular viewing conditions. Suppression is a normal process within the visual perception system and only becomes troublesome when it is abnormally prolonged or extended. Depending on the individual case, the suppressed area of vision may vary in size, frequency, and intensity. It also can present in just one eye or alternate from one to the other.

## *What causes suppression?*

Suppression is a defense mechanism of the brain to eliminate annoying percep-

tual images. These confusing images are frequently caused by a turned eye (strabismus), lazy eye (amblyopia), or a refractive condition called anisometropia. Anisometropia is where there is a significant difference in the refractive power of each eye. Amblyopia is present when the best visual acuity of an eye is reduced in the absence of any apparent structural anomalies or ocular disease. Often with amblyopia and anisometropia the image from one eye is significantly more blurry than the other. Large differences in the refractive condition between the two eyes can cause size differences in the images as well. This blur and/or unequal size of the ocular images results in the superimposition of dissimilar images, causing confusion, and thus, potentially leading to the suppression of the poorer image. Other binocular conditions causing stress in maintaining comfortable fusion of the two ocular images can also cause suppression.

Suppression is not always obvious to the individual. Often patients come to an awareness of the suppression during testing or indirectly, due to a noticed decrease in depth perception. Because the person experiences a continuity of visual space similar to those with normal binocular vision, one suppressing vision in an eye may be asymptomatic.



Potential causes of suppression. A. Strabismus (eye turn). B. Abnormally high refractive condition in only one eye (causing amblyopia and/or resulting from anisometropia—see text).

If suppression goes untreated, the potential for good binocular function is at risk. Decreased depth perception may not only limit the efficiency of the child's visual performance, but may contribute, if not already present, to an undesirable strabismus (eye turn). Statistics also have shown that individuals with suppression associated with amblyopia are at a higher risk for losing vision in the better eye due to trauma or ocular disease. Untreated suppression with its associated conditions may prevent one from entering certain occupations as well.

If you suspect one is suppressing vision in an eye, a complete vision examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

#### ***How is suppression treated?***

Suppression is treated by first addressing the underlying cause responsible for its development. This treatment often will include compensatory lenses in conjunction with a vision therapy program designed to increase binocular function and visual performance. Antisuppression training incorporated in this therapy may take a more

passive or active approach, depending on the patient's level of suppression. A typical form of passive training is a regimen of patching or occluding one eye. An active approach generally involves instruments, targets, and antisuppression techniques.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance of the child by encouraging the following:

- wearing any prescribed lenses
- patching the eye as appropriately prescribed, if indicated
- doing any prescribed vision therapy

Working together, parents, teachers, and the optometrist can help the child improve his or her visual performance by overcoming suppression and strengthening binocularity and depth perception, thus increasing the child's potential for success in school and for the future.

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# OCULOMOTOR DYSFUNCTION

## *What is oculomotor dysfunction?*

Oculomotor dysfunction is the condition where the quality of eye movements is poor. It involves deficiencies in one or more of the following areas: fixation maintenance, saccades, and/or pursuit eye movements.

- Fixation maintenance is the ability to fixate on a target, maintaining a steady position of focus. This allows one to direct special attention on a given point of interest, such as a word or picture in a book.
- Saccades refer to the eye movements that carry the eye quickly from one point of interest to another. This skill is especially important in reading.



Oculomotor dysfunction often affects one's reading ability, as well as one's visual performance in many other activities, including sports. A lens prescription, when indicated, in conjunction with a vision therapy program specific to the child's needs can help one gain the visual skills necessary to reach his or her potential.

- Pursuit eye movements allow the eyes to smoothly track a moving target. This ability is valuable in many ways, especially in sports, games, and other activities.

## *What causes oculomotor dysfunction?*

In most cases oculomotor dysfunction is a functional disorder with no significant underlying pathology. Deficiencies in fixation, saccades, and/or pursuits may be caused by poor visual acuity, fatigue, lack of attention or motivation, emotional stress, drug effects, hyperkinesia (excessive muscular movement, as with a spasm), or perhaps the skills were never learned adequately during development. Often oculomotor dysfunction is associated with left-right confusion and with delay in some aspects of visual perceptual development as well. Oculomotor dysfunction must always be differentiated, however, from other

causes associated with more serious etiologies. These may involve lesions in the neurological pathways to the brain, vascular disease, or tumors. Deficiencies in such cases are typically more dramatic and are accompanied by other signs of disease as well.

Signs and symptoms of oculomotor dysfunction may include the following:

- inefficiency and/or poor comprehension in reading
- omission of words
- skipping lines
- frequent loss of place

- finger reading
- head movement when reading
- short attention span
- problems in sports

If oculomotor dysfunction goes untreated, there is a greater risk that reading and performance in other visual tasks will be compromised. This may not only affect the child's ability to learn, but may later discourage him or her from entering certain fields or occupations requiring a lot of reading or skills involving good eye-hand coordination. Driving and other activities, such as with certain sports, may be more difficult as well.

If you suspect one has oculomotor dysfunction, a complete vision examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

#### ***How is oculomotor dysfunction treated?***

Accurate fixation, saccades, and pursuits require adequate visual acuity. The first step in treating oculomotor dysfunction, therefore, is prescribing compensatory lenses for any significant refractive condition. Plus lenses may also be beneficial

where there is an associated accommodative or binocular problem. In conjunction with the lenses, vision therapy is often prescribed. This treatment typically involves specific instruments, targets, and techniques designed to train and strengthen the deficient oculomotor skills. Generally accommodative, binocular, and perceptual techniques are also incorporated into the therapy. These skills are closely involved with oculomotor efficiency, and therefore, serve to strengthen the deficient eye movements and visual system as a whole.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance of the child by encouraging the following:

- wearing any prescribed lenses
- doing any prescribed vision therapy

Working together, parents, teachers, and the optometrist can help the child gain the efficient oculomotor skills needed, increasing the child's potential for success in school and for the future.

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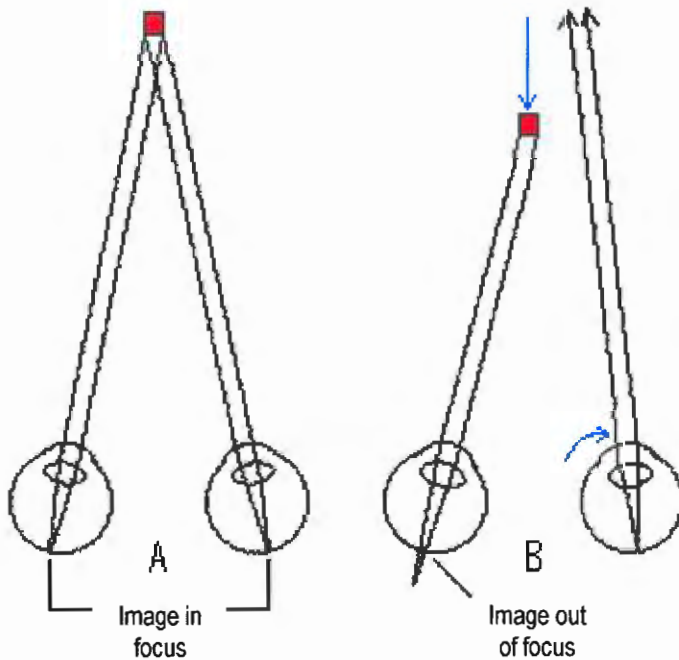
# BINOCULAR DYSFUNCTION

## *What is binocular dysfunction?*

Binocular vision is the condition where both eyes work simultaneously to provide clear, single, comfortable vision. Efficient binocular vision requires a highly integrated relationship between accommodation and vergence. Accommodation is the ability which allows one to obtain a clear focus of an object quickly and efficiently. Vergence refers to the eyes' ability to work together to align appropriately and accurately to comfortably view an object singly. Binocular dysfunction presents when one or both of these systems are not functioning efficiently and perform below expected norms.

## *What causes binocular dysfunction?*

The cause of binocular dysfunction depends on the specific area/s of deficiency. Common causes of accommodative dysfunction may be due to general fatigue, an uncompensated refractive condition, associated vergence problems, and/or normal variation in the population. Causes for vergence system dysfunctions are often less clear or uncertain. In some cases it is believed that deficiencies may arise from visual stress during development when the relationship between accommodation and vergence is fragile. Adults may develop binocular dysfunction of vision associated with prolonged and repetitive computer use. Other less common factors related to



A. Normal binocular function: appropriate alignment and focus of an object. B. Binocular dysfunction: inappropriate alignment and/or focus of an object.

binocular dysfunction may involve ocular or systemic disease, drugs, medications, and/or emotional problems.

Signs and symptoms of binocular dysfunction may include the following:

- blurred vision
- headaches
- fatigue and/or eyestrain while reading
- excessive rubbing of the eyes
- difficulty focusing
- poor reading comprehension
- avoidance of near tasks
- occasional double vision and/or noticeable eye turn
- covering one eye or turning one's head while reading

If untreated, the consequences of binocular dysfunction are determined by the specific deficiencies present and the degree to which the visual symptoms affect the patient. With school children, a loss of visual efficiency may decrease the time a child is able to read or do other near work. This may challenge his or her ability and motivation to learn, thus potentially affecting performance in school as well as other areas. In addition, a noticeable eye turn may become more apparent and be unacceptable.

If you suspect one has binocular dysfunction, a complete vision examination by an optometrist can determine any areas of deficiency and the appropriate treatment.

#### ***How is binocular dysfunction treated?***

Treatment for binocular dysfunction can be accomplished by the use of lenses, prisms, and/or vision therapy. Plus lenses and/or prism are often prescribed in the spectacles to help compensate for inefficient accommodative and/or vergence skills. Vision therapy specific to the type of dysfunction present is also effective in strengthening

accommodative and vergence deficiencies and the efficient interaction of these two closely interconnected systems.

Whatever the treatment may be, it is very important for the child to follow the instructions prescribed by the doctor of optometry. Parents and school teachers play a key role in ensuring good compliance of the child by encouraging the following:

- wearing of any prescribed lenses
- doing any prescribed vision therapy
- using good lighting
- keeping an appropriate reading distance (33 cm for children, 40 cm for adults)
- allowing additional time to complete reading and/or near tasks as needed
- rest breaks with computers and video games (1 minute break for every 15 minutes)

Working together, parents, teachers, and the optometrist can help the child gain the efficient binocular skills needed, increasing the child's potential for success in school and for the future.

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