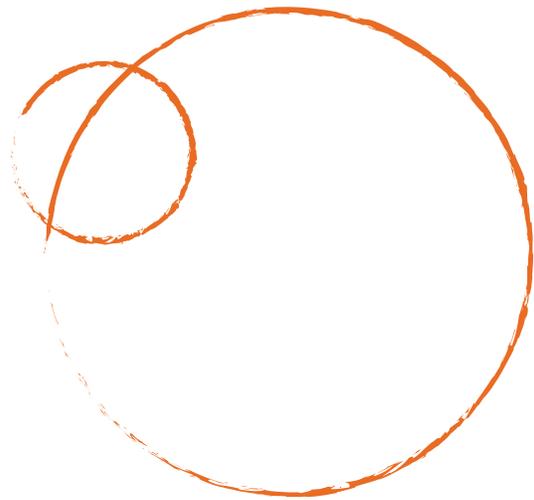


# Fact Sheet

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## Optic Neuritis

# ON



**Optic neuritis (ON)** is an inflammatory demyelinating condition of the central nervous system that results in the loss of vision and is associated with eye pain, loss of color vision and visual field deficits. While ON can occur in isolation, it is often part of Multiple Sclerosis (MS), Acute Disseminated Encephalomyelitis (ADEM) or Neuromyelitis Optica Spectrum Disorder (NMOSD). ON can be the presenting feature of MS (15-20% of the time) and occurs in 50% percent of those diagnosed with MS at some point during their illness. ON is typically monocular (affecting one eye), though it can also affect both eyes sequentially or simultaneously. Bilateral ON tends to be more common in children younger than 15 years old.

The most common cause of ON is inflammatory demyelination of the optic nerve. The pathology (similar to that of acute MS) involves plaques in the brain, with perivascular cuffing, edema in the myelinated nerve sheaths, and myelin breakdown. Similar to MS, a genetic susceptibility for ON is suspected, and it is believed that the demyelination in ON is immune-mediated. However, the specific mechanism and target antigen(s) are unknown.





## Epidemiology

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ON is a rare condition. US studies estimate the annual incidence to be 6.4 per 100,000 in population. The occurrence of ON tends to be the highest in populations located in higher latitudes (in the northern US and Western Europe), and is the lowest in regions closer to the equator. ON is more common in women (predominance ratio of 3:1), and develops in most patients between the ages of 20 and 45. Additionally, ON typically occurs more frequently in Caucasians than African Americans. It has been reported that whites with northern European descent develop ON eight times more frequently than blacks and Asians.



## Signs and Symptoms

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The classic symptoms of acute ON consist of unilateral loss of vision (in 70 percent of individuals), periocular pain, and dyschromatopsia (color blindness or color vision deficiency). This typically comes on over the course of a few days and peaks within one to two weeks. ON usually begins with decreased vision in one eye. Approximately 90 percent of diagnosed individuals also experience pain behind the eye which is usually exacerbated by eye movement. Visual loss can vary from mild reduction and minor blurring to no perception of light. Symptoms tend to exacerbate with increased body temperature. Other common signs and symptoms of acute ON include: visual field defects, swelling of the optic nerve, photopsias (the presence of perceived flashes of light), and an afferent pupillary defect always occurs in ON if the other eye is uninvolved.

Another key aspect of ON is that vision and eye pain usually improve within 2 to 3 weeks after the onset of symptoms. More than 90 percent of individuals experience visual improvement within this timeframe regardless of treatment. Should symptoms persist for longer than 3 weeks, it suggests that it is either an atypical type of ON or is a different diagnosis.



## Diagnosis

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Generally, a clinical diagnosis of ON is based on the history and examination findings. Though demyelination is its most common identifiable cause, many other causes of optic neuropathy may resemble ON, and misdiagnosis is not uncommon. Diagnostic testing is typically directed toward excluding other causes of visual loss in atypical cases, and assessing the risk of subsequent MS. An early evaluation is essential to ensuring visual recovery has begun and to reconsider the diagnosis if it has not.

As mentioned, in typical cases of ON, visual improvement occurs within 2 to 3 weeks regardless of treatment. Thus, in typical cases, which show no additional clinical signs and symptoms of a systemic disease, the value of diagnostic testing is fairly low. However, if there are atypical signs and symptoms (i.e., bilateral presentation, younger than 15 years old, or possible infection) suggesting an alternative diagnosis, a complete assessment should be undertaken.



## ... Diagnosis

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MRI is used to take images of the brain and orbits to confirm the diagnosis of ON. However, the real value of MRI in typical ON is not to image the optic nerves, but rather to image the brain as a prognostic indicator for the future development of MS. Often the brain MRI shows white matter abnormalities, or lesions, which are characteristic of MS – ovoid, periventricular, and larger than 3 mm lesions which indicate a higher risk of developing MS.

Lumbar puncture is usually not considered an essential diagnostic test in ON, but should be considered in atypical cases. Approximately 60 to 80 percent of ON diagnoses show nonspecific abnormalities in cerebrospinal fluid (CSF). Additionally, 56 to 69 percent of individuals also show oligoclonal bands (OCB) in their CSF, which implies a higher risk of developing MS. However, since OCB is closely associated with white matter lesions seen in MRI, the presence of OCB is not of high prognostic importance.

Finally, optical coherence tomography (OCT) is also commonly used to detect ON. OCT measures the thickness in the retinal nerve fiber layer and detects thinning in 85 percent of patients with ON. While lower values correlate with impaired visual outcome, its usefulness as a prognostic tool is limited due to the fact that abnormal values do not show up until early swelling disappears. OCT is also important as a number of studies have found that a greater severity of optic nerve injury, seen on OCT, suggests NMOSD rather than ON associated with multiple sclerosis.

Additional diagnostic tests used to detect ON or assess the risk of other conditions include: fluorescein angiography, visual evoked response, Aquaporin-4-specific serum autoantibody, and anti-MOG antibody.



## Acute Treatments

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Corticosteroids are the most common treatment for ON. They may be given intravenously or as high dose tablets. While corticosteroids have been effective in improving short-term visual recovery, they do not seem to affect the long-term outcome. Due to the lack of long-term benefit and the risk of potential side effects (including: insomnia, weight gain, and mood alterations), the use of corticosteroids is usually not advised. However, there are specific situations where they may be used to reduce the period of impairment and are usually considered when a more rapid recovery is required (such as patients with severe bilateral visual loss or those with occupations that require normal visual acuity). Unfortunately, there are currently no acute treatments that can reverse vision loss caused by ON.



## Prognosis and Management

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Most people recover well from ON. In approximately 80 percent of individuals, vision tends to recover by itself starting within 2–3 weeks from the onset of symptoms, usually stabilizing over months and continuing to improve for up to 1 year. According to a large clinical trial (the Optic Neuritis Treatment Trial), 1 year after the initial ON



## ... Prognosis and Management

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attack, 93 percent those diagnosed with ON had a visual acuity of 20/40 and 69 percent had visual acuity of 20/20. Additionally, the severity of initial visual loss does seem to affect final visual outcome and the best predictor of visual recovery is the baseline acuity at the time of the attack. On average, visual function is worse when ON is an early presentation of MS.

Even though recurrences of ON can occur, the long-term outcome remains good. ON can recur either in the same or the contralateral eye. After ten years of follow-up in the previously mentioned Optic Neuritis Treatment Trial, 35 percent of participants experienced at least one documented recurrence. Long-term follow-up studies have shown that only two percent are left with significant visual impairment in both eyes. Not surprisingly, recurrence is more common in those who are later diagnosed with MS.

In some cases, where there is no response to steroids (either intravenous or oral), plasma exchange is considered as a therapy. Long term immunomodulation and MS therapies (interferon beta-1a and interferon beta-1b) can be used to delay the progression or onset of MS in individuals who are likely to be diagnosed as MS.



## Rehabilitation

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- Fact 01 Activity and rehabilitation are key to living optimally with a rare neuroimmune diagnosis.** Rehabilitation should be started soon after someone with a rare neuroimmune disorder is medically cleared for activity, whether one has regained some muscle strength or has shown no short-term recovery. Starting a rehabilitation program early can help mitigate some of the bone loss and muscle atrophy that occurs in the areas affected by paralysis.
- Fact 02 Endogenous stem cells in the nervous system can be activated.**<sup>1</sup> It is possible for the nervous system to repair itself many years after a demyelinating event or a non-traumatic spinal cord injury from a rare neuroimmune disorder. Our nervous system has endogenous stem cells, which are stem cells that originate from our bodies. These stem cells can repair damage in the spinal cord and brain. The stem cells in the spinal cord can only repair the damaged connections, if those connections are active, which can be accomplished through a rigorous rehabilitation program. This process is very slow, so even if immediate progress is not seen, continuing rehabilitation can re-activate connections.
- Fact 03 Activity-based restorative therapy has been shown to be successful.** The goal of activity-based restorative therapy (ABRT) is to activate the neurological levels above and below the injury. ABRT includes patterned activity, such as locomotor training and functional electrical stimulation (FES), non-patterned activity, such as strengthening and task-specific training, and sensory stimulation. Studies on ABRT have shown positive results, including increased muscle strength, improved walking speed, endurance, and symmetry, and improved standing balance.<sup>2</sup>



## ... Rehabilitation

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**Fact 04** **A rehabilitation program should include various types of activity and target multiple muscle groups.** Rare neuroimmune disorders may affect multiple muscles and functions of the body. A rehabilitation program should involve activation of multiple muscles and various types of activity (e.g., FES, weight training, cardio etc.), unless there is a medical contraindication. A rehabilitation program should always include functional goals that are important to the person enrolled in the program including walking, going up stairs, driving, etc.

<sup>1</sup> Sadowsky CL, McDonald JW. Activity based restorative therapies: concepts and applications in spinal cord injury-related neurorehabilitation. *Dev Disabil Res Rev.* 2009;15(2):112-6.

<sup>2</sup> Jones ML, Evans N, Tefertiller C et al. Activity-based therapy for recovery of walking in individuals with chronic spinal cord injury: results from a randomized clinical trial. *Arch Phys Med Rehabil.* 2014;95(12):2239-46.

**Myth 01** **All rehabilitation programs are alike.** The truth is, a good rehabilitation program should be custom designed by physicians and therapists for individuals with rare neuroimmune disorders based on level of disability and the goals individuals have for their recovery. A rehabilitation program should allow for periods of rest, accommodate for falls, changes in health, and management of neuropathic pain and fatigue symptoms after a rare neuroimmune diagnosis. Individuals diagnosed with rare neuroimmune disorders should work with their therapists and physiatrists to customize a program for them – one that they will be able to do on their own with support of family or friends.

**Myth 02** **It can be too late to start a rehabilitation program.** In fact, it is never too late to start a rehabilitation program. The repair process in the spinal cord can continue throughout life if an active and aggressive rehabilitation program is maintained. An individual can start a rehabilitation program even years after diagnosis. While it was initially thought that recovery only occurs within the first two years, this is no longer thought to be the case. It was also initially thought that a third of people with the diagnosis of Transverse Myelitis (TM) recover fully, a third partially recover, and a third don't recover at all, but this data predates a number of more aggressive treatment protocols currently used and is likely invalid. Furthermore, regardless of when it is started, a rehabilitation program can improve cardiovascular health, help build muscles, decrease atrophy, and promote bone health.

**Myth 03** **Neuropathic pain and fatigue will worsen with activity.** Fatigue can often be an issue for those with a rare neuroimmune disorder. Starting a new rehabilitation program slowly, and then escalating the activity program over time can help reduce issues with fatigue. Some people stop activity because of pain, but pain levels tend to improve the more active one becomes. Working closely with a physician to determine the best way to manage pain, whether it is orthopedic or neuropathic pain, can be beneficial for ensuring that an activity routine is maintained. Activity has been shown to decrease fatigue levels and improve mood and decrease stress levels. Fatigue can also be managed by recognizing the underlying causes, such as poor sleep, depression, medication side effects, and addressing stress levels.



## ... Rehabilitation

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**Myth 04 Activity can trigger a relapse.** While activity should not trigger a relapse, an increase in body temperature can cause recurrence of old symptoms but this is not harmful and should subside with a short rest. If this is the case, doing therapy indoors or using a cooling device can help prevent overheating. Activity may trigger a potentially dangerous condition called autonomic dysreflexia (AD). AD is not a relapse and should subside if a trigger for the AD is found.

### Rehabilitation Glossary

**Activity-based restorative therapy** Activity-based restorative therapy (ABRT) is a rehabilitation strategy that emphasizes activating the neurological levels located both above and below the injury level using different rehabilitatio techniques.

**Autonomic Dysreflexia** Autonomic Dysreflexia (AD) occurs when the involuntary nervous system abnormally overreacts to stimulation. AD is a medical emergency that can occur in those with spinal cord damage at or above the T6 level. If one experiences AD during activity, stop the activity immediately and try to identify the trigger, which can often be related to the bladder or bowel needing to be emptied.

**Functional Electrical Stimulation** Functional Electrical Stimulation (FES) is a rehabilitation strategy where electrodes placed on the skin on top of muscle send an electrical signal that activates both the muscle and the connected nerve, which then sends a signal into the spinal cord, and back to the muscle. It is important to connect this stimulation with a functional task to get the most benefit from the activity. Recovery from using FES may be slow, but tracking changes in muscle strength and sensation over months and years with a physician or trained therapist can quantify progress. An FES bike for both arms and leg muscles can be used from a seated position or in a wheelchair.

**Locomotor training** Locomotor training is one type of rehabilitation that re-teaches walking. Individuals with rare neuroimmune disorders are placed on a treadmill, with the assistance of a harness if necessary, and trained therapists move their legs in a walking pattern.

**Neuropathic Pain** Neuropathic pain is a certain type of pain that occurs when there is damage to the spinal cord. It occurs because sensory input to the brain is interrupted and incomplete, so the brain fills the gap of the missing sensory signals with unpleasant sensations, such as burning and tingling.

**Non-Patterned Therapy** Non-patterned therapy includes strengthening activities, such as lifting weights, and task specific training, which is when individuals are re-trained on how to do functional tasks.

**Patterned Therapy** Patterned therapy includes FES and locomotor training (see above).



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**Resource Library** To access up-to-date resources on rare neuroimmune disorders, which include symposium videos, newsletters, podcast recordings, published research summaries, information sheets and relevant external resources, visit our Resource Library. [srna.ngo/resources](https://srna.ngo/resources)

