

Intranasal neurostimulation yields positive results for dry eye disease

November 15, 2017

The first portable, external neurostimulator to be approved in eye care stimulates endogenous tear production without physical irritation. The device can dramatically reduce symptoms and may enable patients to stop use of some or all tear substitutes or medications, noted John Sheppard, MD, MMSc.

By Fred Gebhart; Reviewed by John Sheppard, MD, MMSc

A novel validation trial suggests that an intranasal neurostimulation device (TrueTear Intranasal Tear Stimulator, Allergan), approved by the FDA earlier this year, could be a useful treatment for dry eye disease. The device stimulates the production of tears that can return the ocular surface to a more normal condition.

“[The product] demonstrated increased endogenous tear production upon stimulation of the nasal cavity,” said John Sheppard, MD, MMSc.

“It looks like [the treatment] is appropriate for any patient with dry eye who has a normal external nasal passageway,” said Dr. Sheppard, professor of ophthalmology, Eastern Virginia Medical School and president, Virginia Eye Consultants in Norfolk, VA. “It provides rapid amelioration of the symptoms of dry eye and a return to a more normal physiologic state.”

How it works

As the first portable, external neurostimulator to be approved in eye care, the handheld device features a reusable base with a dual-pronged replaceable tip that is inserted into the nose to contact the anterior nasal mucosa. The tip transmits a precisely timed series of low-voltage electrical pulses to the trigeminal nerve, triggering the nasolacrimal reflex to emulate the neural signals that stimulate natural tear production.

“If you eat something like jalapeno peppers, you get a brisk stimulation to the ophthalmic branch of the trigeminal nerve within the nasal cavity and produce tears,” Dr. Sheppard said.

“Normal respiratory activity stimulates this same pathway, constitutively producing normal tears,” he said. “Sensory signals are carried via afferent neurons to the brain; then efferent neurons in the parasympathetic and sympathetic nervous system carry signals back to the lacrimal functional unit (LFU).”

The treatment activates those same pathways that carry signals to the brainstem and back to the ocular surface, lacrimal glands, goblet cells, and meibomian glands to create tears.

Slicing onions and eating spicy foods can create unpleasant burning sensations as tears are produced, he added, but the intranasal device stimulates endogenous tear production without the physical irritation by emulating the afferent loop of the natural pathway. The patient can control intensity and duration of stimulation using buttons on the base of the device.

Retraining the LFU

What appears to be normal tear production can persist for several hours after the device is used. Dr. Sheppard likened intranasal neurostimulation to weight training, where the benefits of exercise persist and increase with regular repetition. Regular use of the treatment seems to train the LFU to produce tears in a more normal fashion and relieve dry eye symptoms.

“Stimulating in a proper fashion, at the right place, with the right intensity and the right pattern, can teach your trigeminal nerve to work harder and more efficiently around the clock,” Dr. Sheppard said. “This is precisely how the body learns to adapt to its environment and to better serve the ocular surface.

Study highlights

In a randomized, controlled, double-masked, crossover trial conducted at two sites, the device showed a 2.5-fold increase in mean Schirmer score compared with two control applications.

A total of 48 patients with a baseline index of 13 or higher and an anesthetized Schirmer test of 10 mn or less received three randomly ordered stimulations: one active extranasal stimulation, one sham intranasal stimulation, and one real intranasal stimulation. The active intranasal stimulation produced a mean Schirmer score of 25.3, compared with 9.2 for the sham intranasal stimulation and 9.5 for the active extranasal stimulation ($p < 0.001$ for both comparisons).

‘Everybody benefits’

Though the treatment is not a cure for dry eye, it can dramatically reduce symptoms and may enable patients to stop some or all tear substitutes or medications, Dr. Sheppard said.

The device can be particularly useful for patients who cannot reliably place drops in the eye, tend to poke their eyes while administering drops, suffer from a tremor, or simply prefer to keep their eye makeup intact. The device is also a more effective alternative to store-brand tears, allergy drugs, and over-the-counter vasoconstrictors that can be deleterious in patients with dry eye.

“Everybody benefits with fewer visits to the doctor, less unnecessary medication, less time off work, and so on,” he said.

“It can reduce healthcare costs, because patients are using an effective, self-directed, safe intervention and not using medications that can exacerbate their dry eye problems.”

No serious adverse events were reported during the trial. Four patients reported nasal itching, transient lightheadedness, exacerbation of hypertension and corneal abrasion. Of the four adverse events, nasal itching was considered related to treatment and the transient lightheadedness possibly related to the device. All four of the events resolved without sequelae.

“We are having very good early success getting some insurance companies on board with this new device,” Dr. Sheppard said. “They are recognizing that nasal neurostimulation can be an effective mechanism of action for patients with dry eye by providing a unique combination of dosage and precisely targeted anatomical delivery.”

John Sheppard, MD, MMSc

e: jsheppard@vec2020.com

This article was adapted from Dr. Sheppard’s presentation at the 2017 meeting of the American Society of Cataract and Refractive Surgery. He is a paid consultant to Allergan.
