

Ocular Rehabilitation with the Enhanced Palpebral Spring

By Robert E. Levine, M.D.

Editor's Note: Dr. Levine served for many years as a member of the ANA Medical Advisory Board. He is Clinical Professor of Ophthalmology at the U.S.C. School of Medicine, and Co-Founder & Co-Director of the Center for Facial Nerve Function of the House Ear Clinic in Los Angeles, CA. As an oculoplastic surgeon with a special interest in facial paralysis, he has cared for thousands of patients with facial paralysis over the past 30+ years. Dr. Levine's article titled "Modern Management and Rehabilitation of the Eye in Facial Paralysis" appeared in our September issue. The following article expands on the topic.

The concept of using a spring to reanimate the upper lid in facial paralysis was first introduced by Morel Fatio and Laladrie in the early 1960's. I began performing the surgery in 1968 and now have a series of approximately 1500 spring implant patients.

How the Spring Works

The concept of how the spring works is elegant in its simplicity. When the opening muscle of the eyelid, the levator, receives a signal (via the third cranial nerve) to open the eye, the force of the spring is overcome and the upper lid opens (Figure 1A). When the levator muscle receives an off signal (absent innervation), as normally occurs when one closes the eye or blinks, the spring takes over and pushes the lid to the closed position (Figure 1B). During the next blink cycle, the levator again opens the lid and subsequently again the spring closes it.

The third cranial nerve enters the eyelid from behind the eye and is there-

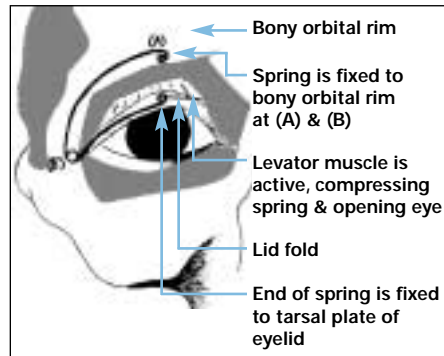


Figure 1A. The active levator muscle overcomes the spring and compresses it, as the levator opens the eye.

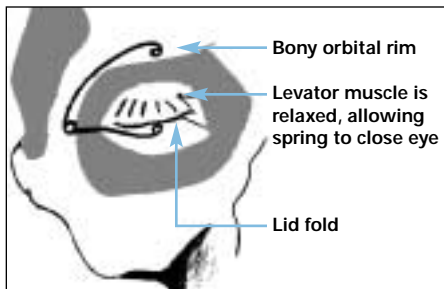


Figure 1B. The relaxed levator muscle allows the spring to decompress, which closes the eye.

fore unaffected by either an acoustic tumor or the surgery for it. Therefore, even in complete facial paralysis when the closing muscle of the eye is unable to close, the opening function of the eye remains intact.

Since the operation of the spring is dependent upon the third nerve innervation, it is the patient's own physiologic signal system which controls the spring's operation. Therefore, no conscious effort to either close the eye, open it, or blink is required. The spring seamlessly replaces the role of the normal (now paralyzed) closing muscle in the blink cycle.

Nonetheless, two limitations of the spring remained to be ameliorated. First,

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selected patients who had complete facial paralysis and were expected to recover in approximately one year, such as patients following facial nerve re-anastomoses, nerve grafts, and VII-XII anastomoses. At that time the intent was to use the spring primarily for the short term and remove it when the facial nerve again began to function. In fact, that is what I did in many patients. However, some patients recovered function around the eye only partially, or not at all, even in cases where the lower face did recover. In those patients the spring was left in as a long-term prosthesis. Some have had the device for more than 20 years and others for shorter periods. Some springs have worn out and have needed replacement. Nonetheless, the experience showed us that patients with long-term facial paralysis, i.e., those who could not look forward to further recovery, were also candidates for spring implants.

Over the years, the enhanced palpebral spring procedure has moved from only a means to protect the eye to a rehabilitative surgery. By restoring long-term lid function, it has become possible to elevate the brow in those patients who previously depended on brow droop to protect the eye. It has also become

possible to consider corneal transplant surgery in patients with prior corneal scars with the realistic anticipation that the cornea would not scar again from exposure. Similarly, some eyes that were turned in (due to a concomitant sixth nerve problem) were not considered candidates for strabismus surgery because of the blurred vision caused by frequent ointment use. Those eyes became candidates for strabismus surgery after spring implantation.

Those patients who could indeed reduce their ocular lubrication to a point where useful vision was once again possible further benefitted generally by being able to regain binocularity. They could therefore more confidently undertake those tasks which required binocularity, such as driving a car or flying an airplane.

We also learned that in some patients it made more sense for the neurosurgeon or neuro-otologist performing VII-XII anastomoses to aim for successful reinnervation of only the lower face, leaving the spring and related procedures to care for the eye problem. In some such instances, the possibility of a partial VII-XII anastomosis without loss of tongue function then became a possibility.

Issues of lower lid position, brow position and upper lid entropion are generally addressed at the same time as spring

implantation. The surgery can be performed on an outpatient basis with a combination of local anesthesia and minimal intravenous sedation by an anesthesiologist

The Spring and MRI Studies

The current wire being used for spring implantation is MP35N, an alloy with a long track record in pacemaker leads and other biomedical applications. This wire contains less than 1% ferrous metal and is therefore non-magnetic. Even though I have never seen a problem arise from a magnetic resonance imaging scan in a patient with a palpebral spring even when I was using stainless steel wire, with the current wire there is not even a theoretic concern of any interaction between the wire and the magnetic resonance imaging scan.

Summary

Because of my special interest in the ocular manifestations of facial paralysis, I have had the privilege of caring for thousands of patients with facial paralysis. I have found the enhanced palpebral spring surgery to be the best procedure for reanimating the paralyzed upper lid. It both protects the eye and becomes the cornerstone of a program of rehabilitation for the face and the patient as a whole.