Case Report

Sustained Visual Field Recovery Following Autologous Stem Cells and Exosomes Based Therapy in Recurrent Optic Neuritis – A Case Report

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ABSTRACT

A 40-year-old male had recurrent episodes of optic neuritis. Best-corrected visual acuity was evaluated, and Humphrey Visual Field analysis was done before and after treatment. Treatment consisted of three weekly cycles of intravenous platelet-rich plasma combined with exosomes, followed one week later by bilateral posterior sub-tenon, retrobulbar, and intravenous injections of blood-derived mononuclear cells. At 3 months of follow-up, Humphrey visual fields showed significant improvement. The patient reported subjective improvement in visual acuity. No further relapses occurred, and no steroid or other systemic therapy was required during the follow-up period. The combined approach of using autologous PRP, exosomes, and hematopoietic stem cell therapy may cause sustained visual field recovery in recurrent optic neuritis refractory to corticosteroids.

Keywords: Optic Neuritis, Platelet-Rich Plasma, Exosomes, Mononuclear Cells, Vision Loss, Stem Cell Therapy.

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INTRODUCTION

Optic neuritis is an inflammatory disorder of the optic nerve which can lead to acute or subacute impairment of vision in one or both eyes. Recurrent optic neuritis is characterized by repeated episodes of inflammation and consequently decreased vision, progressive visual field constriction, reduced contrast sensitivity and diminished color vision.[1] The underlying pathophysiology includes immune mediated damage to myelin sheath and axons, eventually resulting in cumulative neuronal damage and irreversible axonal loss.[2] It can occur as an isolated condition or associated with autoimmune diseases such as multiple sclerosis and neuromyelitis optica spectrum disorder (NMOSD).

High dose of intravenous corticosteroids is used to speed up the visual recovery in acute episodes. Repeated courses of steroid treatment pose a significant risk of multiple systemic side effects. Immunomodulatory agents such as azathioprine, mycophenolate mofetil, and cyclophosphamide are used as steroid sparing drugs, but irreversible optic nerve damage responds poorly to conventional therapy.[3]

Recently, there is significant research data to support the use of autologous biomolecules such as platelet-rich plasma (PRP), exosomes, and hematopoietic stem cells for retinal and optic nerve disorders.[4] PRP provides a rich source of growth factors to support neuro-regeneration and axonal repair. Exosomes deliver neurotrophic factors, stimulate cell proliferation and have neuroprotective and anti-inflammatory properties.[5] Stem cells secrete different growth factors and cytokines which support

photoreceptor survival, differentiation into retinal neural cells and formation of new intercellular connections. They also show anti-apoptotic, anti-inflammatory, immunomodulatory and angiogenic effects. The eye is known to be immune privileged and long-term immunosuppressive treatment is not needed after stem cells implantation.

We report a case of a 40-year-old male with recurrent optic neuritis who showed marked improvement in visual fields after treatment with combined regimen of PRP with exosomes and autologous blood-derived mononuclear cells. This is one of the few documented cases of steroid-resistant recurrent optic neuritis treated using autologous biologic approach.

Case Presentation

The patient is a 40-year-old male with a history of recurrent optic neuritis who presented with the complaint of decreased vision in left eye for 7 years and in right eye for last one and a half month. During this period, he had experienced recurrent episodes of optic neuritis characterized by acute, painless blurring of vision along with other signs of optic nerve dysfunction. Treatment consisted of high-dose intravenous corticosteroids (500mg to 1g/day) which caused only short-term visual recovery. The disease followed a relapsing course despite steroid therapy. There were no systemic comorbidities, and the results of his general physical and neurological examination were normal.

On presentation, best-corrected visual acuity measured with Snellen's chart was 6/6 (partial) in the right eye and 6/6 in the left eye. Near vision on N chart was N-5 in both eyes. Color vision and contrast sensitivity were also reduced. Right pupil showed relative afferent pupillary defect. Fundoscopy revealed blurring of optic disc margins in right eye and paleatrophic disc in the left eye. Visual field analysis of both eyes using a Humphrey field analyzer with program 24-2 showed severe field constriction/loss with depressed sensitivity bilaterally**(Figure 1& 2)**. Pretreatment and post-treatment visual field parameters of both eyes are given in the **Table 1.** For autoimmune diseases workup, ENA profile test was performed which was insignificant.

Table 1:*Pretreatment and post-treatment Visual field parameters.*

Pretreatment Visual Field Parameters	**Right Eye**	**Left Eye**
Visual Field Index (VFI)	45%	35%
Mean deviation (MD)	-20.44dB	-22.47dB

Post Treatment Visual Field Parameters	**Right Eye**	**Left Eye**
Visual Field Index (VFI)	59%	51%
Mean Deviation (MD)	-17.91dB	-19.66dB

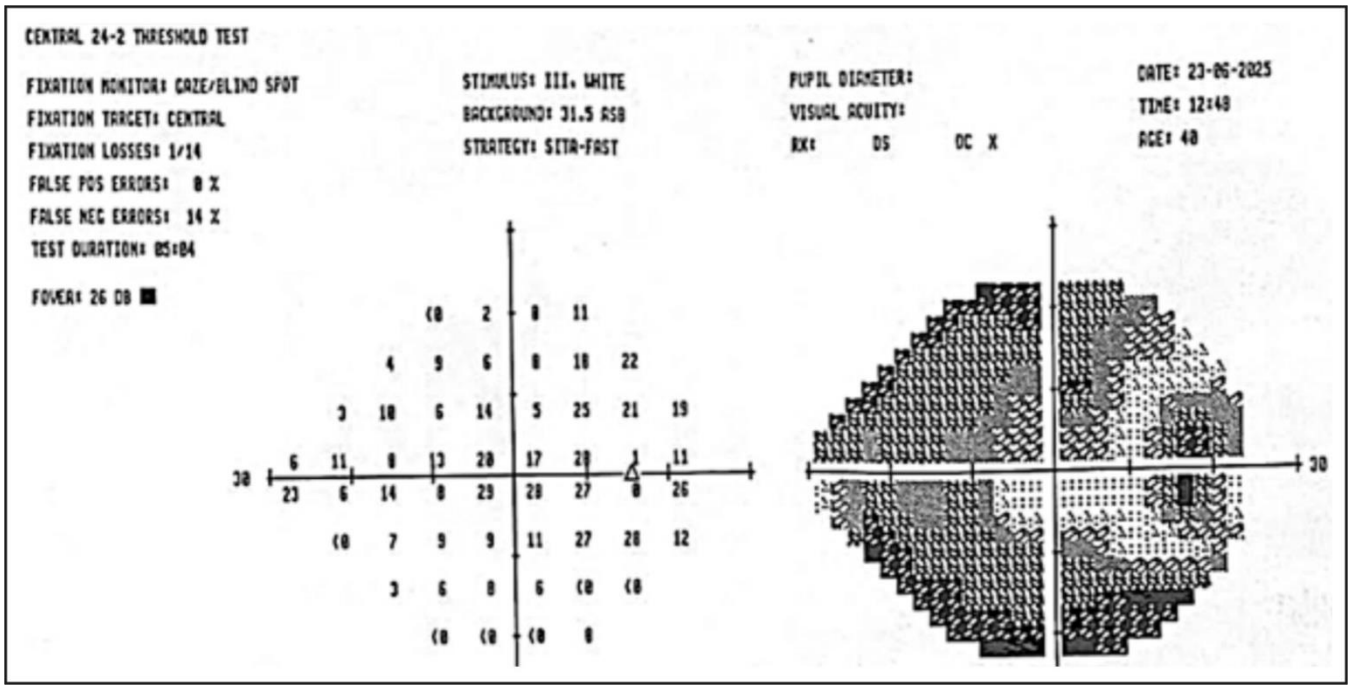

Figure 1: Pretreatment Humphrey Visual Field (24-2) of right eye.

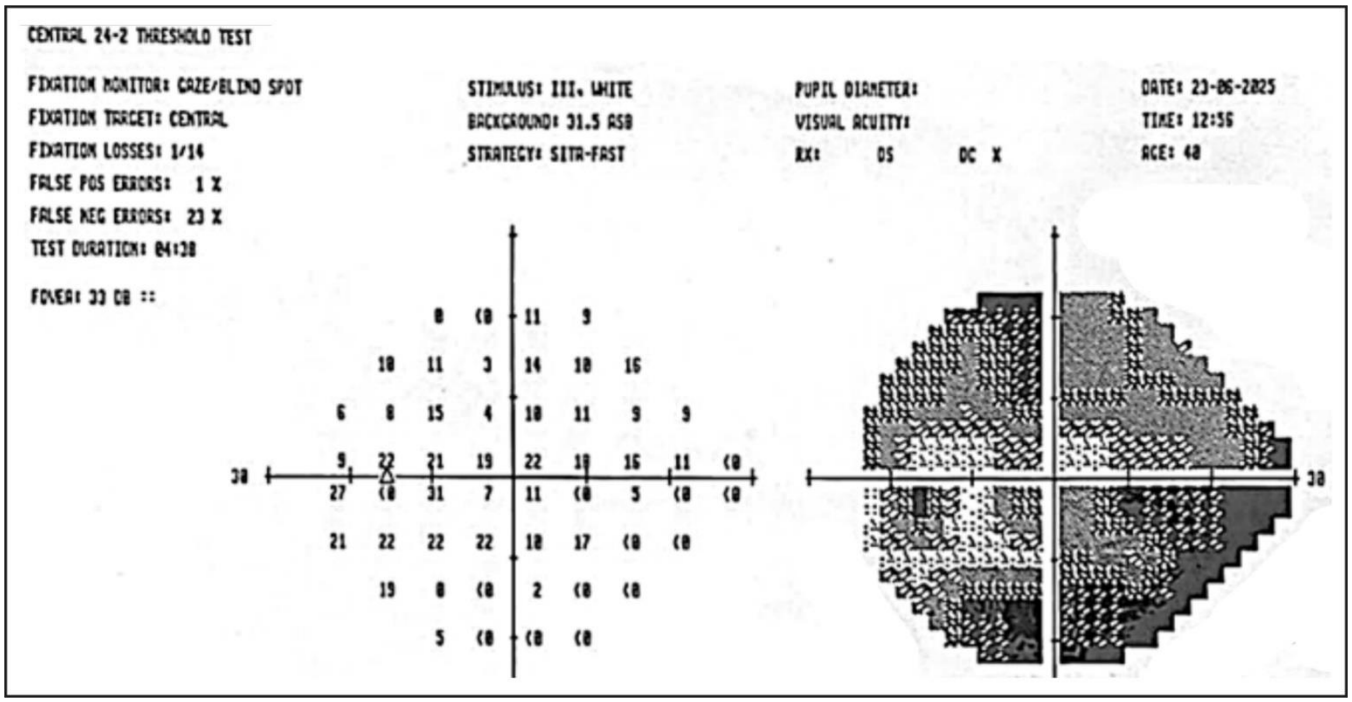

Figure 2: Pretreatment Humphrey Visual fields (24-2) of left eye.

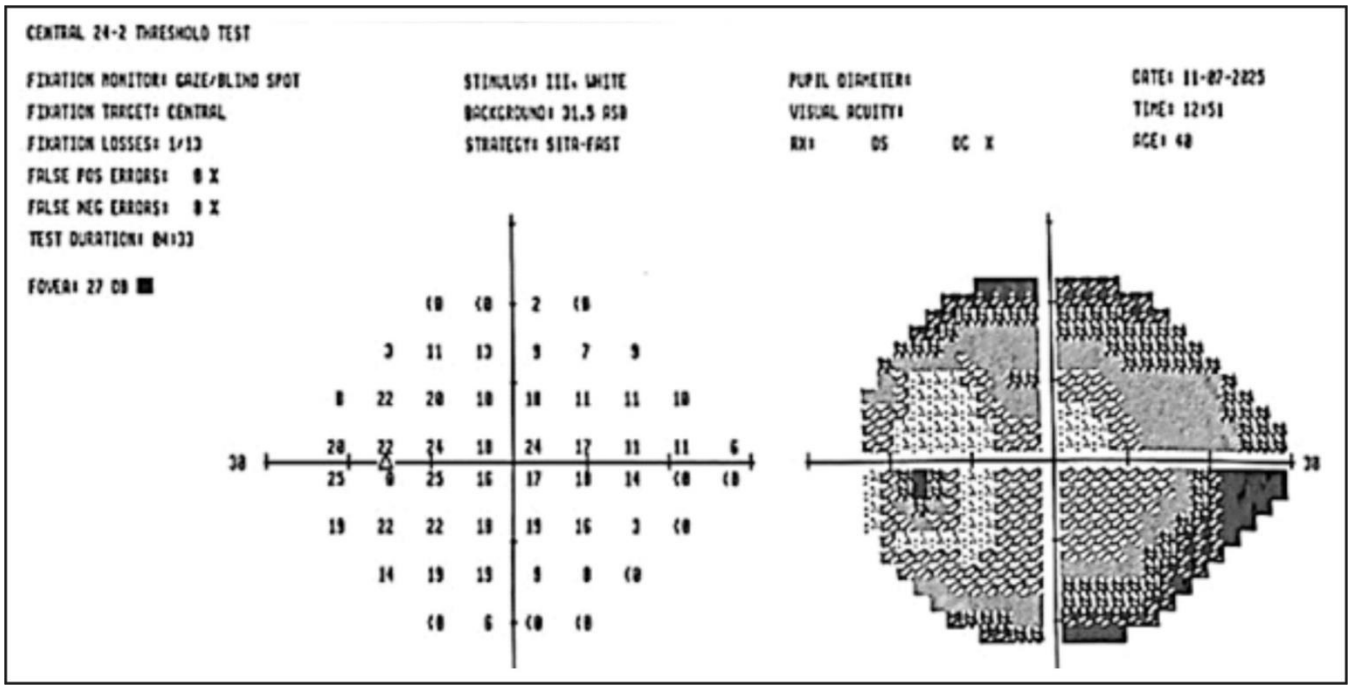

Figure 3: Post treatment Humphrey Visual Fields of right eye 24-2 (left image) and 10-2 (right image).

Due to the previous history of corticosteroid therapy with limited efficacy and multiple relapses, the patient was scheduled to undergo regenerative treatment regimen following Stem Cell Ophthalmology Treatment Study (SCOTS).Treatment consisted of three intravenous injections of platelet-rich plasma (PRP) combined with exosomes given at weekly intervals, each injection of 20 ml volume. One week after the final injection, bilateral posterior sub tenon, retro bulbar and intravenous injections of

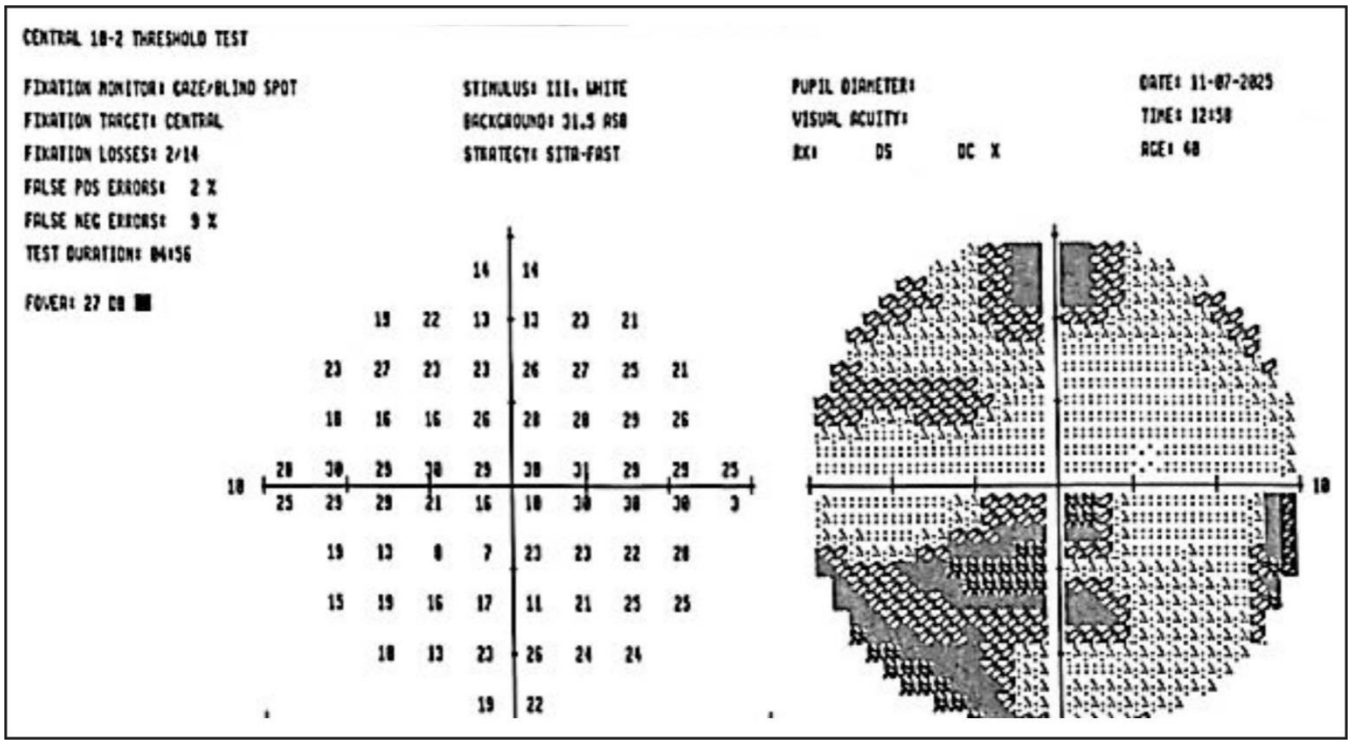

Figure 4: Post treatment Humphrey Visual Fields of left eye, 24-2 (left image) and 10-2 (right image).

autologous hematopoietic mononuclear cells were administered. Posterior sub-tenon and retro bulbar injections consisted of 2 ml volume each having about 5 to 6 million stem cells. All procedures were performed under strict aseptic measures. No complications were reported.

The patient was followed for three months after treatment. At 1 month follow-up, there was remarkable improvement in visual fields of both eyes using Humphrey visual field analysis patterns 24-2 and 10-2 shown below in **Figure 3** (Right eye) and **Figure 4** (Left eye). The patient also described significant improvement in color perception and contrast sensitivity on subjective testing. There were no more relapses, and the patient was able to maintain stable vision without the need of any corticosteroids or immunosuppressive treatment during the whole follow up period.

The stem cell therapy was completed as per protocol and no complications were reported. At three months follow-up period, visual fields of both eyes showed significant improvement. All visual field parameters including Visual Field Index and Mean Deviation values improved accordingly. The patient also reported increased sensitivity across central and paracentral visual fields.

Patient's best corrected central visual acuity remained stable at 6/6 during the follow up period. He also noted sustained improvement in color vision and enhanced contrast sensitivity. There was no need for systemic corticosteroids or immunosuppressive treatment with no relapses reported.

DISCUSSION

We present a case of a patient with history of recurrent optic neuritis which led to severe visual field depression bilaterally due to axonal loss. There was repeated inflammation despite the central visual acuity being maintained at 6/6 throughout. After treatment with high dose corticosteroids with very little to no visual recovery, he was enrolled to undergo a regenerative treatment regimen in which he was given PRP combined with exosomes and autologous hematopoietic mononuclear stem cells via intravenous, posterior sub tenon and retro bulbar route which resulted in remarkable visual fields improvement and prevention of further relapses.

Traditionally corticosteroids constitute the mainstay treatment of optic neuritis, but they do not provide long term visual improvement, as concluded in the Optic Neuritis Treatment Trial.[6]

Immunomodulatory agents such as mycophenolate mofetil and cyclophosphamide act as steroid sparing drugs and are also used to decrease the incidence of recurrences but they also do not provide complete visual recovery with high risk of serious side effects.[7]

Autologous biological molecules have significant importance in recent years as they provide neuro-regeneration, neuroprotection and immunomodulation. PRP is rich in bioactive molecules like PDGF, VEGF, and IGF-1, which provide an improved potential for neural repair by augmenting neurotrophic and proangiogenic secretions.[8] The functional recovery documented here is consistent with prior regenerative studies, such as the Stem Cell Ophthalmology Treatment Study (SCOTS), in which patients with optic neuropathies experienced significant improvements in visual function following autologous stem cell administration.[9] Notably, in this case, improvement was achieved using less invasive routes, intravenous infusion and posterior sub tenon injection, rather than intraocular or intra-optic nerve delivery, suggesting that peripheral biologic administration may still confer therapeutic benefit.

While these results are encouraging, this is a single-patient report, and larger controlled studies with longer follow-up are required to validate efficacy, durability, and safety. Nonetheless, the sustained recovery in this steroid-refractory patient suggests that autologous biologic therapies may represent a promising adjunct or alternative strategy for the management of recurrent optic neuritis.

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Conflict of Interest: Authors declared no conflict of interest.

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Authors Designation and Contribution

Huma Ali Mirza; Senior Registrar: *Literature Search, Data Acquisition, Data Analysis, Statistical Analysis.*

Muhammad Irfan Karamat; Senior Registrar: *Concepts, Design.*

Zaigham Abbas; Professor: *Concepts, Design.*

Kashif Jahangir; Associate Professor: *Manuscript Editing, Manuscript Review.*