

# Corrugator Superciliaris Muscle Excision for Tension and Migraine Headaches

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**Purpose:** This study investigates the effect of corrugator superciliaris muscle excision on patients with frequent tension or chronic migraine headaches emanating from the glabellar or frontal regions.

**Methods:** We present a prospective study of 12 patients with chronic and frequent tension and/or migraine headaches. Patients who had already elected to undergo corrugator excision for cosmesis ( $n = 64$ ) were given questionnaires to evaluate for the presence of chronic, recurrent migraine and/or tension headaches. Patients who answered in the affirmative went on to answer questions such as onset, location, frequency, severity, and duration of their headaches. Patients were grouped by types of headaches: tension, migraine, and combined headaches. Twelve patients who met all criteria were entered into the study and underwent corrugator excision in combination with blepharoplasty. Postoperative questionnaires and interviews were administered to evaluate the response of the patients' headaches to corrugator excision.

**Results:** All 12 patients had less frequent headaches and said they would have the procedure performed again for headache. Eleven of 12 patients (92%) had less intense headaches after corrugator superciliaris excision. Overall, 58% noted complete relief of their headaches. Follow-up ranged from 6 to 19 months.

**Conclusions:** Corrugator superciliaris muscle excision provides significant relief for headaches emanating from or localizing to the frontal and glabellar regions. Although improvement of migraine headaches has been previously described with this technique, this is the first report, to our knowledge, of effective surgical treatment of tension headaches by corrugator excision.

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Tension and migraine headache are common ailments, especially in adults, and frequently result in physician and hospital visits and the purchase of expensive medications. It is estimated that 6% of men and 18% of women are affected by migraine headaches in the United States.<sup>1</sup> The prevalence of tension headaches is much higher, ranging from 30% to 60%.<sup>2,3</sup> Botulinum toxin has proved to be an excellent treatment alternative for patients with chronic, recurrent tension and migraine headaches.<sup>4,5</sup> The complete explanation for the efficacy of botulinum toxin for migraine headaches is still being evaluated. However, the recently recognized role of peripheral mechanisms involving substance P and other neurotransmitters in migraine headaches is important.<sup>6,7</sup> Tension headaches have been more clearly attributed to peripheral origins.<sup>8</sup> Recently, the role of corrugator excision in the treatment of migraine headaches has been reported and reinforces the role of peripheral factors in

this disease process.<sup>9,10</sup> Corrugator excision for chronic, recurrent tension headaches has not been previously reported in the literature.

Neuromuscular interactions are common sources of both tension and migraine headaches. Although there is some clinical and diagnostic overlap between these entities, they are separate processes and occur through separate mechanisms. We postulate that corrugator muscle excision will benefit patients with tension headaches. The much higher prevalence and frequency of recurrent chronic tension headaches in the general population demonstrate the potential effect of this procedure. Our study shows a consistent and dramatic benefit for tension headache patients undergoing corrugator muscle excision in addition to the expected and previously reported benefit for patients with migraine headaches.

## METHODS

Over a 20-month period, 91 patients had corrugator extirpation in a private practice setting. Twenty-seven patients with functional disorders such as blepharospasm who underwent corrugator muscle extirpation were excluded from the study. Sixty-four patients elected to undergo corrugator excision for cosmetic improvement of glabellar furrows in conjunction with blepharoplasty. These 64 patients were interviewed and asked to complete confidential questionnaires regarding headaches

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**FIG. 1.** External intraoperative photograph of blepharoplasty incision of left eye demonstrating the opening of the brow fat pad with scissors.



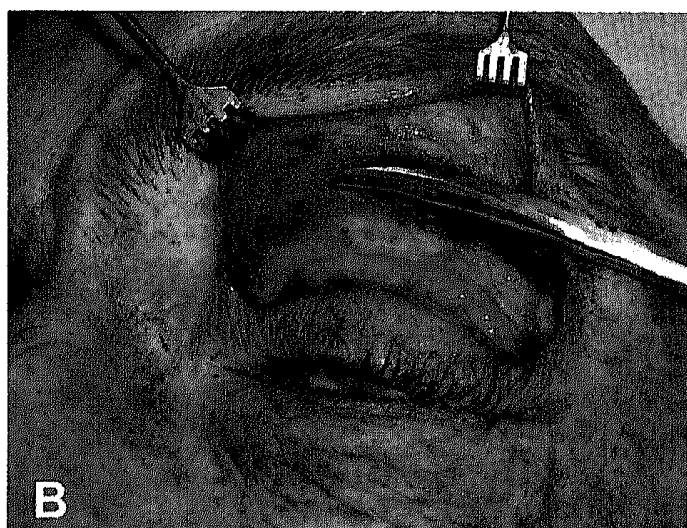
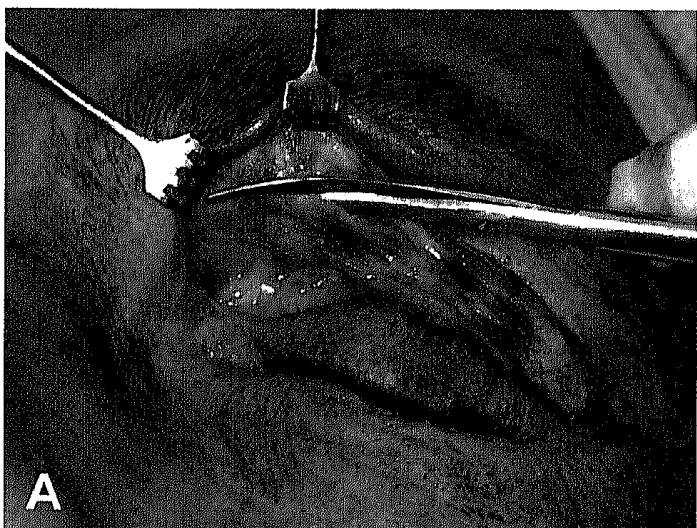
**FIG. 3.** External intraoperative photograph of left eye demonstrating excision of the corrugator superciliaris muscle. Remaining in anterior plane minimizes injury to the supraorbital and supratrochlear neurovascular bundles.

before their surgery, after appropriate informed consent was obtained. If the presence of recurrent, chronic headaches was confirmed, the questionnaire went on to elicit information regarding onset, frequency, severity, and duration of headache episodes. Patients were asked to elaborate on the location of the headaches and to provide information about any aura or headache characteristics consistent with migraine headaches. The patients were then asked to provide information regarding present prophylactic or interventional treatments. Last, they were asked if they had been diagnosed with tension or migraine headache by their neurologist or primary care physician. Twelve patients were eventually enrolled in the study.

Patients with mild symptoms or with tension headaches less than two times per month were excluded. Patients taking prophylactic migraine medications or who had migraines less than once per month were also excluded. Only patients with headaches emanating from or localizing to the frontal/glabellar regions were included in the study. Only patients with moderate to marked glabellar furrows were included. Two patients who

had undergone prior botulinum toxin therapy to the glabellar region in the past were included. Neither of these patients had headache improvement with botulinum toxin therapy. Patients with a history of trauma, brain tumors, or other neurologic injuries coinciding with the onset of their headaches were excluded from the study. A diagnosis of migraine or tension headache by a primary care physician or neurologist was required for entry in the study.

All patients underwent corrugator excision in conjunction with upper blepharoplasty. Corrugator muscle excision has been previously described by several authors.<sup>11,12</sup> Our technique differs and begins with a standard blepharoplasty incision with skin/muscle flap excision with removal of excess temporal orbicularis muscle. The brow fat pad is then opened through the anterior leaf of the deep galea<sup>13</sup> (Fig. 1). Next, this plane of dissection is carried medially with Stevens scissors to expose the oblique head of the corrugator complex (Fig. 2). The corrugator superciliaris muscle is excised (Fig. 3) with care



**FIG. 2.** A, External photograph of left eye showing the extension of the earlier surgical plane medially. B, The corrugator superciliaris muscle is exposed.



**FIG. 4.** A, External preoperative photograph of patient actively furrowing her glabellar muscles. B, Postoperative photograph of the same patient attempting to furrow the glabellar muscles.

taken to preserve the supraorbital and supratrochlear neurovascular bundles. The depressor superciliaris muscle is then extirpated and the procerus muscle is weakened. Hemostasis is maintained with bipolar cautery. The same procedure is performed on the opposite side.

After completing the typical postoperative care and healing period, serial follow-up questionnaires and interviews were administered. Patients were questioned about improvement, resolution, or recurrence of their headaches. They were asked to compare intensity and frequency of headaches to their preoperative state. The interviews also explored the use of headache medications and botulinum toxin in the postoperative period. Patients were asked about postoperative forehead anesthesia and hypesthesia or any other side effects. Patients were also asked whether or not, in hindsight, they would choose to have this procedure performed again for headache. All patient data were gathered and relayed in accordance with state and US laws and the Declaration of Helsinki.

## RESULTS

All 12 enrolled patients had improvement in the frequency of their headaches. All but one patient (92%) had less intense headaches after corrugator excision. Four of the 7 tension headache sufferers (57%) had complete resolution of their symptoms. Two of the 3 patients with combination tension and migraine headaches had complete resolution of symptoms. One of the patients with migraine headaches only had no recurrence of symptoms after surgery and required no further migraine therapy. The other had much less intense and less frequent headache episodes. All patients demonstrated decreased glabellar furrowing after surgery (Fig. 4).

Eight of 12 patients reported complete resolution of forehead anesthesia. This correlated directly with time elapsed since surgery. All patients in the 13- to 19-month follow-up range had no remaining forehead anesthesia or hypesthesia, whereas only 4 of the 8 patients in the 6- to 8-month follow-up range had regained normal forehead sensation.

The patients with complete resolution of their symptoms required neither interventional nor prophylactic headache medications. Each patient with only improvement of the headaches required less medication to manage their symptoms. All patients stated they would elect to have the procedure performed

again in hindsight for headache management. Follow-up ranged from 6 to 19 months. The results are compiled in the Table.

Patient 3 received botulinum A toxin in the forehead during the postoperative period for cosmesis only, but she reported a complete cessation of headaches during the 10-week interval between surgery and injection. This patient had received botulinum toxin injections to the forehead and glabella on several occasions before surgery without any improvement of the tension headaches. This patient remains nearly free of headaches 15 months after surgery.

## DISCUSSION

We present 12 patients who displayed improvement or resolution of their frontal and glabellar headaches with corrugator muscle excision through blepharoplasty incisions. Other authors have reported similarly promising results using corrugator excision for migraine headache patients.<sup>9,10</sup> This study, to our knowledge, is the first report of improvement or resolution of tension headaches by corrugator excision. This is important because tension headaches affect a much greater proportion of the population and typically occur more frequently than migraine headaches.<sup>2,3</sup> Therefore, the number of patients who could potentially benefit from this procedure is significant.

It is well known that some overlap exists in the symptoms and diagnosis of tension and migraine headaches. However, it is generally accepted that these are in fact separate diagnoses.<sup>14,15</sup> At the very least, they may be viewed as disparate points along a spectrum. Nonetheless, it appears to be their shared relation with peripheral mechanisms that makes them both amenable to treatment by corrugator excision. The results of this and other studies suggest that corrugator excision is a possible alternative for selected patients who have either tension or migraine headaches.<sup>10,11</sup>

Prior studies examining the relation between corrugator excision and migraine headaches used response to botulinum toxin as a prognosticator of response to cor-

Summary of patient data

Patient	Headache Type	Frequency Before Surgery	Results After Surgery	Meds	Botox <sup>®</sup>	Would Do Again?	Follow-Up (Months)
1	Tension	2x/week	Resolved	None	No	Yes	6
2	Tension	2x/month	Resolved	None	No	Yes	13
3	Tension	3x/week	1x/3months	None	Yes	Yes	15
4	Tension	Daily	< 1x/month	None	No	Yes	18
5	Tension	Daily	Resolved	None	No	Yes	8
6	Tension	Daily	Resolved	None	No	Yes	7
7	Tension	3x/week	Monthly	None	No	Yes	7
8	Tension	2x/week	Both	None	No	Yes	7
9	Migraine		Resolved				
	Tension	5x/week	3x/week	Prn	No	Yes	19
10	Migraine	2x/week	1x/week				
	Tension	Daily	Both	None	No	Yes	8
11	Migraine	3x/week	Resolved				
	Migraine	Monthly	Resolved	None	No	Yes	7
12	Migraine	2x/week	2x/month	None	No	Yes	8

rugator excision.<sup>10</sup> Zygomaticotemporal nerve ablation was used for patients with less than complete response to botulinum toxin. Our study used headache location as the prognosticator of success and excluded patients who did not fit this specific criterion. We also limited our surgical intervention to corrugator excision and extirpation of the depressor supercilii and procerus muscles. We would be the first to note that internal brow fat sculpting and blepharoplasty were combined with corrugator excision in these cases. The resulting elevation of the brow and relaxation of frontalis muscles may combine to help relieve the headaches in these patients. In addition, some hypesthesia and/or anesthesia are induced in the glabellar region by this procedure and may have some effect on headache reduction. However, as the anesthesia and hypesthesia resolve with time, the headaches have not returned to their preoperative severity or at all in most cases.

Patients 3 and 4 are of particular interest because of their lack of response to botulinum toxin in the preoperative period and subsequent improvement of headaches after surgery. There are a number of potential explanations for this phenomenon. Although these patients could have been simply undertreated with botulinum toxin for their level of headaches, corrugator superciliaris extirpation may offer a level of localized motor denervation and muscle weakening greater than that achieved with botulinum toxin. In future studies, EMG analysis in the postoperative period may shed light on this question. Furthermore, these patients could have been relegated to a more extensive procedure if response to botulinum toxin alone were used as a prognosticator. This highlights the need for further evaluation of efficacy prognosticators and outcomes with larger studies using randomization and double-blinded parameters. Because corrugator excision is performed through a blepharoplasty incision, this procedure would be amenable to a

sham procedure study arm to mask patients and to assess placebo effect.

Tension and migraine headaches are common disabling disorders experienced subjectively by individual patients. Although subjective data are evaluated in any headache study, we believe that an individual patient's experiences, symptoms, and feedback are, in fact, the best way to effectively analyze this subjective disorder. Despite the inherent difficulty in assessing and grading headaches, we can affirm that all patients in the study reported significant improvement, and 57% of tension headache patients had complete resolution. Moreover, all 12 patients indicated that they would have the procedure performed again for headaches.

These results are encouraging, but larger, controlled studies are required to further validate these findings. Furthermore, in cosmetic cases of corrugator muscle removal, it has been noted that some furrowing and muscle strength may recur with time. Longer follow-up will be required to determine if headache relief is permanent. Although we are not advocating corrugator superciliaris muscle excision for tension headaches as a primary treatment, it is an excellent option for selected patients undergoing blepharoplasty who have this chronic, recurrent, and often debilitating condition.

## REFERENCES

1. Stewart WF, Shechter A, Rasmussen BK. Migraine prevalence: A review of population-based studies. *Neurology* 1994;44:S17-23.
2. Pryse-Phillips W, Findlay H, Tugwell P, et al. A Canadian population survey on the clinical, epidemiologic and societal impact of migraine and tension-type headache. *Can J Neurol Sci* 1992;19:333-9.
3. Rasmussen BK, Jensen R, Schroll M, Olesen J. Epidemiology of headache in a general population: A prevalence study. *J Clin Epidemiol* 1991;44:1147-57.
4. Schulte-Mattler WJ, Wieser T, Zierz S. Treatment of tension-type headache with botulinum toxin: a pilot study. *Eur J Med Res* 1999;4:183-6.
5. Blumenfeld AM, Binder W, Silberstein SD, Blitzer A. Procedures

- for administering botulinum toxin type A for migraine and tension-type headache. *Headache* 2003;43:884-91.
6. Moskowitz MA. The neurobiology of vascular head pain. *Ann Neurol* 1984;16:157-68.
  7. Goetz C, Pappert E. *Textbook of Clinical Neurology*. Philadelphia: Saunders; 1999.
  8. Vaughn R, Pall ML, Haynes SN. Frontalis EMG response to stress in subjects with frequent muscle-contraction headaches. *Headache* 1977;16:313-7.
  9. Guyuron B, Varghai A, Michelow BJ, et al. Corrugator supercilii muscle resection and migraine headaches. *Plast Reconstr Surg* 2000;106:429-37.
  10. Guyuron B, Tucker T, Davis J. Surgical treatment of migraine headaches. *Plast Reconstr Surg* 2002;109:2183-9.
  11. Guyuron B, Michelow BJ, Thomas T. Corrugator supercilii muscle resection through blepharoplasty incision. *Plast Reconstr Surg* 1995;95:691-6.
  12. Knize DM. Transpalpebral approach to the corrugator supercilii and procerus muscles. *Plast Reconstr Surg* 1995;95:52-62.
  13. Lemke BN, Stasior OG. The anatomy of eyebrow ptosis. *Arch Ophthalmol* 1982;100:981-6.
  14. Rasmussen BK, Jensen R, Schroll M, Olesen J. Interrelations between migraine and tension-type headache in the general population. *Arch Neurol* 1992;49:914-8.
  15. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. Headache Classification Committee of the International Headache Society. *Cephalalgia* 1988;8(suppl 7):1-96.