

Managing Diplopia in TBI with Fresnel Prisms and Leapfrogging

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SECTION TITLE?

There are few things that give a better feeling of helping someone than walking into a room where the patient is experiencing constant double vision or who has been given an eye patch to wear full time to get rid of their constant double vision, and walking out of the room with a solution for them that has them seeing single with both eyes open. I have yet to meet the patient who absolutely needed a full-time opaque patch. These days, it is easy to carry everything needed to perform this “miracle.” The tools needed to make this happen vary from Fresnel prisms, to Bangerter filters (spatial frequency filters which can “soften” up the scene to allow one channel to dominate), to binasal occluders (usually applied with tape to the glasses), to a spot patch if needed (often a small circular piece of surgical tape applied to the lens of one eye), or some variation of these.

Well, DR, a 77-year-old male who suffered a stroke, was just one of these patients. My then resident, Tina Esposito, OD, and I walked into his hospital room with my briefcase on July 6, 2013. DR had a patch on and said that if he took it off, he would see two of everything. He joked about having two wives now and that both were in the room. The patch made “them” tolerable. It was obvious that he was trying to make a joke, and his wife played along.

His examination that day showed a right hyper and a constant esotropia at all distances. My preferred way to measure these deviations is in free space with the patient using my face as the target. A face presents much more 3D relief and curvatures and surfaces to aid fusion than most handheld targets, which have far fewer cues to aid fusion and binocularity. This is one way of grading the degree of binocularity; getting fusion with my face but not getting it with a hand held target is one level, and getting it with both is another, better level. It also helps to get a good sense of their eye movements as they explore my face, the scene behind me, or their loved ones off to the side. I found that with 6 prism diopters of base out and 4 diopters of base down over his right eye, when he looked at my face there was a smile, and he said that he saw only one of me.

CLINICAL PEARL

Using hand-held prisms is superior to prism bars in these cases. Their larger field of view is helpful in providing your patient with the best chance of fusion, and it makes holding up these kinds of combined horizontal and vertical prisms at the same time very easy.

Once the prism was in place, we checked his range of fusion. The range we checked was not your typical base in or base out range. Rather, the ranges were how far to the right can we move until he sees double? How far to the left? How far up? How far down? So many of the cases we see in the hospital are non-concomitant. Generally, the higher the degree of non-concomitancy, the more difficult it will be to find a prism to establish binocularity over much of a range.



FIGURE 1: Patient DR in the hospital with the Fresnel prism mounted on the inside surface of his right lens.

DR was able to keep it single upwards to about 30 degrees and downwards to about 20 degrees. Once he doubled, he could switch which eye he looked with, and we found that when he looked with his right eye, the deviation was worse. We also found that

in right gaze the problem was worse. We decided to put on the compensatory prisms and to put it asymmetrically all on the right eye as we wanted him to stay left eye dominant.



FIGURE 2: This is a different patient. In this instance, we needed base in and base up. Prior to putting the prism on here, the patient was forcibly closing down his left eye and he had a constant headache. This gave him some immediate relief, and over time the left eye opened more and more.



FIGURE 3: Some cases require a spot patch of some sort. These generally have much more non-concomitancy than those with which we try compensatory prisms. In this instance, he was able to learn to look with his right eye, and if he saw double to move his head until the spot blocked the direct view of his left eye. He was much safer during his rehabilitation when learning to transfer to and from the bed and to and from his wheelchair.



FIGURE 4: Binasal occluders placed on a frame using 3M Magic Tape. These are used to decrease the area of binocular overlap and essentially let the left eye work in left space and the right eye in right space. The sizes of the binasals can be varied as needed and often are placed asymmetrically on the lenses.

OBLIQUE FUN - VECTOR ADDITION OF PRISMS

Instead of putting two different prisms, one base out and one base down, we did some intuitive vector addition, grabbed an 8 diopter prism, and rotated it to about 35 degrees. On went the lens over the right eye, and voila! he saw me single, and I could see the smile come over his face, which confirmed that indeed all was on the road to being right in DR's world. The prism was left in place for about 20 minutes while we saw another patient in the same facility, and ranges were checked again.

When we returned, we could also see that as he moved his gaze from one place in the room to another, he also adjusted his head position to almost automatically move his fixation inside the cone of binocularity. The Fresnel prism was cut and applied to the inside surface of his glasses. His occupational therapist and physical therapist were tracked down, and they were given some eye movement activities to do with him to try to expand the cone of binocularity.

Four days later on July 10, 2013, he was still in the rehab hospital. He was doing the eye stretches almost too aggressively, causing some vertical downbeat nystagmus when he would get to the extreme up and down gaze positions. We kept the prism the same and suggested that he follow up with a visit to The Eye Center (TEC) at Southern College of Optometry on his release.

On July 22, 2013, we saw DR at TEC, and determined that it was not time to decrease the prism, but we prepped DR that soon we would begin the leapfrogging technique. His vertical range within which he could see single at this time was more than double what we saw the first day at the hospital, and he could now get downward to between 45 and 50 degrees before seeing

double. One new pair was made at this visit, and this time a 6 diopter prism was used and placed also over the right eye at 35 degrees base out and base down, which effectively delivered a 25% reduction in both the horizontal and the vertical prism power.

DR was instructed to begin each day wearing the lower powered prism glasses and to “work” a bit at getting his eyes to work together. When he felt that he was trying too hard, he was to shift over to the stronger pair. Once he was wearing the weaker power all day for a few days in a row, we would be ready to leapfrog the stronger pair and make a new weaker pair.

He returned to us on September 30, 2013 and stated that the majority of the time he was now using the lower powered pair of glasses. He wasn't using the stronger pair much at all, so we tried just 2 diopters of vertical prism for a period of time. He was able to see single with some work but not too much. He sat for 10 minutes with just the reduced vertical prism on, and he liked it. We cut the prism, and this became his new “leapfrogged” weaker pair. He was instructed to use this pair as much as possible but not to feel bad going back to the 6 diopter combo base out/base down prism, which was now the “stronger pair.”

At the next session, October 28, 2013, we were able to entirely remove the vertical prism in testing. So the new “leapfrogged” weaker pair was the one that had no prisms at all! His “stronger” pair, with which he was left as a sort of safe haven if needed, was the pair with the 2 diopters of vertical prism only. DR was entering a driver retraining program, which made him very happy.

LEAP FROGGING POWERS

When	Where	Prescribed – all prism over right eye
1st visit (7/6/2013)	Hospital	8 PD Fresnel BO/BD at axis 35
2nd visit (7/10/2013)	Hospital	8 PD Fresnel BO/BD at axis 35
3rd visit (7/22/2013)	SCO-TEC	Weak – 6 PD Fresnel BO/BD at axis 35; Strong – 8 PD Fresnel BO/BD at axis 35
4th visit (9/30/2013)	SCO-TEC	Weak – 2 PD BD; Strong – 6 PD Fresnel BO/BD at axis 35
5th visit (10/28/2013)	SCO-TEC	Weak – No prism; Strong – 2 PD BD

CONCLUSION

The idea of leapfrogging his compensatory prisms over each other and using the weaker lens for as long each day as he could also helped to drive the adaptations towards a more symmetrical use of his visual process. DR diligently worked to push against the boundaries of his cone of binocularity. Goldstein, in his book, *The Organism*, talks about altering the milieu of the patient so that they avoid disordered performances. It is critical to recover lost function constantly to be, as Vygotsky called it, the zone of proximal development and push against those boundaries. Two sets of prisms were leapfrogged over one another several times in this case, leading to a full recovery of binocularity without the need for office-centered visual therapy.

REFERENCES

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