

Care of the Patient with Accommodative and Vergence Dysfunction



American Optometric Association

A. DESCRIPTION AND CLASSIFICATION

Accommodative and vergence dysfunctions are diverse visual anomalies. They occur when the visual system is incapable of performing near vision tasks efficiently either because these tasks lack the stereoscopic cues required for accurate vergence responses or because the tasks require accurate and sustained accommodative and vergence functioning without fatigue. Most symptomatic patients have defects in more than one area of binocular vision, e.g., a patient with an accommodative dysfunction may have a secondary vergence problem and a patient with a vergence dysfunction may have a secondary accommodative problem.

- Accommodative dysfunction** interferes with the ability of the eyes to focus clearly on objects at various distances, resulting in the lack of clear retinal images.
- Vergence dysfunction** involves disjunctive eye movements in which the visual axes move toward each other (convergence) or away from each other (divergence), resulting in the inability of the eyes to accurately fixate and stabilize a retinal image.

Classifications of accommodative and vergence dysfunction, described in Tables 1 and 2, respectively, include:

1. Accommodative Dysfunctions

- Accommodative insufficiency
- Ill-sustained accommodation
- Accommodative infacility
- Paralysis of accommodation
- Spasm of accommodation

2. Vergence Dysfunctions

- Convergence insufficiency
- Divergence excess
- Basic exophoria
- Convergence excess
- Divergence insufficiency
- Basic esophoria
- Fusional vergence dysfunction
- Vertical phoria

B. RISK FACTORS

1. Accommodative Dysfunction

- Need to sustain increased accommodation for viewing targets at near
- Accommodative fatigue
- Accommodative adaptation
- Slow accommodation
- Various drugs and certain systemic diseases (e.g., diabetes mellitus, myasthenia gravis)

NOTE: This Quick Reference Guide should be used in conjunction with the Optometric Clinical Practice Guideline on Care of the Patient with Accommodative and Vergence Dysfunction (Reviewed 2001). It provides summary information and is not intended to stand alone in assisting the clinician in making patient care decisions.

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2. Vergence Dysfunction

- Alteration in visual environment (e.g., increase in near work)
 - Closed head trauma (e.g., concussion)
 - Certain systemic diseases (e.g., Graves disease, myasthenia gravis, Parkinson disease, Alzheimer disease)
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C. COMMON SIGNS, SYMPTOMS, AND COMPLICATIONS

Symptoms commonly associated with accommodative and vergence anomalies include blurred vision, headache, ocular discomfort, ocular or systemic fatigue, diplopia, motion sickness, and loss of concentration during a task performance. Signs, symptoms, and complications of accommodative and vergence dysfunction are summarized in Tables 1 and 2, respectively.

D. EARLY DETECTION AND PREVENTION

Early examination of children is important to detect and eliminate both accommodative and vergence dysfunction because these anomalies may affect future school and work performance adversely.

Early detection of accommodative dysfunction is especially important when the accommodative convergence/accommodation (AC/A) ratio is high and accommodation results in an esotropia at near. Early detection of clinically significant nonstrabismic vergence anomalies is important as some of these deviations may decompensate and become strabismic, resulting in the loss of stereopsis and the development of suppression.

E. EVALUATION

The evaluation of patients with signs and symptoms suggestive of accommodative and vergence dysfunction or patients diagnosed with these dysfunctions includes all areas of a comprehensive

adult or pediatric eye and vision examination with particular emphasis on the following areas:

1. Patient History

- Nature of presenting problem and chief complaint
 - Visual, ocular, and general health history
 - Developmental and family history
 - Medication usage and allergies
 - Vocational, educational, and avocational vision requirements
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2. Ocular Examination

- Visual acuity (distance and near)
 - Refraction
 - Ocular motility and alignment (cover testing, versions, measurement of heterophoria using Risley prisms in a phoropter, a Maddox rod, or a stereoscopic device)
 - Near point of convergence
 - Near fusional vergence amplitudes (age-appropriate testing)
 - Relative accommodation measurements (positive and negative relative accommodation)
 - Accommodative amplitude (push-up or minus lens method) and facility (± 2.00 D lenses)
 - Stereopsis (Randot or Titmus stereo tests, contour line stereograms, random dot stereograms)
 - Ocular health assessment and systemic health screening (evaluation of anterior and posterior segments of the eye and adnexa, biomicroscopy, dilated fundus examination)
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3. Supplemental Testing

- Accommodative convergence/accommodation ratio (distance-near method or gradient method)
- Fixation disparity/associated phoria
- Distance fusional vergence amplitudes
- Vergence facility
- Accommodative lag

F. MANAGEMENT

Management of the patient with accommodative or vergence dysfunction is based on interpretation and analysis of the examination results. Table 3 (adapted from Figure 5 in the Guideline) provides an overview of patient management strategies for accommodative and vergence dysfunction.

1. Basis for Treatment

The goals for treating accommodative and/or vergence dysfunction are to assist the patient to function efficiently in school performance, at work, and/or in athletic activities and to relieve ocular, physical, and psychological symptoms.

- Vision therapy – accommodative therapy to increase the amplitude, speed, accuracy, and ease of accommodative response; vergence therapy to enhance sensorimotor fusion.
- Prism therapy – horizontal prisms to eliminate symptoms of asthenopia and reduce fusional vergence demand of vergence dysfunction; vertical prisms to eliminate any vertical imbalance.
- Lens therapy – plus lenses to reduce the motor demand on either the accommodative or vergence systems.
- Surgery – to decrease the size of the deviation.

2. Available Treatment Options

- Optical correction – ophthalmic lenses, prisms (horizontal, vertical)
- Vision therapy – accommodation, vergence, and accommodative/vergence interaction
- Medical (pharmaceutical) – pharmacological agents
- Surgery – extraocular muscle surgery for strabismic and large angle non-strabismic vergence defects

3. Patient Education

The clinician should educate the patient and parents of children with accommodative and vergence dysfunction. It should be emphasized that these anomalies are neuromuscular problems, not refractive problems, and that treatment improves accommodative and vergence function.

4. Prognosis and Followup

When the patient is compliant with the prescribed treatment regimen, the prognosis for elimination of most accommodative and vergence dysfunction is excellent. Proper treatment usually results in a permanent cure.

Patients with accommodative and vergence problems who have been treated successfully should be seen twice a year for the first year, then annually thereafter. Patients for whom spectacles are prescribed to eliminate symptoms of asthenopia should be seen after they have worn their prescribed spectacles for 1 month. An additional followup visit should be scheduled 3-6 months later. The frequency and composition of followup visits for the various forms of accommodative and vergence dysfunction are summarized in Table 3.

Table 1

Clinical Classification of Accommodative Dysfunction

Type of Dysfunction	Description	Etiology	Signs and Symptoms
Accommodative insufficiency	Less AA than expected for patient's age (not due to sclerosis of the crystalline lens)	Usually idiopathic; can result from systemic medications	Asthenopia, blurred vision, difficulty reading, poor concentration, and/or headaches Decreased AA for age Failure of the +/-2.00D flipper test Decreased PRA MEM lag > +1.00 D
Ill-sustained accommodation	The AA is normal but fatigue occurs with repeated accommodative stimulation	Accommodative adaptation or slow accommodation	Blurred vision after prolonged near work, asthenopia Failure of the +/-2.00 D flipper test Decreased PRA
Accommodative infacility	Slow or difficult accommodative response to a dioptric change in stimulus	Idiopathic	Intermittent blur at distance following near work or blur at near after prolonged distance viewing Failure of the +/-2.00 D accommodative facility test monocularly and binocularly Abnormal PRA and/or NRA
Paralysis of accommodation	Rare condition in which the accommodative system fails to respond to any stimulus monocularly or binocularly	Use of cycloplegic drugs, trauma, ocular or systemic disease (e.g., Adie's pupil, neuropathy), toxicity, or poisoning Paralysis of the ciliary muscle	Blurred vision Fixed dilated pupil Decreased AA Possible micropsia
Spasm of accommodation	Ciliary muscle spasm that produces excess accommodation	Fatigue, systemic or cholinergic drugs, trauma, brain tumor, or myasthenia gravis Psychogenic factors Overstimulation of the parasympathetic nervous system	Impairment of distance vision MEM lead

Legend: AA = amplitude of accommodation; D = diopter, MEM = monocular estimate method; NRA = negative relative accommodation; PRA = positive relative accommodation

Table 2

Clinical Classification of Vergence Dysfunction

Type of Dysfunction	Description	Etiology	Signs and Symptoms
Convergence insufficiency	A deficiency of PFC relative to the demand and/or a deficiency of total convergence, as measured by the NPC	Breakdown in the accommodative-convergence relationship Genetic predisposition Closed head trauma (concussion) Systemic disease (e.g., Graves disease, myasthenia gravis)	Blurred vision, diplopia, a gritty sensation of the eyes, discomfort associated with near work, frontal headaches, pulling sensation, heavy eyelids, sleepiness, loss of concentration, nausea, dull ocular discomfort, and general fatigue. Possible decreased depth perception, motion or car sickness Receded NPC, reduced PFC at near, deficient NRA May cause nervousness, tension, and anxiety
Divergence excess	Exotropia or high exophoria at distance greater than the near deviation	Involves innervation; divergence occurs in the absence of stereoscopic cues	Closing of an eye in bright sunlight; distance blur Normal NPC, adequate PFC at near, equal vision in each eye, and normal stereopsis at near Exophoria or exotropia at far greater than the near deviation by at least 10 PD Sequelae may consist of suppression, diplopia with NRC, ARC with single vision, and panoramic viewing
Basic exophoria	Exodeviation of similar magnitude at distance and near	Typically idiopathic; possibly a patient with divergence excess who develops secondary convergence insufficiency	Asthenopia Normal NPC, adequate PFC at near, equal vision in each eye, and normal stereopsis at near Normal AC/A ratio
Convergence excess	Orthophoria or near-normal phoria at distance and esophoria at near	High AC/A ratio	Blurred vision, diplopia, headaches and difficulty concentrating on near tasks Near deviation is at least 3 PD more esophoric than the distance Low fusional divergence amplitude and PRA in relationship to near point demand
Divergence insufficiency	Esotropia or high esophoria at distance greater than the near deviation	High tonic esophoria	Diplopia or blur at distance Tonic esophoria is high when measured at distance, but less at near Low fusional divergence amplitude at distance Low AC/A ratio
Basic esophoria	Esodeviation of similar magnitude at distance and near	Tonic vergence errors which develop early in life Genetic predisposition	Symptoms occur when fusional divergence amplitudes are not large enough to compensate for the esophoria High tonic esophoria at distance and at near Normal AC/A ratio
Fusional vergence dysfunction	Reduced fusional vergence amplitudes	Idiopathic	Asthenopia, especially during vergence testing Normal phorias Normal AC/A ratio Reduced PFC and NFC ranges
Vertical phoria	Deviation in the direction of gaze that is perpendicular to the plane of fixation	May be idiopathic Muscle paresis or other mechanical cause Congenital or early-acquired fourth nerve palsy Newly acquired fourth nerve palsy due to vascular, infectious, traumatic, or neoplastic incidents	Vertical diplopia Head tilt and/or asthenopia In fourth nerve palsy, hyperphoria in primary gaze initially greatest during depression and adduction of the affected eye; over time the deviation may be larger during elevation and adduction of the affected eye

Legend: AC/A = accommodative convergence/accommodation; ARC = anomalous retinal correspondence; NPC = near point of convergence; NRA = negative relative accommodation; NRC = negative relative convergence; PD = prism diopter; PFC = positive fusional convergence

Table 3

Frequency and Composition of Evaluation and Management Visits for Accommodative or Vergence Dysfunctions

Dysfunction	Number of Evaluation Visits	Treatment Options	Prognosis	Number of Follow-up Visits (VT)	Management Plan
Accommodative insufficiency	1	Vision therapy; plus lenses	Excellent	10	Provide VT to build accommodative amplitudes and accommodative facility and/or prescribe plus lenses at near; educate patient
Ill-sustained accommodation	1	Vision therapy; plus lenses	Excellent	10	Treat with VT or plus lenses; educate patient
Accommodative infacility	1	Vision therapy; plus lenses	Excellent	10	Consider plus lenses initially; proceed with VT; educate patient
Paralysis of accommodation	1	Optical correction	Poor	—	Determine underlying cause; correct with progressive lens when necessary; educate patient
Spasm of accommodation	1-2	Plus lenses; vision therapy; cycloplegic drug	Fair	10	Begin with plus lenses and VT; if VT fails, use cycloplegic agent temporarily; educate patient
Convergence insufficiency	1	Vision therapy; prisms	Excellent	15-20	Provide VT; use prisms if patient is not able to participate in VT; educate patient
Divergence excess	2	Vision therapy; prism; minus lenses; surgery	Good	30	Provide VT including occlusion, base-in prism, and minus lenses for noncommunicative patient; surgery if VT is not successful or the deviation is too large; educate patient
Basic exophoria	1	Vision therapy; prism	Good	30	Treat near problems like CI; treat distance problems like DE; educate patient
Convergence excess	1	Plus lenses; vision therapy; prism	Excellent	15-25	Prescribe plus lens addition at near; provide VT for residual symptoms; increase plus acceptance; use prism for the nonresponsive patient; educate patient
Divergence insufficiency	1-2	Vision therapy; prism	Fair	15-25	Differentiate functional DI from acquired DI in children; refer patient for MRI if neurological; treat with VT or prismatic correction at distance; educate patient
Basic esophoria	1	Vision therapy; prism	Good	20	Provide VT; prescribe prismatic correction, if necessary; educate patient
Fusional vergence dysfunction	1	Vision therapy	Excellent	15-20	Provide VT balanced between convergence and divergence; treat abnormal accommodative system; educate patient
Vertical phoria	1-2	Prism; vision therapy	Good	20	Correct vertical deviation with prism; if vergence dysfunction, proceed with horizontal vergence VT; educate patient

Note: VT = vision therapy; MRI = magnetic resonance imaging; CI = convergence insufficiency; DE = divergence excess; DI = divergence insufficiency

*Adapted from Figure 5 in the Optometric Clinical Practice Guideline on Care of the Patient with Accommodative and Vergence Dysfunction.