Use of Hyaluronic Acid Gel in the Management of Paralytic Lagophthalmos: The Hyaluronic Acid Gel "Gold Weight"

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Purpose: To evaluate the safety and efficacy of injecting hyaluronic acid gel in the upper eyelid as a nonsurgical alternative in the treatment of paralytic lagophthalmos.

Methods: This is a retrospective study of 9 patients (10 eyelids) with paralytic lagophthalmos treated with hyaluronic acid gel in the prelevator aponeurosis region and/or pretarsal region of the paralytic upper eyelid. Pretreatment, posttreatment, and follow-up photographs were digitized, and overall outcomes assessed. Measurements of lagophthalmos were standardized and compared. Slit-lamp examination was used to evaluate the degree of exposure keratopathy. ImageJ was used for photographic analysis.

Results: Ten eyelids (9 patients, 7 men; mean age 69.2 years; range, 31–90 years) with paralytic lagophthalmos were treated with hyaluronic acid gel. The average amount of injected hyaluronic acid gel was 0.9 ml (range, 0.2–1.2 ml). All patients demonstrated significant improvement in lagophthalmos and exposure keratopathy. The mean improvement in lagophthalmos was 4.8 mm (range, 0.9–11.9 mm; $p = 0.001$). Of the 5 patients with follow-up, the mean follow-up period was 3.6 months (range, 2–5 months). Of these, 2 had no change in lagophthalmos (both maintained 0 mm at 5 months), one had a slight decrease in lagophthalmos (4.8–4.6 mm at 2 months), one had a slight increase in lagophthalmos (0.3–0.5 mm at 2 months), and one had a more significant increase in lagophthalmos (1.9–4.3 mm at 4 months). The latter patient underwent a second treatment with further reduction of lagophthalmos to 0.4 mm. Overall, there was a decrease in margin reflex distance from the upper eyelid margin to the corneal light reflex (MRD1) but it was not statistically significant. Complications were minor and included transient ecchymosis, edema, and tenderness at the injection sites.

Conclusions: On the basis of these preliminary results, hyaluronic acid gel shows promise as a safe and effective nonsurgical treatment for the management of paralytic lagophthalmos. This treatment may be particularly useful in patients who are poor surgical candidates and/or as a temporizing measure in patients in whom return of facial nerve function is anticipated, given the hyaluronic acid gel's properties of slow resorption and reversibility with hyaluronidase.

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Paralytic lagophthalmos, with accompanying exposure keratopathy, is a common problem presenting to the oculofacial plastic surgeon. Initial management is supportive and includes frequent use of ocular lubricants, eyelid taping, bandage contact lens, moisture chambers for nocturnal protection, and even botulinum toxin.[1,2] Despite aggressive medical therapy, exposure may progress.

Surgical interventions include temporizing static measures such as temporary tarsorrhaphy and more robust procedures such as muscle transfer reanimation, silicone encircling bands, and springs. By far, eyelid-loading techniques are the most frequently used; however, eyelid weight implantation (either gold or platinum) has potential complications. These complications include extrusion, allergy (believed to be a type IV hypersensitivity reaction), poor cosmesis with eyelid distortion, induced astigmatism, and undercorrection or overcorrection with resultant residual lagophthalmos or blepharoptosis, respectively.[3,4] Furthermore, orbicularis oculi function may return in many cases of Bell palsy, occasionally necessitating weight removal. In one retrospective case series of 103 patients with facial nerve palsy, 46 patients had the eyelid loads removed from their original site of placement, with 78% of eyelid loads removed because of facial nerve recovery.[5]

The management of paralytic lagophthalmos is complicated by the unpredictable course of the disease, and so there would be great benefit from an effective, minimally invasive, reversible treatment. In this article, we describe a nonsurgical treatment alternative for paralytic lagophthalmos using hyaluronic acid gel.

METHODS

A retrospective study was conducted on all patients with paralytic lagophthalmos presenting to our clinic from January 1, 2007 to December 31, 2007. Patient demographics and the etiology of the paralytic lagophthalmos were recorded. The type and amount of hyaluronic acid gel was recorded. Either Restylane (Medicis, Scottsdale, AZ, U.S.A.) or Juvederm Ultra (Allergan, Irvine, CA, U.S.A.) was used as the filler/loading substance. Patients with other orbital or eyelid procedures that may have affected the outcome during the follow-up period were excluded from the study.

Pretreatment, posttreatment, and follow-up photographs were taken. All photographs were obtained using a standardized technique in the frontal position with the eyelids open and closed and facial muscles relaxed. The technique of using photographs for comparison of eyelid position measurements has been established in previous studies.[6] ImageJ was used for photographic analysis with individual image calibration based on the horizontal corneal diameter of 11.7 mm.[7,8] The following measurements were taken by a masked observer before and

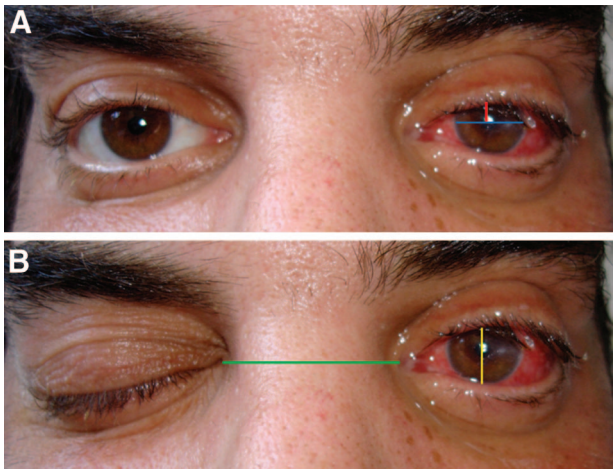

FIG. 1. External photograph illustrates measurement technique. Four pictures per patient were analyzed: open eye before and after injection, closed eye before and after injection. **A,** With the eyelid open, distance (pixels) from the light reflex to upper eyelid margin (MRD1, red line) and the corneal diameter (blue line) were recorded. MRD1 was standardized to an arbitrary horizontal corneal diameter of 11.7 mm by multiplying the ratio of MRD2 to corneal diameter in pixels by 11.7.[8] **B,** With the eyelid closed, distance from the upper eyelid margin to lower eyelid margin (lagophthalmos, yellow line) and the intercanthal distance (green line) were recorded. Lagophthalmos was standardized using the intercanthal distance, because the cornea would not be visible with the eyelid closed.

after injection: margin reflex distance from the upper eyelid margin to the corneal light reflex (MRD1) (eyelid open), lagophthalmos at the 6 o'clock position, and intercanthal distance (Fig. 1). A ratio of the lagophthalmos to the intercanthal distance was calculated and standardized. Slit-lamp examination was performed to evaluate the degree of exposure keratopathy.

Technique of Loading the Upper Eyelid With Hyaluronic Acid Gel. A similar injection technique has been described previously.[9] Topical EMLA cream (a eutectic mixture of lidocaine and prilocaine) is initially applied over the upper eyelid skin. Using a 30-gauge needle, hyaluronic acid gel is injected in small amounts via multiple small puncture sites across the length of the upper eyelid, avoiding the area adjacent to the upper canaliculus (Fig. 2). A layered approach with multiple fine, threadlike injections (10–20 per eyelid) deep to the orbicularis oculi muscle is used to avoid superficial or excessive deposition of gel in any single area. Hyaluronic acid gel is placed in the pretarsal and/or prelevator aponeurosis regions until the desired endpoint: resolution of lagophthalmos without occluding the visual axis.

RESULTS

A total of 10 eyelids (9 patients; 7 men; mean age 69.2 years; range, 31–90 years) with paralytic lagophthalmos were treated with hyaluronic acid gel. Patient characteristics are presented in the Table (http://links.lww.com/A587). The etiology of paralytic lagophthalmos included Bell palsy (n = 3), tumors (n = 3), iatrogenic trauma (n = 1), childhood mastoiditis (n = 1), and polyneuropathy secondary to mixed cryogobulinemia (n = 1). Indications for treatment were persistent exposure keratopathy despite maximal medical therapy, poor surgical candidates, and patients who declined surgery. The average amount of injected hyaluronic acid gel was 0.9 ml (range, 0.2–1.2 ml). The volume used in each case was customized based on specific anatomy, presence of residual hyaluronic acid gel from a previous injection, severity of lagophthalmos, and overall aesthetic outcome. Procedures were performed either in the clinic or at bedside.

All patients demonstrated significant improvement in lagophthalmos and exposure keratopathy immediately after treatment. The mean improvement in lagophthalmos was 4.8 mm (range, 0.9–11.9 mm; $p = 0.001$). Of the 5 patients with follow-up, the mean follow-up period was 3.6 months (range, 2–5 months). Of these, 2 had no change in lagophthalmos (both maintained 0 mm at 5 months), one had a slight decrease in lagophthalmos (4.8–4.6 mm at 2 months) because of edema, one had a slight increase in lagophthalmos (0.3–0.5 mm at 2 months), and one had a more significant increase in lagophthalmos (1.9–4.3 mm at 4 months) because of excessive resorption. The latter patient underwent a second treatment with further reduction of lagophthalmos to 0.4 mm, albeit with induction of visually significant blepharoptosis.

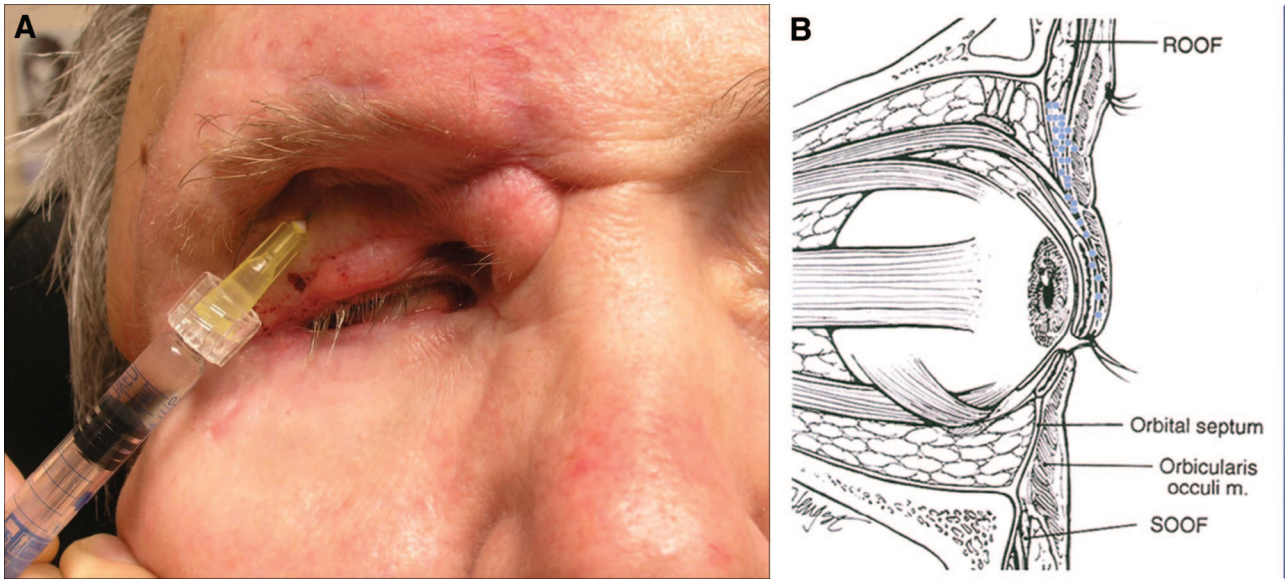

FIG. 2. **A,** Intraoperative image of a prelevator aponeurosis injection of hyaluronic acid gel. **B,** Schematic diagram of the pretarsal and prelevator aponeurosis injection sites of hyaluronic acid gel (blue circles).

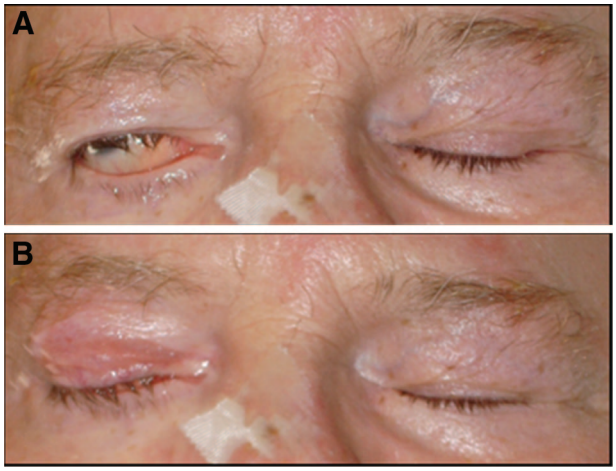

FIG. 3. Preinjection (**A**) and immediate postinjection (**B**) photographs of a 74-year-old intensive care unit patient with right paralytic lagophthalmos and exposure keratopathy with eyelid closed who underwent right upper eyelid hyaluronic acid gel (Juvederm Ultra) injection. Note resolution of the lagophthalmos.

Complications were minor and included transient ecchymosis, edema, contour irregularities, and tenderness at the sites of injection. Overall, there was a nonstatistically significant decrease in MRD1, with 2 cases of visually significant blepharoptosis. There were no vision-threatening complications from periorbital injections, and subjective patient satisfaction was high in all cases. Pretreatment and posttreatment images are presented in Figures 3 to 5.

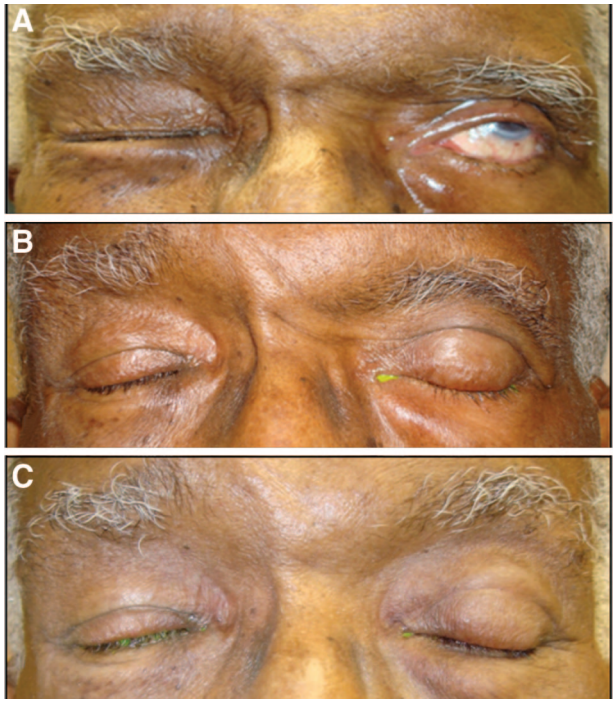

FIG. 4. A 90-year-old black patient with left paralytic lagophthalmos due to Bell palsy who underwent hyaluronic acid gel (Juvederm Ultra) injection in left upper eyelid. **A**, Preinjection, **B**, postinjection, **C**, at 5 months follow-up with eyelids closed. Note resolution of lagophthalmos.

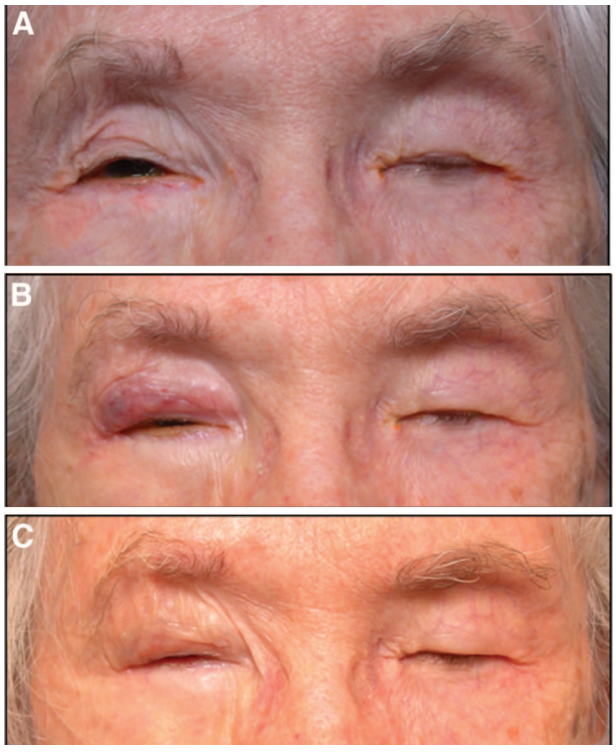

FIG. 5. Preinjection **(A)**, immediate postinjection **(B)**, and 2-month follow-up **(C)** closed-eyelid photographs of an 87-year-old woman with paralytic lagophthalmos due to childhood mastoiditis, with upper eyelid gold weight, and significant residual lagophthalmos who underwent hyaluronic acid gel (Restylane) injection in right upper eyelid. She had been using plastic wrap covering over her right eye, which she stopped posttreatment. Note concurrent sulcus hollowness improvement.

DISCUSSION

Cross-linked hyaluronic acid gel has been commercially available for soft-tissue augmentation in Canada and Europe since 1997, and was approved for use by the U.S. Food and Drug Administration in December 2003.[10] In addition to its cosmetic use in filling facial rhytids, hyaluronic acid gel has had expanding applications in the functional arena including treatment of glottal insufficiency and unilateral vocal paralysis,[11] orbital volume augmentation for correction of enophthalmos,[12] treatment of incontinence,[13] and in treating lower eyelid retraction with scleral show.[14]

In this pilot study, we found loading of the upper eyelid with hyaluronic acid gel to be an effective treatment for paralytic lagophthalmos. There was a mean reduction in lagophthalmos of 4.8 mm, ranging from 45% reduction to 100% reduction in 9 patients (10 eyelids). This is an improvement comparable with or superior to results obtained by upper eyelid prosthetic weights.[3,4] All patients reported significant improvement in exposure symptoms and reduction or cessation of ocular lubrication requirements.

The use of hyaluronic acid gel for correction of paralytic lagophthalmos offers a number of advantages when compared with surgery. It is ideal for those who are poor surgical candidates or who are medically unstable (Fig. 3). The temporary effect of hyaluronic acid gel fillers offers the capability to temporary adjust the eyelid position, allowing for a flexible approach in patients whose underlying problem may be changing over time (Fig. 4). Furthermore, a temporary, minimally

invasive approach may be particularly attractive for patients who prefer a less invasive alternative and are not dissuaded by the concept of outpatient maintenance procedures. It can also be used to correct residual lagophthalmos in those who have undergone previous upper eyelid gold-weight placement (Fig. 5). Injections can be repeated in a stepwise manner for accuracy of volume correction. Additional layers may be injected as needed, and hyaluronidase may be used to reduce the effect of filler at specific sites,[15,16] providing the surgeon with the ability to fine-tune the placement of filler to attain an optimal result. Many patients in our series had aesthetic hollowing of the eyelid and periorbital area as a result of aging and weight loss. Hyaluronic acid gel filling in these patients provided not only vertical support for the upper eyelid, but also improvement in the superior sulcus hollow (Fig. 5).

The effect of upper eyelid enhancement is expected to decrease over time, with a gradual recurrence of lagophthalmos. Because of the low mimetic activity of the paretic eyelid, the hyaluronic acid gel may last longer when compared with its use in dynamic areas of the face. During the interval from initial treatment to follow-up visit, the effect of the hyaluronic acid gel diminished significantly in only one patient in our study, with an increase in lagophthalmos from 1.9 to 4.3 mm over 4 months.

There were only minor complications in our study. Patients may experience transient edema, erythema, tenderness, and pain that may last for a period of a few days. Ecchymosis may persist for up to 2 weeks. The risk of severe complications is remote,[17,18] and there were no vision-threatening complications from periorbital injections in this study. It should be noted, however, that intravascular injection of any type of filler agent can cause tissue necrosis, particularly in the glabellar region. The risk of embolization in the orbital circulation is a remote but potentially severe complication as with any injection in the orbital area.[19,20]

Two patients in this study experienced a postinjection MRD1 of 0 at some point in their course. These results are not surprising. Patient 1 (Table, http://links.lww.com/A587) had some return of his orbicularis oculi muscle function from Bell palsy at the 5-month follow-up visit. In Patient 10 (Table, http://links.lww.com/A587) lagophthalmos increased in the postinjection period from a preinjection MRD1 of 1.9 to 4.3 mm at the 4-month follow-up visit, at which point he was given a substantially greater amount of hyaluronic acid gel (1.7 ml) in the upper eyelid to ensure long-term closure. In cases of a large decrease in lagophthalmos, or in cases of residual lagophthalmos needing further treatment, induction blepharoptosis may be necessary.

The limitations of our study should be considered. Although hyaluronic acid gel shows promise as a treatment of paralytic lagophthalmos, this is a study with a small number of patients with different etiologies for paretic orbicularis oculi muscles and variability in the baseline severity of lagophthalmos and exposure keratopathy. Furthermore, the follow-up period was limited and differed among the patients. Long-term follow-up will better clarify the required frequency of injections and the degree of hyaluronic acid gel retention and eyelid position over time.

Hyaluronic acid gel shows promise as a novel, quick, safe, effective, predictable, nonsurgical means to manage paralytic lagophthalmos and accompanying exposure keratopathy. To our knowledge, this is the first study that describes the use of hyaluronic acid gel in the treatment of paralytic lagophthalmos. The temporary effect of filler offers the capability to provisionally adjust the eyelid position over time, thus eliminating the potential morbidities of surgical intervention, and injections can be repeated to maintain the effect. Simultaneous aesthetic improvement in periorbital hollowing may be achieved. A temporary, minimally invasive approach may be particularly attractive for patients who are poor surgical candidates or in those inclined to pursue a less invasive approach.

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