

# Innovation in Eye Care

Technology innovation is one of the key “functional arms” at LVPEI. Its core purpose is to translate innovative ideas into market-ready solutions that can create large-scale impact in Indian eye care, and across the world. However, innovation is never easy. It is inherently risky and is often marked by misfires, near-hits, and long periods of quiet perseverance.

Every once in a while, an idea matures into a solution that addresses a real-world problem and achieves true ‘product market fit’. This becomes especially important in India, where we are often consumers of technologies developed in a very different health system and populations.

To its credit, the Indian eye care sector has a robust set of indigenous service delivery models, and industry partners that have spearheaded economical and appropriate technology to solve real-world problems. At LVPEI, we embarked on the technology innovation journey in 2012, progressing steadily over the years. I am delighted to share that this month, in collaboration with our marketing and production partner, Forus Health Pvt. Ltd., two of our products have formally begun their commercialization journey. I now eagerly wait to see these products create an impact in the months ahead.

## The Pupil: A Window to Health

There is a saying that our eyes are the windows to our soul. Indeed, our eyes can tell a lot about us, both in health and dysfunction. This month, I sat through a presentation from a scientist colleague, Shrikant Bharadwaj, whose prototype device opened a new world of possibilities for me. His team has been working on the Pupil N, a pupillometer that objectively measures the pupil’s response to light. The pupil of our eye is the aperture that regulates the amount of light that enters it. If it’s dark, it ‘dilates’ and opens up to let more light in so that we can see better. If we are out in the sun, it ‘constricts’ and reduces the blinding light entering our eye. All these actions are involuntary, exquisitely controlled by the brain, and occur in milliseconds.

Because of this close neurological control, the pupil’s response to light is a powerful indicator of the health of a person’s brain. Many of us have witnessed first responders at traffic accident sites shining a torch on the victim’s eyes to gauge their pupil response. If it is ‘sluggish’ then it’s the first sign that something is wrong with the brain. Similarly, in a neurological ICU, patients’ pupil response is often checked for the first signs of improvement or worsening of their clinical condition.

However, these assessments using a torch are largely subjective and depend on the individual nurse or medical technician’s judgment. Further, subtle variations in pupillary response are often missed, and valuable information is lost when the patient is passed along the care pathway from the first responder to the trauma nurse, to the consulting doctor and so on.

Shrikant, an optometrist and an associate network director for research at LVPEI, is interested in understanding this pupillary response mechanism. Working closely with a team of clinicians, engineers and designers, he has been working on a device that can offer an objective measure of the pupillary response in a patient. The team put together a hand-held device that is powered by a mobile phone; LEDs provide a light stimulus, while an infrared camera precisely measures pupil size and reaction time. Equally powerful is the software. It operates fully on-device, compares responses against established thresholds, stores previous readings, and allows clinicians to track trends over time.

This became 'PupilN', a robust screening device that gives you an objective pupil reaction reading within seconds. It is sturdy and does not need a radio signal or internet connectivity to function. It is designed for use even in challenging environments. At an accident site, it will inform the technician on the risk-profile of a patient. In a neuro ICU, it will monitor change. An 18-year-old patient was admitted in a state of coma to a neuro hospital in Hyderabad. He had a severe attack of meningitis that inflamed his brain stem. Nurses used a PupilN to take readings of his pupillary response every day. The device began showing an improvement in responses, and it offered early hope—hope that was later realised. The patient regained consciousness, moved to the general ward, and was eventually discharged.

## Vision screening

Many of you may recall my earlier updates on BaVis, our Baby Vision Screening device developed at LVPEI's Centre for Technology and Innovation (CFTI) by PremNandhini Satgunam.

BaVis records the "looking behavior" of babies before and after cataract surgery and provides a quantitative measure of their visual function. Unlike adults, very young children (or those with intellectual disabilities) cannot perform a vision chart test—our gold standard for measuring vision. BaVis addresses this gap by tracking eye movements as children respond to patterns of LEDs arranged within a dome, enabling objective assessment of visual function at an age when such measurements are conventionally not possible.

## Building Bridges Beyond Eye Care

Both BaVis and PupilN are 'class 1' screening devices; they are pre-diagnostic tools that generate valuable data from physiological responses and provide insight into aspects of a patient that were hitherto invisible to care providers. They both use the fact that our eyes are largely involuntary and autonomous systems whose responses are modulated by our brain. Any dysfunction in these systems gives us critical insights into the health of the brain. In this process, they build bridges beyond eye care; these devices are useful to any clinical practice that is trying to understand the health of the brain. The applications range from trauma care to neurology, and we are delighted that these devices now have the potential to break out into these domains. Importantly, both devices are indigenous, appropriate technologies that strive to be affordable for their use case.

In January, we signed an MoU with Forus Health who will take these devices to market in 2026.

CFTI has always represented LVPEI's belief that meaningful innovation takes time, patience, and unwavering commitment. Ramesh Kekunnaya, who heads the function, and the clinician-scientists Shrikant and PremNandhini, along with the teams that have enabled their vision, deserve a big round of applause. Together, they have helped bring light to aspects of health care that have been shrouded in darkness—a reflection of our founder's vision of traversing the "path less travelled" as well as our enduring mission to combine excellence with equity.

I look forward to seeing what else will come from our innovation efforts.

-Prashant Garg