Rehabilitation of Left Homonymous Hemianopia with Adjacent Palomar Prism Technique and Visual Therapy on Line

Fernando-J. Palomar-Mascaró*

Palomar Ophthalmological Centre, Spain

Abstract: We present a case of a female who suffered a right cerebral infarction, which caused left Homonymous hemianopia. She couldn't walk alone or do tasks of near vision, like reading.

We used Palomar's prisms and visual therapy online with stimulation exercises and spatial localization for his rehabilitation.

The patient was able to totally recover the central visual field in one year of treatment, being able to walk alone with the far visual aid.

Keywords: Hemianopia, low vision, prism adaptation, rehabilitation, visual field, Palomar Prisms.

Homonymous hemianopia (HH) can be defined as the complete or partial loss of vision in both eyes' right or left halves of the field of vision [1, 2].

It occurs as a result of structural pathological processes that affect retrochiasmatic visual pathways, and it can be caused by a variety of lesions such as a stroke of the posterior cerebral artery, a traumatic brain injury, tumors, and surgery [3, 4].

HH prevalence is approximately 0.8% in the general population older than 49 years, [5] with about 2 million stroke survivors in rehabilitation suffering from either HH or hemineglect in the United States annually [6, 7].

Patients who suffer from a complete homonymous hemianopic defect have a lot of difficulties in their everyday lives.

HH is a result of structural pathological processes which affect the retrochiasmatic visual pathways, the primary location being the occipital bone (55%) and the vascular the most frequent etiology (76.5%). Recuperation only occurred in 1/3 of the cases and was optimum in 10% of them.

These pathological processes sometimes affect the cognitive level of the patient (speech, understanding), causing, in some cases, a decrease in his intellectual level. The recovery of the lost visual field facilitates neuro-sensorial recovery processes, helping in the recovery process of his disability in intelligence. Consequently, a key question that needs to be addressed by the visual sciences concerns the extent to which some degree of rehabilitation or partial recovery of the lost field of vision (FoV) can be achieved [8, 9]. Specialists in visual rehabilitation for hemianopia are also interested in whether or not the acquisition of compensatory oculomotor strategies by these patients could lead to improved performance in their everyday activities [10].

Given the prevalence of hemianopia resulting from stroke and the increasing longevity of the population, research on the treatment of hemianopia must be regarded as a priority. A number of studies [11-14] have reported that prisms (usually Fresnel prisms) can be an effective treatment for HH. Palomar-Petit described how the central field could be restored by placing small prism strips onto the spectacle lenses (on the side with hemianopia) of patients [15].

We present the case of a 58-year-old female who suffered an Ischemic stroke in the territory of the right posterior cerebral artery, which caused a left HH (Figure **1**).

Although postoperative recovery was generally satisfactory, HH failed to resolve. The patient attended our ophthalmology practice complaining of severe limitations in such habitual tasks as house care, reading, or watching television, associated with a left visual field loss, which impeded her from being able to walk without assistance.

We used the adjacent Palomar prism technique for her rehabilitation, which consists of the binocular adaptation of prism bands. These are 15mm-wide strips, moved 2mm towards the heminopsic side (Figure **2**). The patient did not have central diplopia and was able to totally recover the central visual field

*Address correspondence to these authors at the Palomar Ophthalmological Centre, Spain; Tel: +34934584448; Web: http://www.centrospalomar.com; E-mail: fpalomar@centrospalomar.com

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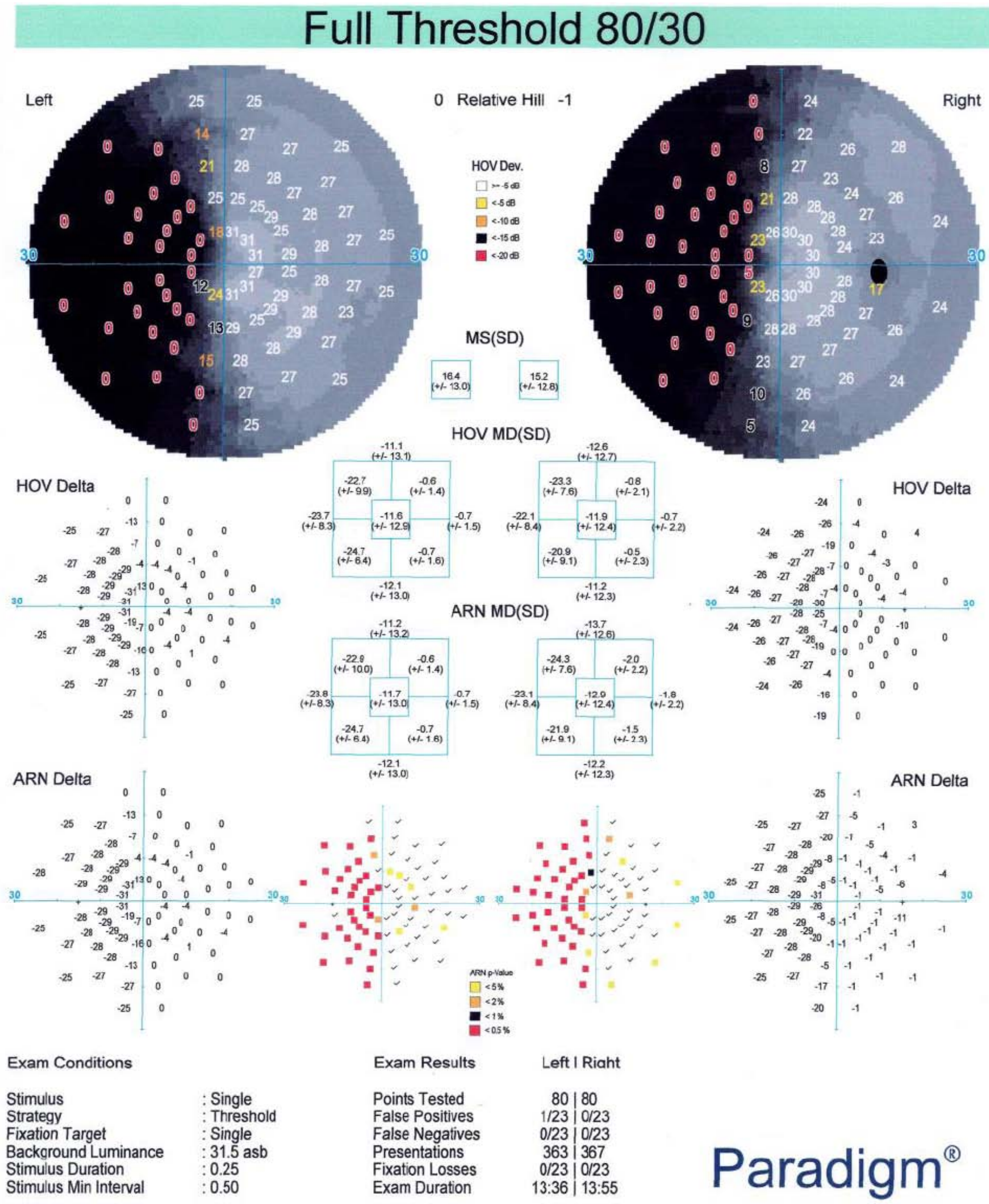


Figure 1: Dicon computerized visual field (Paradigm Medical) in this case; we can observe left HH.

without needing to do any ocular movements to see both sides of the field, being able to walk without assistance.

The patient presented with normal extrinsic and intrinsic ocular motility; neither latent nor constant ocular deviations were discovered. Slit-lamp and ophthalmoscope examinations were unremarkable.

Rehabilitation with ground-in sectorial prisms and training was considered as the best treatment option for this patient.

The adaptation of the prisms was carried out over his refraction:

RE.:+1.75, with a visual acuity of 20/20 and LE: 165º - 0.50 +1.75 with a visual acuity of 20/20,

Prismatic lens power was obtained by calculation based on the empirical formula [16].

PT = PD + 2/5 PN, where PT is total prism power, and PD and PN require prism power for distance and near vision.

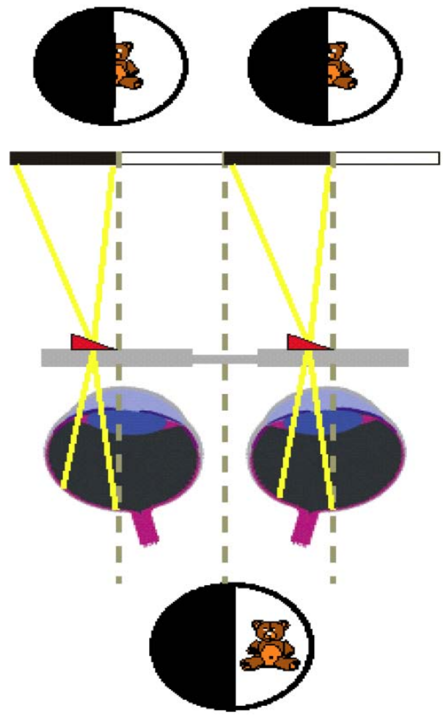
Prism power for distance and near vision were determined with the aid of our trial case prisms (Figure **3**), putting the prisms on top of his glasses with adhesive removable putty. We determined a prismatic power of 14 diopters (Figure **4**).

Figure 2: Glasses with the adjacent Palomar prisms for left HH.

Figure 3: Reduced trial case Palomar prisms with prisms of 10, 15, 25, and 30 prism dioptres.

The patient with the binocular Palomar prisms receives images from the FoV of the left and right eyes, projected onto the functional hemiretinas. Images corresponding to the FoV of the non-functional hemiretina are captured through the prisms. The visual system must reconstruct the visual space subtended for each eye, combining (merging) both reconstructed spaces. Thus, using the computerized perimeter, it is possible to assess the restored central FoV by comparing the spatial localization accuracy under both conditions executed with or without the aid of the attached prisms (Figure **5**).

a



b

Figure 4: a. Detail of the Palomar prisms on her glasses with adhesive removable putty to determine the necessary prismatic power by trial and error, in this case of left HH.

b. diagram illustrating the functioning of the attached prisms in the case of a patient with left CHH.

Two overlapping images are projected onto the patient's retina with the prism attached to the patient's glasses. One of them corresponds to the individual's usual field of registration, while the other overlaps the first due to the image displacement caused by the prisms and the corresponding visual field damage. This is why, when starting treatment, the patient reported experiencing spatial displacement in the restored half-field but did not report any diplopia or confusion as other authors indicate [17, 18].

He was prescribed exercises with games of small pieces, such as exercises of locating objects, to help the adaptation.

Further improvement in quality of life was described by the patient during the third visit. Indeed, she was

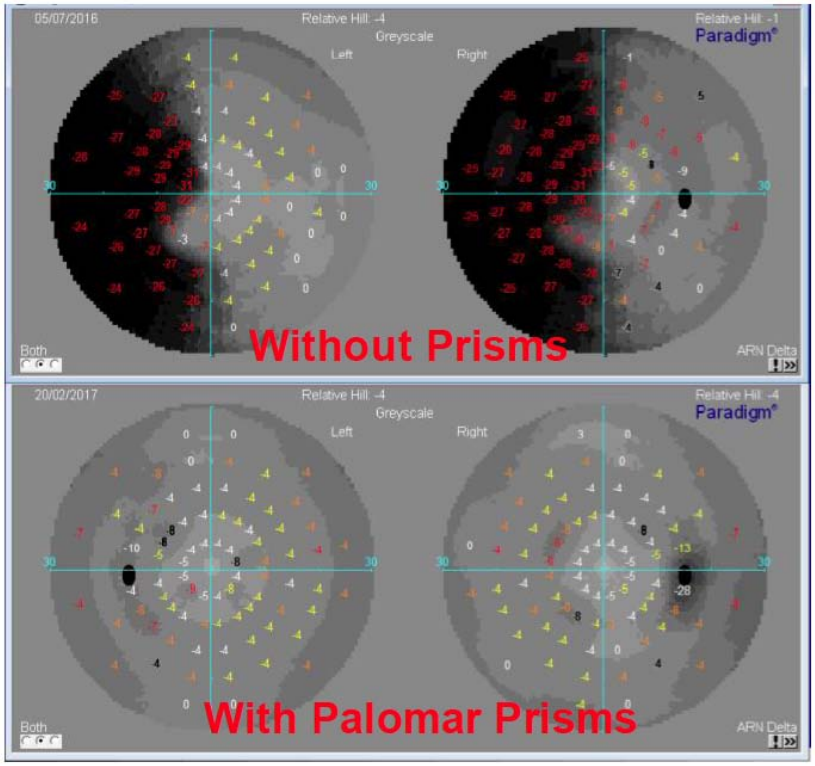


Figure 5: Visual field of the patient with and without Palomar prisms.

walking completely unassisted. She reported being able to watch television and perform near-vision tasks with less difficulty, and successfully interact with various daily life objects. Follow-up visits were scheduled every 6 months. Two years later, the patient has a relatively satisfactory quality of life with no complications with her visual aid.

Patients suffering from a complete homonymous hemianopsic defect have demonstrated to have great difficulty with spatial orientation. Therefore, although most of the time they have good visual acuity, in both far distance and near distance, they have a lot of difficulties in their everyday lives. The results obtained with the adjacent Palomar prisms are very encouraging [19].

This could be due to the fact that they provide an image of good optical quality, which allows the patient to adapt more easily.

On the other hand, we defend the point that the exact determination of prismatic power by means of trial lens sets allows us to obtain more precise and individualized values.

Complete lateral HH creates a very disabling visual incapacity, especially in people who conserve good visual acuity and only have this neurological defect. These campimetria losses notably decrease the patient's quality of life.

The present case describes the successful rehabilitation of a young patient with left HH with binocular ground-in sectorial prisms, achieved through precise prism power and location adjustment. Indeed, prism power was determined by calculation based on an empirical formula that takes into account distance and near prism requirements.

The results from this calculation, which was derived from previous clinical experience with similar cases, [20] were later refined with the aid of trial case prisms and a trial spectacle frame, allowing for accurate determination of prism location. Prism location is critical to avoid diplopia in primary gaze while allowing objects that would normally fall in the hemianopic field to be relocated to the residual field, thus becoming visible in primary gaze [21, 22].

During this time, patients are also instructed to follow a program of daily exercises online to facilitate their acceptance of the new optical device and improve spatial localization.

By means of adaptation of adjacent prisms in hemianopic patients, their quality of life is significantly improved [23].

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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