

# PARALYZED EYELIDS REANIMATED WITH A CLOSED-EYELID SPRING\*†

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## ABSTRACT

Implantation of gold weights and open wire springs to close the eyelid have provided good corneal protection in selected patients with eyelid paralysis. These techniques, however, do not overcome lower eyelid drooping. The closed-eyelid spring technique was developed to address this problem, and, to date, the author has implanted 27 closed-eyelid springs. This technique has reestablished a voluntary blink, provided corneal protection, and effectively held the lower lid in a relatively normal position in 25 of 27 patients. This report describes patient selection, surgical technique, and results of implanting closed-eyelid springs to reanimate paralyzed eyelids.

Exposure keratitis is the most serious complication of facial paralysis, as it may lead to loss of vision as a result of permanent corneal scarring or perforation into the anterior chamber. The classical treatment for exposure keratitis that is unresponsive to medical measures is tarsorrhaphy, but it is accompanied by limitation of vision, creates a cosmetic blight, and often leaves the cornea exposed in spite of medial and lateral lid closure. Over the 8-year period 1978 to 1986, 272 patients (with facial paralysis due to a variety of causes) (Table I) requiring eyelid reanimation were seen. The 332 eyelid reanimation procedures performed included gold-weight implantations in 144 patients and implantation of springs in 188 patients. The gold implantation technique was popularized by Jobe,<sup>1</sup> and the wire spring by Levine<sup>2</sup>; both techniques were further modified by May.<sup>3,4</sup>

Although satisfactory results have been achieved with these techniques, some patients experienced persistent drooping of the lower lid despite addition of a lower lid tightening procedure (to the spring implantation) to reanimate the lids. This led to incomplete eyelid closure and exposure keratitis of the inferior third of the cornea. At the suggestion of a colleague (John Conley, MD, personal communication), a closed-eyelid spring was inserted in 27 patients with this problem. In four of these patients, a combination of a closed and open spring was inserted.

Eyelid closure was achieved in all but two patients, one of whom continued to experience underclosure, and the other overclosure of the eyelids. Thus, the closed-eyelid spring, either alone or in combination with an open-eyelid spring, was successful in 93% of the patients (Figs. 1, 2).

## INDICATIONS FOR PROCEDURE

The closed-eyelid spring was inserted in patients

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with total facial paralysis and significant lower eyelid droop in whom eyelid tightening procedures were unsuccessful. Patients were selected for correction of the lower eyelid droop to improve their appearance, as well as decrease the irritation from chronic exposure along the lower aspect of the cornea. The device is opened by action of the levator superioris muscle as the eyelids are opened; with relaxation of the levator muscle upon blinking, the spring pulls the eyelids together again.

## TECHNIQUE

Materials used for the closed-eyelid spring technique are listed in Table II. Before surgery the wire spring is fashioned from 0.01-inch orthodontic round wire, with the special pliers listed in Table II, as shown in Figure 3-A. The orthodontic wire must be shaped to conform to the curvature of the upper and lower lid margins, but the wire is brittle and breaks easily, so it must be shaped carefully. However, the wire will retain its shape once it is formed. Once the spring is ready, a topical anesthetic is applied over the patient's cornea, and 1% Xylocaine® with 1:100,000 adrenalin solution is instilled just below the skin of the lid in the incision areas indicated in Figure 3-B (dotted lines). Through the incisions indicated in Figure 3-B the tarsal plates of the upper and lower lids, and the periosteum in the lateral orbital rim area are exposed. Then spinal needles are inserted from the tarsal incisions to the lateral orbital rim area (Fig. 3-C). The spring is inserted through the lumens of the spinal needles, and the spinal needles are then withdrawn. The fulcrum of the wire is sutured to the periosteum of the lateral rim at about the level of the lateral canthus, with two or three 5-0 clear Prolene® sutures (Fig. 3-D). Next the ends of the wire limbs are cut with the wire cutter so that they will be the correct length to form a loop to reach to approximately the pupillary line. The loop is formed with the smooth side towards the palpebral aperture, using the looping pliers (Fig. 3-E). Then a Dacron® sleeve is fashioned from a 3-mm x 4-mm patch that is

TABLE I.  
Causes of Facial Paralysis Requiring Eyelid Reanimation  
(1978-1986).

Cause	No. Pts.
Trauma	143
Tumor	43
Bell's palsy	35
Herpes zoster oticus	22
Congenital deficit	14
Infection	5
Hemifacial spasm	3
Other	7
Total	272



Fig. 1. A. One year after acoustic tumor surgery on the right side; patient had total facial paralysis with medial and lateral tarsorrhaphy. B. Incomplete eyelid closure, even with tarsorrhaphy, is much more severe when tarsorrhaphy is reversed. C. Four months after implantation of closed-eyelid spring the lower lid drooping remains corrected. D. Eyelid closure almost complete.

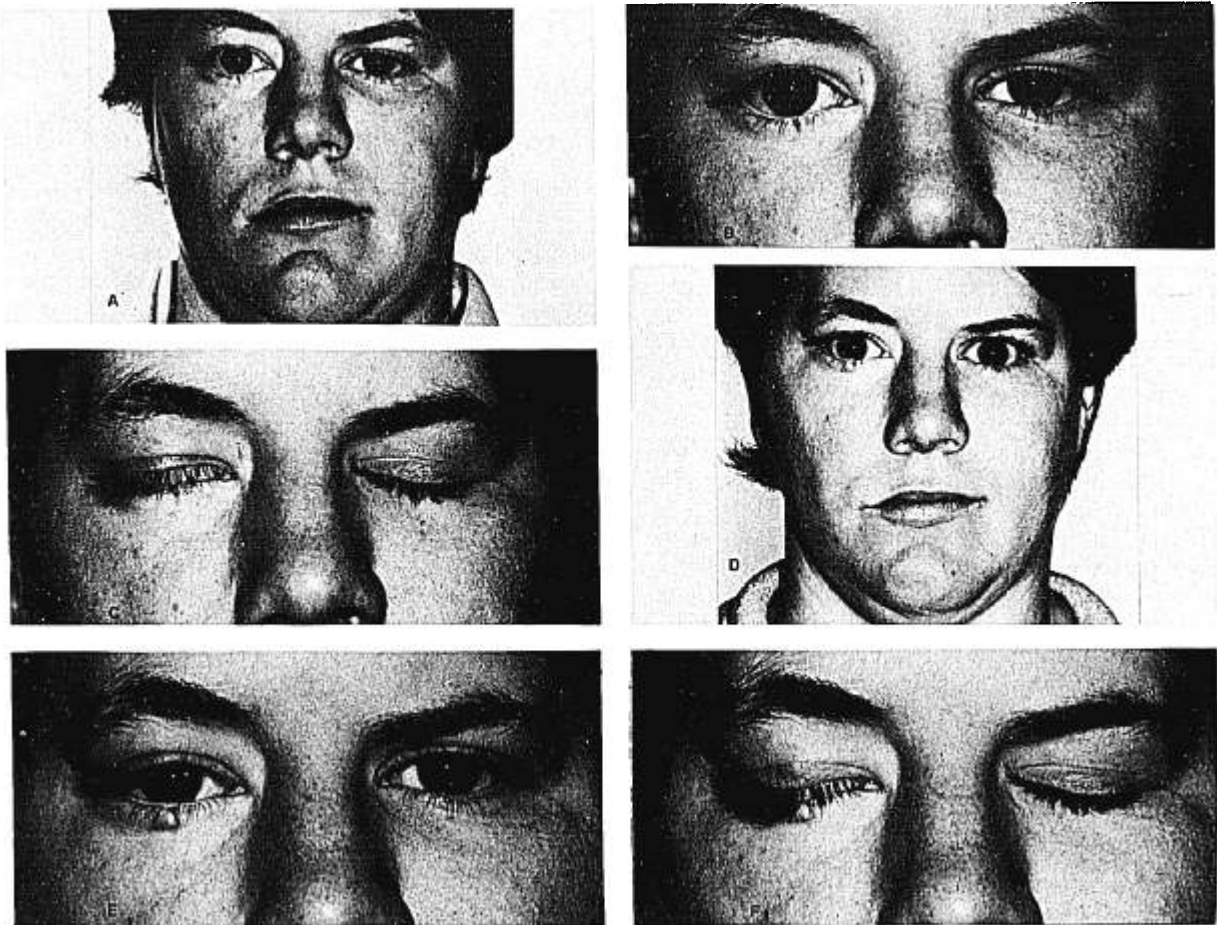


Fig. 2. A. 21-year-old born with right facial paresis. Note widening of the inner palpebral fissure on the right, due mostly to drooping of the lower lid. B. Closer view of eyes open. C. Eyes closed. D. Patient 6 months after insertion of a closed-eyelid spring on the right. E. Closer view of eyes open. F. Eyes closed. Note how closed-eyelid spring corrects lower lip droop. In addition, facial symmetry and eyelid closure are improved.

TABLE II.  
Equipment for Closed-Eyelid Spring Implant.

Special Instruments and Equipment

Methylene blue or marking pencil  
Contact lens (placed over globe beneath the lids to protect the cornea)  
Sparta blade breaker, disposable microrazor blade, and blade holder (to make skin incisions)  
Westcott scissors, iris scissors  
Small, four-pronged rake  
Micro-bipolar cautery  
Weck cell sponges  
Spinal needle No. 19 (B-D and Luer Lok #5183) (2) (to pass wire through upper and lower eyelids)  
0.01 Orthodontic round wire (#216-100) to make spring\*  
Tweed loop plier (No. 800-404); Bar light wire birdbeak plier (No. 815-416), Bar utility plier (No. 815-401), and How plier offset (No. 804-407) to fashion spring\*  
Microcutter (No. 800-506) to cut wire\*  
Dacron® patch fabric (Cat. No. CH-001628 V. Mueller Co.)  
Small Gelfoam® press (Storz No. N 1705-91) to compress the Dacron® when it is placed in the autoclave

Sutures

6-0 mild chromic (Davis and Geck Co.) 326-13, CE-2 (for skin closure)  
5-0 clear Prolene® 8602 (Ethicon Co.) and PS-4 cutting needle (to fix fulcrum of wire)  
8-0 Ethilon® (Ethicon Co.) 1714G (to fix wire loop to Dacron® patch fabric)

\*The wire, pliers, and cutter can be purchased from Unitek Corp, Monrovia, CA 91016.

pleated by folding it on itself and placing it in a Gelfoam® press, which is then placed in an autoclave and flashed for 3 minutes. Following this, a permanent pleat is made in the Dacron® and the sleeve is completed by closing it on two sides using 8-0 Ethilon suture material (Fig. 3-F). This Dacron® sleeve is placed over the wire loop and fixed to the loop with an 8-0 Ethilon suture to prevent extrusion of the loop: tissue grows through the mesh and fixes the loop to the surrounding soft tissue. However, some movement is required for the spring to work effectively, which is why the suture is not placed through the tarsus. Finally, the wounds are closed and the procedure is terminated.

## RESULTS

Restoring eyelid function with a gold weight or open spring has been a significant contribution since it makes tarsorrhaphy unnecessary. However, although implantation of a gold weight or an open-eyelid spring can significantly improve eyelid closure, many patients still experienced problems due to drooping of the lower eyelid. The technique described here for implanting a closed-eyelid spring has provided gratifying results in 25 of 27 cases. The longest evaluation time for a patient with a closed-eyelid spring was 18 months, and there have been no extrusions to date. This may change with longer follow-up, but we do not expect that the extrusion rate will be any worse than with the open-eyelid spring, and there have been no extrusions of these springs over the past 6 years, since we began use of the Dacron® envelope.

The closed-eyelid spring is effective in approximating the lateral half of the lids, but is not completely effective in the medial third (Fig. 1-D, 2-D). It is

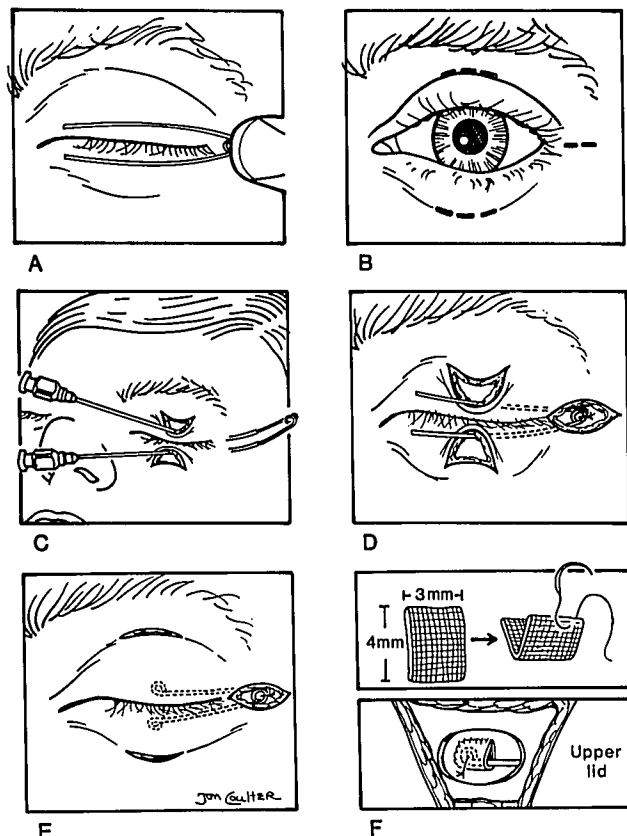


Fig. 3. Technique for implantation of a closed-eyelid spring.

tempting to extend the limbs of the spring across the midline in an effort to achieve complete closure of the entire lid margin; however, when this was tried with the open-eyelid spring, the loop tended to protrude when the eyelids were open, so the wire was cut to reach only to the midpoint of the eyelid. A medial canthoplasty was effective in three patients to overcome the problem of incomplete closure in the medial third of the eye, while in two others medial canthoplasty was not sufficient to accomplish complete eyelid closure because of an overactive levator muscle. Perhaps this can be corrected by weakening the medial aspect of the levator muscle where it inserts into the tarsus of the upper lid.

## CONCLUSION

The facial reanimation surgeon's goal is to restore normal facial function. Until this goal can be realized, however, we must continue to seek improved ways of restoring the functions of individual portions of the face. Eyelid reanimation is a primary concern — to protect vision as well as for cosmetic reasons. Implantation of a closed-eyelid spring is the most effective procedure to date for managing patients with total facial paralysis who continue to experience significant lower eyelid droop, despite eyelid tightening procedures.

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