
VISION CENTER
OF EXCELLENCE

ALGORITHM CARDS FOR
THE EYE CARE PROVIDER

# ASSESSMENT AND MANAGEMENT OF OCULOMOTOR DYSFUNCTIONS ASSOCIATED WITH TRAUMATIC BRAIN INJURY

# ASSESSMENT AND MANAGEMENT OF OCULOMOTOR DYSFUNCTIONS ASSOCIATED WITH TRAUMATIC BRAIN INJURY

These cards are intended to help guide the assessment, management and rehabilitation of patients with oculomotor dysfunctions associated with traumatic brain injury (TBI).

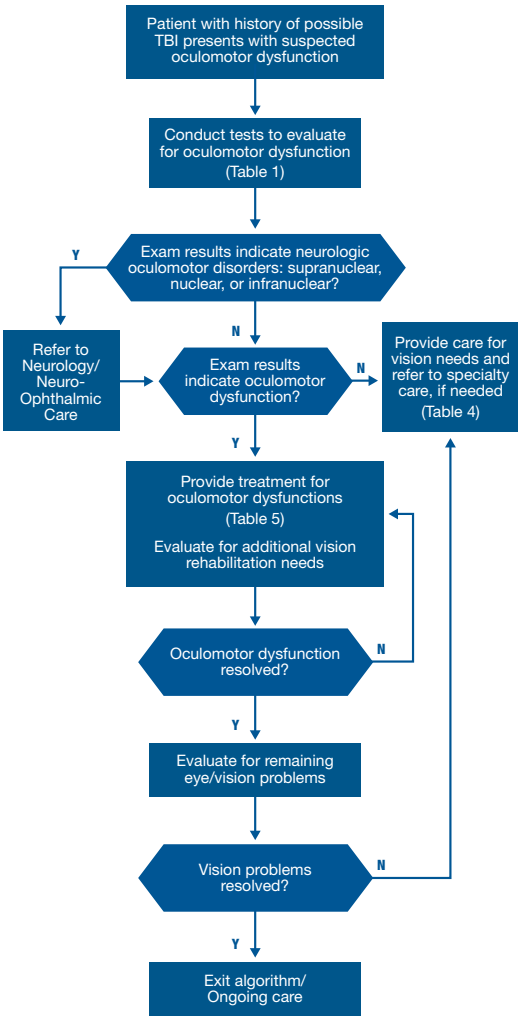


**Figure 1:** Algorithm for the Care of Oculomotor Dysfunctions Associated with Traumatic Brain Injury

**Table 1:** Recommended Tests to Evaluate for Oculomotor Dysfunctions*

| Oculomotor Parameter | Testing |
|---|---|
| Eye alignment | • *Distance and near cover test in multiple positions of gaze and head tilt*<br>• *Phorias (vertical and horizontal)*<br>• Maddox rod<br>• Modified Thorington |
| Vergence | • *Vergence ranges (vertical and horizontal)*<br>• *Vergence facility* |
| Convergence amplitude | • *Near point of convergence*<br>- Repeated measures |
| Accommodation | • *Push-up method*<br>- Repeated measures<br>• *Minus lens*<br>- Repeated measures<br>• *Accommodative facility (monocular and binocular)*<br>• *Negative relative accommodation / Positive relative accommodation (NRA/ PRA)*<br>• Near retinoscopy<br>• Accommodative convergence /<br>• accommodation (AC/A) ratio |
| Eye Movements | • *Ductions*<br>• *Versions*<br>• *Pursuit*<br>• *Saccades*<br>• Developmental eye movement (DEM)<br>• King-Devick |
| Suppression check | • *Worth 4 Dot (distance and near)*<br>• Random dot stereopsis |
| Vestibulo-ocular reflex | (if positive, refer to audiology, otolaryngology, or vestibular PT)<br>• Dynamic visual acuity<br>• Head thrust<br>• Low frequency head shake |

**Note: not all tests are required; bolded tests provide more comprehensive results as recognized by our expert panel, but selection of tests is left to the clinical judgement of the eye care provider.*

| Table 2: Treatment Strategies for Oculomotor Dysfunction |
|---|
| Correction of refractive error to improve vision, binocular alignment, and accommodative function |
| Added lenses to improve binocular alignment and accommodative function |
| When necessary, prism therapy to eliminate double vision and restore visual comfort |
| Office-based oculomotor rehabilitation (with home-reinforcement) using a variety of procedures to improve oculomotor function |
| When necessary, surgery for associated strabismus or other relevant oculomotor problems |

| Table 3: Functional Outcome Measures |
|---|
| **Improvement or normalization of clinical findings** |
| Tests of oculomotor dysfunction (**Table 1**) |
| **Improvement or normalization of symptom surveys** |
| Brain Injury Visual Symptom Survey (BIVSS) |
| Convergence Insufficiency Symptom Survey (CISS) |
| College of Optometrists in Vision Development (COVD) Quality of Life |
| National Eye Institute Visual Functioning Questionnaire (NEI-VFQ-25) and 10 item Neuro-Ophthalmic Supplement |

| Table 4: Referral to Appropriate Facility-Specific Provider |
|---|
| Audiology/Otolaryngology/Vestibular PT |
| Blind/Low Vision Rehabilitation |
| Occupational Therapy |
| Physical Therapy |
| Speech / Language Therapy |
| Neurology/Neuro-Ophthalmic Care |
| Psychology/Psychiatry/Neuro-Psychiatry |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI*

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Accommodative Insufficiency / Ill-Sustained Accommodation | Plus powered lenses | **Oculomotor rehabilitation**<br>(Follow sequential program)<br>• Phase One<br>- Gross convergence<br>- Positive fusional vergence (ramp)<br>- Monocular accommodative therapy (minus lens therapy)<br>• Phase Two<br>- Voluntary convergence<br>- Negative and positive fusional vergence (ramp)<br>- Monocular accommodative therapy (plus and minus lens therapy)<br>• Phase Three<br>- Negative and positive fusional vergence<br>- Binocular accommodative facility (plus to minus lens therapy) with speed |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Accommodative Excess | **Oculomotor rehabilitation**<br>(Follow sequential program)<br>• Phase One<br>- Negative fusional vergence (ramp)<br>- Monocular accommodative therapy (plus lens therapy)<br>• Phase Two<br>- Negative and positive fusional vergence (ramp)<br>- Monocular accommodative therapy (plus and minus lens therapy)<br>• Phase Three<br>- Negative and positive fusional vergence<br>- Binocular accommodative facility (plus to minus lens therapy) with speed | |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Accommodative Infacility | **Oculomotor rehabilitation**<br>(Follow sequential program)<br>• Phase One<br>- Gross convergence<br>- Positive fusional vergence (ramp)<br>- Monocular accommodative therapy (minus lens therapy)<br>• Phase Two<br>- Voluntary convergence<br>- Negative and positive fusional vergence (ramp)<br>- Monocular accommodative therapy (plus and minus lens therapy)<br>• Phase Three<br>- Negative and positive fusional vergence<br>- Binocular accommodative facility (plus to minus lens therapy) with speed | |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Convergence Insufficiency† | **Oculomotor rehabilitation**<br>(Follow sequential program)<br>• Phase One<br>- Gross convergence<br>- Positive fusional vergence (ramp)<br>- Monocular accommodative therapy (minus lens therapy)<br>• Phase Two<br>- Voluntary convergence<br>- Negative and positive fusional vergence (ramp)<br>- Monocular accommodative therapy (plus and minus lens therapy)<br>• Phase Three<br>- Negative and positive fusional vergence (jump vergence)<br>- Binocular accommodative facility (plus to minus lens therapy) with speed | **Prism lenses**<br>**Extraocular muscle surgery** |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Convergence Excess | Plus powered lenses | **Oculomotor rehabilitation**<br>(Follow sequential program)<br>• Phase One<br>- Negative fusional vergence (ramp)<br>- Monocular accommodative therapy (plus lens therapy)<br>• Phase Two<br>- Negative and positive fusional vergence (ramp)<br>- Monocular accommodative therapy (plus and minus lens therapy)<br>• Phase Three<br>- Negative and positive fusional vergence (jump vergence)<br>- Binocular accommodative facility (plus to minus lens therapy) with speed<br>**Prism lenses** |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Fusional Vergence Dysfunction | **Oculomotor rehabilitation**<br>(Follow sequential program)<br>• Phase One<br>- Negative fusional vergence (ramp)<br>- Monocular accommodative therapy (plus lens therapy)<br>• Phase Two<br>- Negative and positive fusional vergence (ramp)<br>- Monocular accommodative therapy (plus and minus lens therapy)<br>• Phase Three<br>- Negative and positive fusional vergence (jump vergence)<br>- Binocular accommodative facility (plus to minus lens therapy) with speed<br>**Prism lenses** | |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Divergence Insufficiency | Prism lenses | Oculomotor rehabilitation<br>(Follow sequential program)<br>• Follow therapy for convergence excess<br>• After completing convergence excess program, perform vergence therapy at intermediate distances<br>• Perform vergence therapy at distance<br>Extraocular muscle surgery |
| Divergence Excess / Basic Exophoria | Oculomotor rehabilitation<br>(Follow sequential program)<br>• Follow therapy for convergence insufficiency<br>• After completing convergence insufficiency program perform therapy at intermediate distances<br>• Perform therapy at distance | Extraocular muscle surgery |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Basic Esophoria | Prism lenses | Oculomotor rehabilitation<br>(Follow sequential program)<br>• Follow therapy for convergence excess<br>• After completing convergence excess program<br>• perform therapy at intermediate distances<br>• Perform therapy at distance<br>Extraocular muscle surgery |
| Vertical Phoria | Oculomotor rehabilitation and prism lenses<br>• Horizontal fusional vergence therapy<br>• Vertical vergence therapy | Extraocular muscle surgery |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Saccadic Dysfunction | **Oculomotor rehabilitation**<br>(Follow sequential program)<br>• Phase 1<br>- Gross saccade and pursuit therapy<br>- Positive and negative fusional vergence (ramp)<br>- Monocular accommodative therapy<br>• Phase 2<br>- Fine saccade and pursuit therapy<br>- Positive and negative fusional vergence (jump)<br>• Phase 3<br>- Saccade and pursuit movements with vergence and accommodative changes | |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| Cranial Nerve (CN) III Palsy | • Diplopia relief while waiting for resolution<br>- Occlusion<br>- Fresnel prism<br>• Ptosis crutch<br>• Near addition to compensate for loss of accommodation | Extraocular muscle surgery |
| CN IV Palsy | • Fresnel prism<br>• Multiple pairs of glasses (distance and near, not bifocal)<br>• Base down yoked prism near lenses<br>• Reading stands<br>• Sector occlusion and/or full field occlusion<br>• Compensatory head position<br>• Have patient scan ahead, instead of down when walking<br>*Prisms likely ineffective for patients with significant torsion* | Oculomotor rehabilitation<br>• Horizontal fusional vergence therapy<br>• Vertical vergence therapy<br>Extraocular muscle surgery |

**Table 5:** Treatment Options for Common Oculomotor Dysfunctions Associated with TBI* (cont'd.)

| Condition | Primary Treatment | Secondary Treatment |
|---|---|---|
| CN VI Palsy | • Patching for diplopia relief (complete or sector)<br>• Fresnel prism (complete or sector)<br>• Compensatory head posture | **Oculomotor rehabilitation**<br>• Horizontal fusional vergence therapy<br>• Vertical vergence therapy<br>**Medications**<br>**Extraocular muscle surgery** |

**Adapted from Scheiman, M. (2011). Understanding and managing vision disorders after traumatic brain injury: A guide for military optometrists. Office of the Surgeon General. Washington, DC.*

*†For these conditions and conditions like it (such as strabismus, nystagmus, myokymia), medical intervention and/or extraocular muscle surgery may be indicated in addition to conventional treatments and therapies.*

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