



Case Report

Traumatic Optic Neuropathy (TON) and Ayurveda - A case study

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ABSTRACT

The vision loss in the Traumatic Optic Neuropathy is the impact of deformational forces. This occurs due to direct or indirect injuries during trauma to skull. The use of high dose corticosteroids is the primary line of treatment in such injuries still remains a matter of debate. Traumatic Optic Neuropathy is yet an unexplored topic of study in Ayurveda. The Traumatic Optic Neuropathy can be correlated with *Abhighatajanya Vataprakopaj Drishtinash*. The treatment principles of *Vataprakopaj Vyadhi* are *Snehan* (massage), *Swedan* (sudation), *Basti* (enema) and *Nasya* (oleation through nasal route). A 50 year old male patient came to outpatient department suffered from motorcycle accident and had a forehead trauma followed by loss of vision in both eyes after 5 days and diagnosed as Traumatic Optic Neuropathy. An electrophysiological assessment showed absence of waveform in Visual Evoked Potential (VEP). According to Ayurveda patient was diagnosed primarily as *Abhighatajanya Vataprakopaj Drishtinash* and started to follow the protocol of *Vataprakopaj Vyadhi*. Patient received Ayurvedic formulations in morning, after meal and at night for 12 months and a course of *Yapan Basti* (medicated decoction enema) followed by *Netratarpan* (eye satiation), *Nasya* and *Abhyanga* (body and foot massage). Patient showed an improvement in the visual quality from no perception of light to perception of light and rays in right eye in 9 month. Patient had improvement in P100 latencies of right eye in VEP report and subjective improvement in quality of vision to perceive the images and objects. Application of Ayurvedic principles and *Panchakarma* therapy resulted in improvement of the case. An early management of Traumatic Optic Neuropathy with Ayurvedic treatment can have a significant impact on the clinical/visual outcome in terms of recovery in damaged optic nerve fibers.

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1. Introduction

Traumatic Optic Neuropathy (TON) is a result of head trauma which may be moderate or severe and mostly associated with little or no evidence of head injury. Traumatic Optic Neuropathy occurs in approximately 0.5–5% of closed head injury [1] and in 2.25% of patients with maxillofacial trauma and mid face fractures [2]. Loss of consciousness is associated with TON in 20–75% of cases [3,4]. Forehead and supraorbital injuries are the main contributing factors in causing blindness in closed head injuries while temporal region injuries are less common. Younger people between 20 and 50 years of age are the major sufferers of TON in major trauma population [5]. The prevalence of severe initial visual loss ranges from about 43 to 56%. Visual loss may present with no light

perception (NLP) to 20/20 with an associated visual field defect. More severe visual loss is associated with optic canal fractures [6].

Deceleration injuries which are directed to ipsilateral forehead or mid face region from motor vehicle or bicycle accident is most common cause of TON in 17–63% cases. Among these motorcycle accidents is the most common followed by falls in 50% of cases. Assault, gunshot wound, falling objects, skateboarding and minor head injuries are the other causes of TON. The other iatrogenic causes are endoscopic sinus surgery or orbital surgery [7].

The treatment options are limited to the use of corticosteroids with variable doses, optic nerve decompression surgery, use of both corticosteroids as well as surgery or observation only without treatment [8]. Data regarding the randomized clinical trial for TON is deficient. The use of corticosteroids and optic nerve decompression does not shown any visual benefit instead add up to the risk in patients of TON [9]. A case series published recently showed a noticeable effect in visual outcome with intravenous erythropoietin in indirect TON [10]. The visual prognosis in cases of TON is

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mostly depend upon the time lost between trauma and treatment. So it is important for the patient to seek medical treatment at earliest in such cases [11].

Ayurveda is a traditional Indian system of medicine with holistic approach towards health and having a strong philosophical and empirical base. However, the role of Ayurveda always remained limited to chronic illness and lifestyle disorders in society. The subtle principles of Ayurveda certainly have potential in managing ophthalmic disorders. There are some clinical trials that evaluated the role of internal medication and local therapy for improvement of lost retinal sensitivity or delay in progression of neuropathy demonstrated in glaucoma [12,13]. TON is yet an unexplored topic of study in Ayurveda. According to Ayurveda, TON can be correlated with *Abhighatajanya Vataprakopaj Drishtinash*.

A case discussed here is of a patient, who met with road accident and as a result developed anterior visual pathway defect leading to secondary optic atrophy in both eyes. A thorough clinical history was taken according to Ayurvedic perspective and was diagnosed as *Abhighatajanya Vataprakopaj Drishtinash*. The treatment protocol for *Vataprakopaj Vyadhi* (diseases occur due to *Vata* vitiation) was initiated [14]. [Sutrasthana 13/1–3]. Patient received internal Ayurvedic medication for one year and a course of *Yapana Basti*, *Netratarpan*, *Nasya* and application of medicated oil body massage during the course of treatment.

An improvement was observed in vision from no PL to perception of light and rays in right eye and VEP report which showed positive waveform in right eye and absence of waveform in the left eye. The main purpose of this case presentation is to report the impact of Ayurveda treatment with proper diagnosis in stimulating damaged nerve fibers.

1.1. Case report

A 50 years old male patient working as marketing executive visited to OPD with complaint of bilateral loss of vision since 10 days. Patient was having hypertension since 2 years and was prescribed Tab. Telmisartan 20 mg once in a day. He had a motorcycle accident on 25/06/2014. He visited to OPD for Ayurveda treatment on 10/07/2014 and was hospitalized for the same. He had closed lacerated wound on left side of forehead that was sutured during hospitalization. He had taken a course of antibiotics and analgesics for five days for CLW. Sutures were removed after 10 days and wound was healed.

2. Findings

2.1. General examination

Patient had no other major injury, no vomiting, and no unconsciousness after accident. His pulse was 80/minute and blood pressure was 130/80 mmHg. He was not having any addiction. He felt diminution of vision in both eyes from second day after accident which led to complete loss of vision after 5 days of injury.

2.2. Local examination

On local examination his both eye anterior segment was within normal limit but patient had rapid afferent pupillary pathway defect (RAPD) with sluggish pupillary reaction. There was no corneal abrasion (fluorescein test for corneal ulcer-negative) or apparent external injury noted in both eyes. Intraocular pressure of right eye was 14.6 mmHg while that of left eye was 17.3 mmHg taken with Schiottz tonometer (Riester, Germany). On mydriasis, direct ophthalmoscopy (Heine Beta 200, Germany) was conducted. Media from both eyes was clear with pale atrophic optic disc on both side.

2.3. Systemic examination

Patient was conscious and oriented about date, time and place. upon examination, his respiratory and cardiovascular system functioning was found to be normal. His *Nadi* (pulse) was *Vata Pradhan* and *Pittanubandhi*, *Jivha* (tongue) coated, *Shabda* (~speech) was normal, *Drik* (vision) - loss of vision and *Akriti* (built) was medium.

2.4. Investigations

MRI- within normal limit. Visual Evoked Potential (VEP) was showing absent waveform over both optic nerves suggestive of bilateral anterior visual pathway defect. Blood and urine profile was within normal range.

2.5. Diagnosis

Diagnosis was done on the basis of VEP report as anterior visual pathway defect leading to optic atrophy. MRI ruled out other possibilities of optic neuritis, optic nerve avulsion, optic nerve inflammation, optic nerve sheath hematoma, orbital fractures, orbital hematoma, orbital tumors and sinusitis with orbital involvement. According to Ayurveda, patient was diagnosed as *Abhighatajanya Vataprakopaj Drishtinash* and given the treatment protocol of *Vataprakopaj Vyadhi* including *Snehan* (application of medicated oil on body), *Swedan* (steam bath).

- *Dosha: Vata*
- *Dushya: Asthi, Majja*

2.6. Therapeutic intervention

Patient received internal/oral medication (Table 1) along with *Panchakarma* and thereafter local treatment (Table 2). The internal medication treatment plan was initiated on patient's first visit to the OPD (10/07/2014). The follow up observations and outcomes are summarized in Table 3.

2.7. Follow up and outcome

Shown in Table 3. Although, the VEP report of the left eye shown absent waveform after treatment the patient was able to perceive only mild light perception in left eye. There was no improvement seen in pupillary reaction (RAPD was same as the start of the treatment) and optic nerve/disc did not show any significant improvement but patient was satisfied with the visual outcome, patient was followed up monthly (only observation without medication) in clinic and did not show any aggravation in symptoms/visual loss (Till Oct.2015). Besides the improvement in vision, patient had also experienced an improvement in quality of life with normalized *Agni* (digestive fire), *Nidra* (sleep), *Mala* and *Mutra* (urine and bowel habit) leading to improved quality of health and well-being. Further, patient had advised to get regular body massage with *Bala Taila* and foot massage with *Ghrta* and bronze pot.

3. Discussion

Traumatic Optic Neuropathy is a clinical diagnosis which usually occurs after head trauma with or without loss of consciousness, decreased visual acuity and a relative afferent pupillary pathway defect (RAPD). Indirect posterior optic nerve injuries occurring naturally are usually rarely show complete recovery. Most of the

Table 1
Internal medication- Treatment plan and rationale of formulation.

Sr. No	Formulation with doses	Anupana (~compliant)	Time of administration	Rationale of formulation
1	Vasanta Kusumakar (125 mg), Roupayatapyadi Louha (250 mg), Vidari Churna (250 mg)	Jeevanthyadi Ghrita 10 ml.	Pratah Kala (morning)	Santarpan (nourishment of tissue) and Rasayan (rejuvenation)
2	Sitopaladi Churna (250 mg), Brihat Vata Chintamani (125 mg), Saptamrit Roupya (250 mg), Mahayogaraj Guggulu (125 mg), Punarnava Churna (250 mg)	Pathyadi Kwath (20 ml).	Vyanodan Kala (after meal- afternoon & evening)	Vata pacifying, Deepan, Pachan (stimulate and enhance the digestive fire)
3	Triphala (250 mg), Yashtimadhu Churna (125 mg), Saptamrit Louha (250 mg)	Jeevanyadi Ghrita 10 ml	Nishakala (at night before sleep)	Chakshyushya (beneficial for sense organ)
4	Shatapaki Bala Taila (5 ml)	Mudga Yusha (soup of green gram)	Nishakala (at night before sleep)	Chakshyushya and Vata pacifying

Panchakarma therapy was started simultaneously after 15 days of first visit. The details of Panchakarma therapy given as below:

Table 2
Details of Panchakarma and local therapy.

Sr. No	Procedure administered	Medication used	Timings
1	Abhyanga (~whole body massage)	Bala Taila	Daily before bath
2	Swedan (~Sudation)	Steam/sudation therapy of whole body in wooden box	During Yoga Basti administration daily for 8 days Duration- Till the sweating starts on forehead
3	Yoga Basti (3 sittings of Yapana Basti and 5 sittings of Anuvasan Basti)	Baladi Yapana (960 ml), Yashtisiddha Taila Anuvasan (120 ml)	Anuvasan Basti was administered on 1st, 2nd, 4th, 6th and 8th day while Yapana Basti administered on 3rd, 5th, 7th day. (Basti treatment started after 15 days of 1st visit)
4	Netratarpan (eye satiation)	Jeevanyadi Ghrita (10 ml in each eye)	Daily in evening for 15 days after Basti treatment Duration- 15 min (1000 Matra)
5	Nasya (oleation through nasal route)	Shatapaki Bala Taila [2 drops (1 ml) in each nostril- Pratimarsh Nasya]	After Netratarpan daily in morning for one month and thereafter thrice in a week for next 6 month.
6	Padabhyanga (foot massage)	Jeevanyadi Ghrita by Kansya Vati (bronze metal pot) from heel to toe	Daily at night for 10 min

Patient continued oral medication and application of Bala Taila whole body massage for further 6 month.

Table 3
Follow up & Treatment outcomes.

Timeline	Treatment	Outcome
10/07/2014	Internal medication. Patient not taken any other medication	VEP report showed absent waveform over both optic nerve
26/07/2014	Internal medication followed by Basti treatment	Patient was able to see light perception in right eye
11/08/2014	Internal medication along with Basti treatment	Improvement in light perception in right eye
13/10/2014	Internal medication and completed treatment of Basti followed by Netratarpan and Nasya along with Padabhyanga	Along with light perception, patient was able to see projection of rays in right eye
11/04/2015	Internal medication	Symptomatically improvement noted in light perception and patient was able to do his own daily routine work of himself. Improvement in vision i.e.PL seen in right eye with delayed P100 latencies in VEP report of right eye.
15/07/2015	Internal medication	Vision stable with light perception of right eye and patient able to identify object in bright light

Table 4
Properties and rationale of medicines used.

Medicine used	Properties
Vasanta Kusumakar	<ul style="list-style-type: none"> Drug of choice for Indriya Pradoshaj Vyadhi (diseases affecting the sense organ due to Vata vitiation). Plays vital role to cure Apatarpan (under nutrition) caused due to Vata vitiation [18]. [Part 4/Ch.83].
Roupayayukta Tapyadi Louha	<ul style="list-style-type: none"> Pacifying effect on Vata aggravated due to trauma [18]. [Part 3/Ch.48].
Vidari powder (Pueraria tuberosa Willd.)	<ul style="list-style-type: none"> Madhur Rasa and Vipaka, Sheeta Veerya and Vata-Pitta pacifying property [19]. [Guduchyadi Varga/ 180–182]. Vidari is having a synonym as Dheera (the one which assures). So it can be used in diseases where mental status of the patient needs to be taken care along with Santarpana.
Jeevanthyadi Ghrita	<ul style="list-style-type: none"> Vata pacifying Property which gives Santarpana (nourishment) to the body tissue by virtue of its action. Prasadan (nourishing effect) of Rasa and Rakta Dhatu which in turns nourishes the tissue of eyes. Chakshyushya property (beneficial for eyes as a sense organ) which also nourishes the vision through Netratarpan (eye satiation) [14]. [Uttar-tantra 13/2–3].
Sitopaladi Churna	<ul style="list-style-type: none"> Sharkarakalpa (sugar based medicine) which act as Yogavahi (carrier) for other medicines [20]. The other medicines like Brihat Vata Chintamani can be triturated with Sitopaladi Churna to increase its potency and Yogavahitva.
Brihat Vata Chintamani	<ul style="list-style-type: none"> Pacifies Vata-Pitta. Trauma to head causes Dhatukshayjanya Vata Prakopa and Brihat Vata Chintamani is useful in that condition [21].
Saptamrit Roupya	<ul style="list-style-type: none"> Combination of Haritaki (Terminalia chebula Gaertn.), Bibhitaka (Terminalia bellerica Gaertn.), Amalaki (Emblca officinalis Gaertn.), Yashtimadhu (Glycerrhiza glabra Linn.) and Roupya Bhasma (ash of silver). Saptamrit Roupya is a modified form of Saptamrit Louha in which instead of Louha Bhasma, Roupya Bhasma was used considering the involvement of optic nerve. Roupya Bhasma is

(continued on next page)

Table 4 (continued)

Medicine used	Properties
Mahayogaraj Guggulu	<ul style="list-style-type: none"> effective on urinary system, nervous system and pacifies Vata [18]. [Part 1/Ch.11]. It is a combination of multiple Bhasma which is useful in Vata vitiated diseases [18]. [Part 4/Ch.75] especially Saam Vata condition and vitiated Rasadi Dhatu.
Punarnava powder (Boerhavia diffusa)	<ul style="list-style-type: none"> Anti-inflammatory property, Netrya (beneficial for eyes) [19]. [Guduchyadi Varga/232–233].
Pathyadi Kwatha	<ul style="list-style-type: none"> Shiroroga Adhikar (diseases confined to head) [22]
Triphala powder (Combination of trio Haritaki, Amalaki and Bibhitak)	<ul style="list-style-type: none"> Chakshyushya and Tridoshaghna (beneficial in pacifying all Dosha i.e. Vata, Pitta, Kapha) property [19]. [Haritakyadi Varga/42–43].
Yashtimadhu powder (Glycyrrhiza glabra L.)	<ul style="list-style-type: none"> Beneficial in Netragata Mamsadourbalya (weakness of extra ocular muscles) and Chakshyushya [18,19]. [Haritakyadi Varga/145–146].
Saptamrit Louha	<ul style="list-style-type: none"> Useful in all types of eye diseases particularly Timira which is having Dhatuposhak action (nourishes the tissue) and Shothaghna Property (anti-inflammatory action) [23].

patients develop optic atrophy in later stage [15]. In different clinical circumstances, the pathogenesis of traumatic optic neuropathy is related to the variation in extent and rate of recovery and

response to the treatment. In indirect TON, the prognosis of no recovery of visual acuity depends on a) loss of consciousness; b) presence of blood in posterior ethmoidal cells; c) absence of recovery after 48 hours of corticosteroid treatment and d) patient's age above 40 years [16]. Visual Evoked Potential (VEP) is the reliable method for assessment of visual pathway functions in severely injured patients. It is also a useful diagnostic tool in suspected bilateral optic nerve injuries. Visual recovery is difficult where VEP outcomes are not recordable. The electrophysiological assessment provides the diagnostic information for treatment selection.

Acharya Sushruta described the traumatic loss of vision in Drishtigata Vyadhi (diseases affecting vision) [17]. [Uttartantra 7/45]. Trauma and shearing forces cause vitiation of Vata Dosha. These shearing forces can cause loss of visual acuity in most of the patients of TON. So we can compare TON with Abhighatajanya Vataprakopaj Drishtinash. Although, in Ayurvedic classics this terminology was not mentioned but we can consider the correlation on the basis of etiological factors and Doshaprakopa (vitiation of Vata and other body elements) [14]. [Sutrasthana 12/64]. The aggravation and vitiation of Vata seen in trauma is capable of causing damage to the surrounding structures in orbit like optic nerve and cause irreversible damage to vision. Shearing forces exert pressure to an extent that it leads to Drishtinash (complete loss or impaired vision). The diseases due to head trauma causing vision loss are difficult to treat. Hence it can be considered that aggravation of Vata, seen in trauma on head region is capable of causing

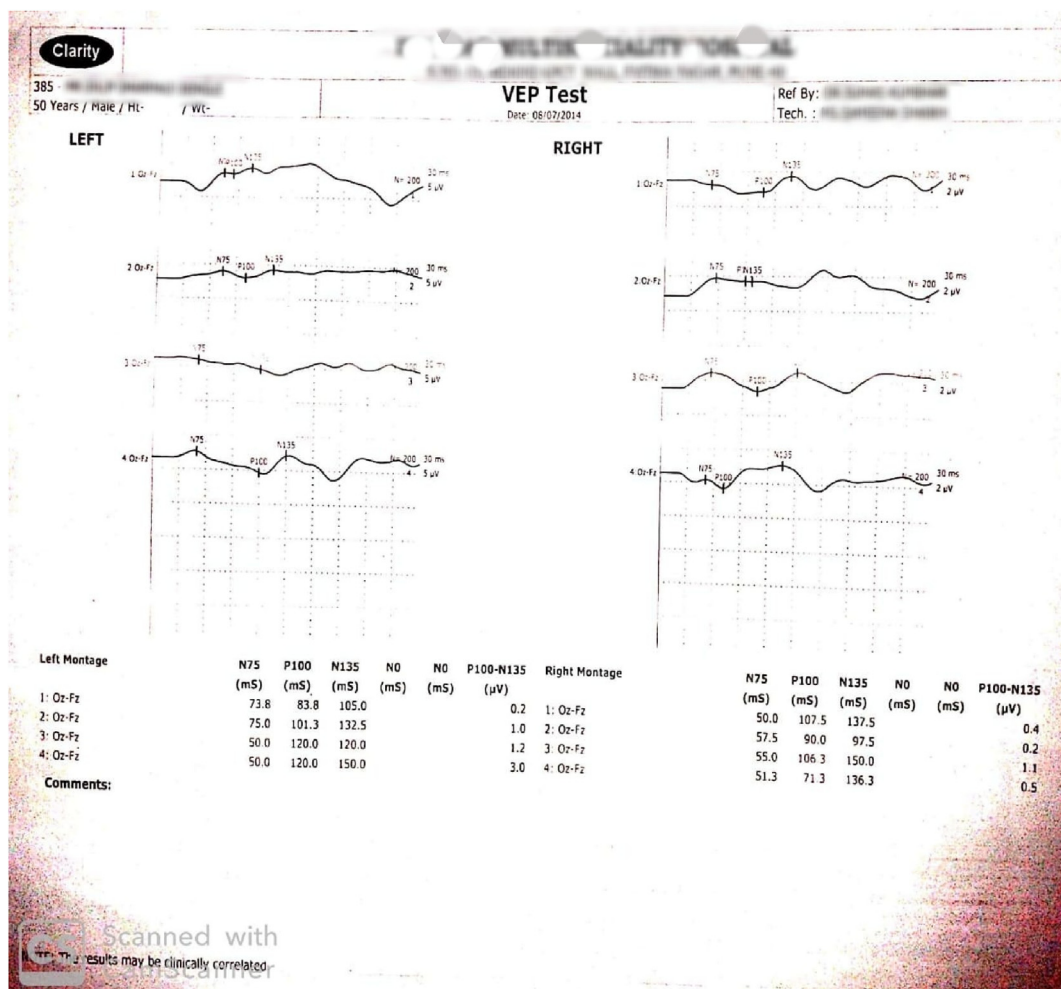


Fig. 1. Pretreatment visual evoked potential (page 1).

Drishthinash. These type of causalities can be confirmed by future studies.

The plan of treatment in this case is based on *Yuktivyapashray Chikitsa* (rational therapy i.e. pharmacological) which mainly includes the *Shaman* (palliative care) and *Shodhan* (purificatory procedure). These are important in pacifying and eliminating the vitiated *Dosha* with medicine and balancing procedures. *Shaman Chikitsa* is intended to decrease, suppress and eliminate the disease.

It pacifies and balance the body humor i.e. *Vata*, *Pitta* and *Kapha* and stops the aggravation of symptoms. *Shaman Chikitsa* is preferable when the patient is in physically or mentally unable to bear the intensity of *Shodhan* [14]. [Sutrasthana 1/24]. This patient had a head trauma and a closed lacerated wound on forehead and was not in a mental state to bear the intensity of *Shodhan* procedure like *Basti* (medicated enema). So initially counselling was done and treatment started with internal medication. The aim of the treatment in

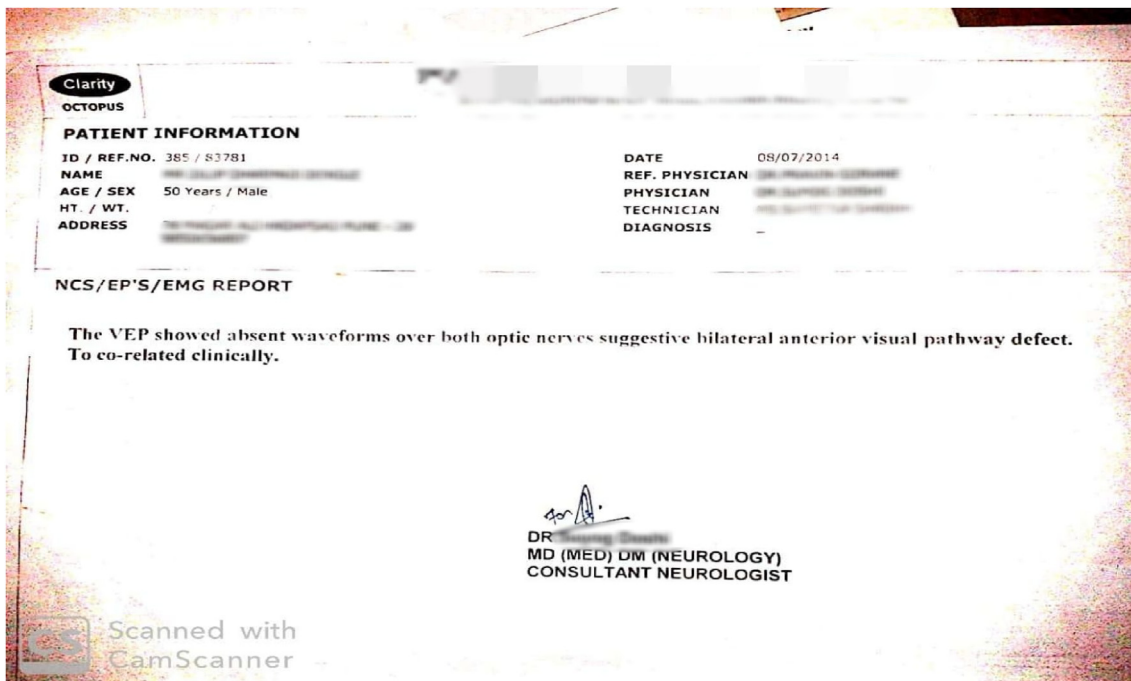


Fig. 2. Pretreatment visual evoked potential (page 2).

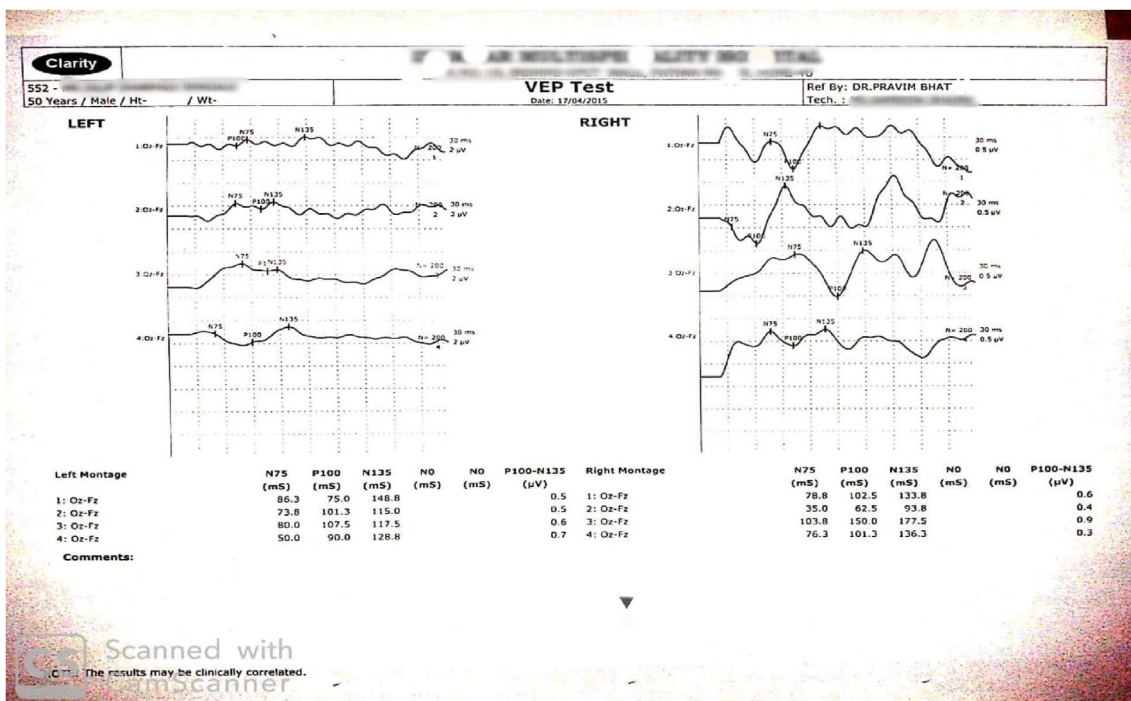


Fig. 3. Visual Evoked Potential during treatment after 9 month (page 1).

this case was not only to treat the trauma or injury but to recover the vision loss occurred due to trauma and additional concerns of optic atrophy. The rationale of treatment shown in Table 4.

The *Bhaishajya Kala* (time of administration of internal/oral medicine) plays an imperial role in treatment of a disease. The administration of medicine in *Pratah Kala* (morning) with empty stomach was prescribed as the disease condition was strong. The *Vyanodan Kala* is the time of administration of medicine after lunch (*Vyana Kala*) and after dinner (*Udana Kala*). *Vyana* and *Udana* are the types of *Vata Dosha* that play an important role in strengthening the color and normal action of tissue. *Nishakala* (night) is best to administer the medicine for the diseases above collar bone [14]. [Sutrasthana 13/37–41]. The *Chakshyushya* medicines are prescribed to administer at night time before sleeping.

Acharya Charaka has mentioned that the diseases which are confined to the bone needs *Panchakarma* [24]. *Basti* (medicated enema) is the prime *Panchakarma* treatment for *Vata* ailments [14]. [Sutrasthana 1/25]. In *Vata* predominant diseases *Niruha* or *Yapana Basti* is preferable. In present case, due to *Marmabhighata* (trauma to the vital points), *Vata* gets aggravated. Considering the physical and mental status of the patient, *Baladi Yapana Basti* was planned. It is indicated for immediate improvement in vision [14]. [Kalpatana 4/5–6]. *Basti* process bypasses the hepatic first pass metabolism and gets absorbed rectally. It stimulates the enteric nervous system and ENS having synergistic working mechanism with CNS. ENS produces the same neurotransmitters found in brain. So *Basti* may activate the concerned part of CNS with chemo or mechano receptors and give results accordingly [25].

It is important to start the local treatment like *Kriyakalpa* only after *Shodhan* Procedure [17]. [Uttartantra 18/5]. *Netratarpan* was administered after *Yoga Basti* procedure. *Kriyakalpa* procedure is administered following the *Shodhan* procedure to pacify the remaining local *Dosha*. *Netratarpan* with *Jeevantyadi Ghrita* nourishes the internal structures by virtue of its action [26]. Since

Ghrítakalpana (clarified butter processed with medicinal plants) was used for *Netratarpan*, it has a lipid soluble property. Lipid soluble substances are have better permeability in the ocular tissue. As the cell membrane contains lipids, the transportation of the drug to the target cell is facilitated by the lipophilic nature of *Ghríta*. *Jeevantyadi Ghrita* contains the drug particles in the form of suspension and hence the tissue contact time and bioavailability is more to achieve the desired therapeutic effect in *Vata Pitta* predominant eye diseases [27]. *Acharya Sushruta* advocated to use the *Tarpan Dravya* in eyes by dipping the eyelashes in it [17]. [Uttartantra 18/8]. The required quantity for this purpose comes to approximately 10 ml in each eye and it may vary with the capacity of orbit of each individual.

After *Netratarpan*, *Pratimarsha Nasya* was administered with *Shatapaki Bala Taila* which is *Indriyabodhak* (nourishes all the five sense organ). *Nasya* plays an important role in diseases confined to head [14]. [Sutrasthana 20/1]. The drug administered through the nostrils, reaches the *Shrigataka Marma*, and spreads into *Murdha* (brain), *Netra* (eyes), *Shrotra* (ear), *Kantha* (throat), *Siramukhas* (opening of vessels) and snatches the morbid vitiated *Doshas* from these region and expel them from *Uttamanga* (region above collar bone). The olfactory nerve and the adjacent nerves are connected to the limbic system of brain including hypothalamus. The stimulation of olfactory nerve causes the stimulation of certain cells of hypothalamus and amygdaloidal complex. The instilled drug over olfactory mucosa are rapidly absorbed by olfactory neurons, supporting cells and capillary bed [28].

Abhyanga (whole body massage) and *Shirobhyanga* (head massage) with *Bala Taila* and *Padabhyanga* (foot massage) with *Ghríta* nourishes the *Drishti* and having *Vata* pacifying properties. Foot massage with metal like *Kansya* (bronze pot) is useful and reported to restore the balance between the two important neurotransmitters serotonin and norepinephrine which regulate a wide variety of neuropsychological processes [29]. *Abhyanga* (whole body massage) is useful in *Drishti Prasadana* (beneficial in improving vision)


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PATIENT INFORMATION			
ID / REF.NO.	552 / 83781A	DATE	17/04/2015
NAME		REF. PHYSICIAN	DR. PRAVIM BHAT
AGE / SEX	50 Years / Male	PHYSICIAN	
HT. / WT.	/	TECHNICIAN	
ADDRESS		DIAGNOSIS	
NCS/EP'S/EMG REPORT			
The VEP showed absent waveforms over left optic nerve while there were inconsistent P-100 latencies over right optic nerve.			
Impression: This VEP is suggestive of anterior visual pathway defect of severe degree over left side along with mildly delayed latencies over right side. As compared to previous record there was mild improvement noticed over right side.			
 DR. PRAVIM BHAT MD (MED) DM (NEUROLOGY) CONSULTANT NEUROLOGIST			

Fig. 4. Visual Evoked Potential during treatment after 9 month (page 2).

and specially can be applied in head region. It mitigates *Vata Dosh* and *Jarahar* (prevents aging) [14]. [Sutrasthana 2/8–9].

A complete Ayurvedic regime with *Panchakarma* showed a good subjective and objective outcome in the case of Traumatic Optic Neuropathy (Figs. 1–4).

4. Conclusion

Presently neuroprotection is a trending topic for neurodegenerative diseases. In TON, if patient seek Ayurveda treatment at earliest, the chances of recovery of damaged nerve fiber increase. The classical Ayurveda principles along with *Panchakarma* therapy, local treatment and palliative care through Ayurveda can prevent the further damage of nerve fiber. The modern diagnostic tool like Visual Evoked potential (VEP) are useful to prove objective improvement in such cases. The subjective and objective effects observed in this case need corroboration from future studies to substantiate effectiveness of Ayurveda treatment with *Panchakarma* in Traumatic Optic Neuropathy (TON).

5. Scope for further study

Retinal Ganglion Cell death (apoptosis) is an important factor in loss of vision in ophthalmic neurodegenerative diseases. The study of Ayurveda medicines on molecular and cellular level is essential to substantiate the results obtained in clinical studies of neuro-ophthalmology. Basic understanding of biochemical mechanism in Traumatic Optic Neuropathy will give a future direction to Ayurveda clinical trials in TON.

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