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Nerve Compressive Stitches: A New Surgical Technique for the Treatment of Blepharospasm

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Abstract

Introduction: Blepharospasm (BSP) is a debilitating condition characterized by hyperactivity of the periorbicular muscles. It results in functional blindness, which affects accomplishment of daily tasks. In addition, BSP can cause serious emotional repercussions because of the difficulty that the spasms impose. Treatment is not currently available, but botulinum toxin applications and surgical procedures are good options. However, the application of botulinum toxin has caused temporary and variable results. In many cases, the improvement does not last for more than one week. The current surgical option is total orbicularis oculi myectomy, which offers good results in some cases but may also cause unsightly and variable results with bad aesthetic sequela.

Methods: We performed a pre-auricular incision and carefully isolated the branches of the facial nerve. Next, we applied nerve compressive stitches in the zygomatic nerve, varying the amount according to the level of spasms in each patient.

Results: Three patients underwent surgery and had good outcomes, with total cessation of spasms in two of them. In one case, few spasms remained, which can be resolved with the reapplication of more nerve compressive stitches.

Discussion: Based on the case reports presented here, we can conclude that nerve compressive stitches are revolutionary for the treatment of blepharospasms, presenting a great alternative to the current treatments for the disease. The main advantages of the technique presented here are adjustable, by increasing or decreasing the stitch quantity, the possibility of reapplication in a short period of time with local anesthesia, and presenting immediate results.

Conclusion: The application of botulinum toxin continues to be the primary treatment for blepharospasms. However, for refractory patients or in severe cases, the application of nerve compressive stitches is highly recommended.

Synopsis: This article presents a revolutionary new approach for treating blepharospasm, using the technique of nerve compressive stitches, presenting a great alternative to the current treatments for the disease.

Keywords: Blepharospasms; Benign essential blepharospasm; Nerve compressive stitches; New surgical technique

Key Messages

What is already known on this topic?

Blepharospasm is a debilitating condition without a currently treatment available. To date, there are some clinical and surgery methods that helps the patient, such as botulinum toxin injections and orbicularis oculi myectomy, but with temporary and partial results.

What this study adds

This new technique, different from others, has the main advantages of being adjustable, by increasing or decreasing the stitch quantity, having the possibility of reapplication in a short period of time with local anesthesia, and presenting immediate results.

How this study might affect research, practice or policy

This article presents a revolutionary new approach for treating blepharospasm, using the technique of nerve compressive stitches, presenting a great alternative to the current treatments for the disease. Furthermore, we believe that this technique is revolutionary and can be applied in countless other conditions where there is nervous hyperactivity.

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Introduction

Blepharospasms (BSP), first reported in 1857 by Sir William MacKenzie [1] is a movement disorder characterized by hyperactivity of the muscles around the eye, mainly the orbicularis oculi muscle [2-4].

Primary or benign essential blepharospasm is characterized by involuntary and excessive closure of the eyelids, and not by a secondary cause. This condition currently affects between 20 to 133 people per million [5] and its cause still unknown. Studies suggest an abnormality of the interneurons that mediate the R2 response of the blink reflex in the brain stem [6-8]. Furthermore, the spasms can be classified also as secondary blepharospasms, which are usually caused by diseases on the eye surface.

The disease is characterized by involuntary, synchronous, and bilateral spasms of the orbicularis oculi muscle [3] which can lead, in more severe cases, to permanent eye closure [9] apraxia of eyelid opening [10,11] and increased blinking rate [12,13]. In addition, the disease increases the probability of spreading dystonia to other body regions, principally the cervical and oromandibular areas [14,15].

The condition also has non-motor manifestations, such as sensorial symptoms (burning eye sensation, photophobia, and dry eye) [16-18] sleeping problems (spasms occur 24 h a day) [19-21] possible cognitive dysfunctions [22] and psychiatric disorders [23-25]. The diagnosis is essentially clinical and requires careful consideration of the different manifestations of the disease [26].

To date, the disease has no cure, but there are some treatments available [27] such as photochromatic modulation, botulinum toxin application, pharmacotherapy, and surgical procedures, although these have certain limitations.

Photochromatic modulation

Considering that the vast majority of people with blepharospasms manifest sensory symptoms such as photophobia, many studies have shown an improvement in symptoms after the utilization of photochromatic modulation, principally with the tint of the lens FL-41 [28,29]. However, this treatment is not fully effective since it does not stop the spasms.

Botulinum toxin

Is the first-line and gold-standard treatment method, and its application in the periorbicular muscles causes reversible paralysis in this region, providing temporary relief [4,30,31]. According to Anderson et al. [32] relief was found in 86% of the patients, but the effect lasted only 4 weeks in 13% of the patients. Therefore, even though it is a good short-term solution, the application of the toxin has some issues, such as variable effectiveness [33,34] necessity to increase the dose, need for long-term treatment, and cost [35,36].

Pharmacotherapy

Being a disease involving nervous contraction, drugs such as dopaminergics and agonists of Gamma-Aminobutyric Acid (GABA) and anticholinergics [37] can be used to reduce the spasms. However, the large variability of effectiveness, temporary effects, and huge number of side effects impede the standardization of this method [38,39].

Surgical procedures

These are recommended for toxin-refractory patients, severe cases, or people who do not want to use medications for life. The procedures consist of neurectomy [40] and myectomy [32]. However, peripheral facial neurectomy has a high recurrence rate, and it is associated with side effects like paralytic ectropion, ephiphora, and facial fall [27]. Thus, the main surgical procedure currently used is myectomy, which consists of total or partial resection of the orbicularis oculi, procerus, depressor supercilii, and corrugator muscles [41,42]. However, the effectiveness is still variable and, in some, cases the results are not very aesthetic furthermore, in cases refractory to toxin and myectomy, differential section of the facial nerve has been reported and may benefit patients as an auxiliary procedure [43,44]. However, it has a low success rate and a high probability of paralytic complications [45].

Searching for an effective and less drastic surgical technique that would reduce the current procedure risks led us to develop a new technique consisting of nerve compressive stitches around the zygomatic nerve on both sides to decrease the electrical stimulus that passes through it.

Purpose

The objective of this study was to introduce a new surgical technique of nerve compressive stitches in the zygomatic nerve for the treatment of blepharospasms.

Methods

In a retrospective review, the records of the first three patients who underwent the surgical procedure of applying nerve compressive stitches from April 2019 through May 2020 were evaluated. Evaluation of outcomes was based on the "Blepharospasm severity scale" [46].

Surgical technique

General anesthesia was used in every patient. The procedure starts with a vertical pre-auricular incision passing in front of the ear extending superiorly in a medial direction, contouring the earlobe, and continuing in the retroauricular region, similar to that employed in face lifting. A cutaneous detachment is performed using Viterbo's blunt dissectors [47] starting with the small size, passing through the medium, and ending with the large, in order to detach all the skin from the pre-auricular region at a distance of approximately 4 cm.

After the region was detached, a 25 mm vertical incision was made 1 cm apart from the ear, compromising the Superficial Musculoaponeurotic System (SMAS) and the superficial layer of the parotid, parallel to the ear (Figure 1).

Afterwards, delicate fine-tipped scissors with a 3.5 magnifying glass are used to perform the dissection of the deep part of the parotid, until the buccal and zygomatic branches of the facial nerve are located.

Figure 1: 25 mm vertical incision compromising the SMAS and the superficial layer of the parotid, parallel to the ear, 1 cm apart.

Figure 2: Nerve stimulation of the zygomatic branch.

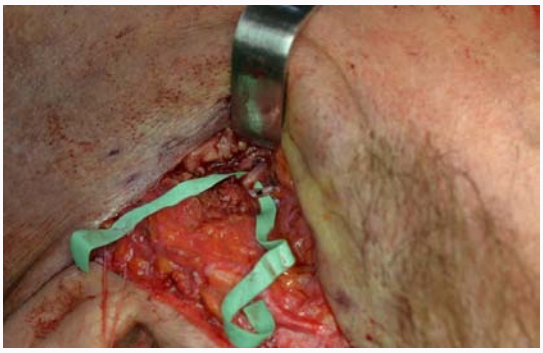

Figure 3: Nerve compressive stitches in the zygomatic branch.

Figure 4: Nerve compressive stiches and looped square knot in the zygomatic branch.

A nerve stimulator is used to identify the branches (Figure 2).

Next, nerve compressive stitches are applied using 5-0 mono-nylon, with an initial double knot and three simpler knots, in order to generate compression in that nervous branch (Figure 3). The initial amount varies depending on the intensity and frequency of spasms. In general, we started with 10 knots- 50% are the "Looped Square Knot" type [48] which can be removed by pulling one end and is left longer for easy identification (Figure 4).

At this point, the anesthetist interrupts the administration of intravenous gauze or medication while maintaining intubation so that the patient wakes up (Awake Test) [49,50]. The patient is asked to open and close the eyelids a few times. Three possibilities can occur: The spasms persist, the patient develops lagophthalmos, or the spasms disappear and eyelid occlusion remains adequate. After the test, the anesthetist resumes anesthesia. If spasms are still present, more compressive stitches are applied. If lagophthalmos is present, some stitches are removed. If eyelid occlusion is present and spasms are

Figure 5: Continuous hemostatic net suture.

absent, the parotid gland and SMAS are closed with simple stitches using a 4-0 PDS thread; the skin incision is continuously suture using a 4-0 mono-nylon thread. Some continuous hemostatic net sutures [51,52] are applied, keeping the skin adhered to the deep structures in order to avoid hematoma and bruising (Figure 5).

Patients were evaluated daily in the days after surgery. If the spasms persist, even at low intensity and frequency, the patient undergoes redo surgery. In this case, local anesthesia is applied to the skin, SMAS, and parotid, and additional compressive stitches are applied. Light sedation with IV midazolam can be used if necessary. The closing procedure is as described earlier.

Postoperatively, the patient is instructed to eat a liquid and pasty diet for 7 days and a non-acidic and non-sweet diet for 21 days. The hemostatic net is removed within 48 h, and the other stitches are removed between days 7 and 10.

Case Series

Case 1

AJML, a 76-year-old man, was diagnosed with blepharospasms when he was 68 years old. The disease condition was severe, and the application of botulinum toxin only showed partial improvement. In April 2019, nerve compressive stitches were applied in the bilateral zygomatic branches. Simultaneously, the patient also underwent neurolysis of the frontal, procerus, and corrugator muscles and a partial myectomy of the orbicularis oculi.

Case 2

RFG, a 52-year-old woman, was diagnosed with blepharospasm at age 48. Her condition was severe, preventing her from performing daily tasks and driving. The patient was refractory to Botulinum Toxin (BTX) therapy. In January 2019, the patient underwent total myectomy of the orbicularis oculi, procerus, depressor supercilii, and corrugator muscles. The procedure had no effect and spasms continued to occur.

In July 2019, nerve compressive stitches were applied in the bilateral zygomatic branches. Simultaneously, the patient also underwent neurotomy of the nasal branch and fat graft application in the region of the previous myectomy.

Case 3

MVN, a 64-year-old woman, was diagnosed with blepharospasm at age 58. The patient's condition was severe, causing partial functional blindness. She received botulinum toxin application; however, it did not have any effect. In May 2020, nerve compressive stitches were applied in the bilateral zygomatic branches. She underwent two more

surgeries one and three days after the first procedure for additional nerve compressive stitches.

The clinical research included in this article complies with the provisions of the Declaration of Helsinki. Written informed consent has been obtained from all patients and relevant persons (such as the parent or legal guardian) to publish the information, including photographs and videos.

Results

The three patients showed good outcomes; their spasms reduced, allowing them to perform daily tasks normally. Patient AJML, who had a severity scale of 5 points in the preoperative period, showed perfect improvement with total cessation of spasms, scoring 0 points postoperatively.

Patient RFG showed marked improvement, considering that her severity scale score reduced from 14 to 7 points. She still had weak spasms, principally when looking up, but this did not disturb her daily tasks. However, as spasms were still noted, further surgery is planned to add a few more stitches.

Patient MVN showed dramatic improvement, with her severity scale score improving from 11 to 0 points. Although she no longer suffers from spasms, her nasal muscle is continually contracted. This will be resolved with a neurotomy and muscle ablation.

Discussion

Blepharospasm, in severe cases, can cause functional blindness and is an incapacitating disease hindering working and daily activities. Many patients report not being able to read, watch television, write, drive, or even walk. For mild cases of benign or secondary essential blepharospasm, the application of botulinum toxin remains the first and main treatment, given its ease of application and lack of necessity to perform surgery.

For cases refractory to botulinum toxin or with reduced effect duration, such as for only 7 to 15 days, surgical procedures are indicated. However, neurectomy can cause unwanted paralysis, and partial myectomy of the orbicularis oculi muscle is associated with a high degree of recurrence. Total myectomy of the orbicularis oculi muscles of the eyes, corrugator, and procerus presents variable results, ranging from excellent to severe and intractable aesthetic lid sequelae. In addition, this procedure requires the dissection of all the thin skin on the upper, lower, and para-orbital eyelids and healing may lead to drastic retractions in patients with very thin skin.

The major advantage of nerve compressive stitches on the zygomatic nerve is that it is adjustable, by increasing or decreasing the number of stitches. It can be reapplied in a short period of time with local anesthesia, shows immediate results, and helps maintain an intact eyelid region.

The Awake test has the advantage of being able to test eyelid movements perioperatively. In the dissection and application of nerve compressive stitches, it is especially important to use an electrostimulator to prevent damage to the buccal branch, which would cause significant damage to the smile and dynamic symmetry of the face.

In some cases, the zygomatic branch has distal branches that innervate the zygomatic muscles. Compressive points should not be applied in these branches. We used 5-0 mono-nylon thread for nerve compressive stitches, as it seemed more appropriate than 6-0, in terms of strength, and 4-0, in terms of flexibility. Experimental studies will probably define the most suitable thread and gauge as well as the number of stitches. We do not rule out testing non-absorbable threads, but we believe that they should be multifilament to ensure that the knot becomes tight over time. Monofilament threads such as nylon can lose strength more easily over time.

Removal of the nerve compressive stitches in cases of lagophthalmos with scissors or scalpels without nerve damage is almost impossible. Therefore, we applied 50% of these stitches, as described by Sasaki et al. [48] with one end. This is not fixed by the knots and is left longer, allowing for its identification and traction. This helps unwind the stitches and allows its nontraumatic removal. The liquid and paste diets for 7 days prevented the mobilization of tissues that could cause hematoma or impair healing.

The non-acidic and non-sweet diet for 21 days allows little stimulation of the parotid gland and little production of saliva, avoiding Sialorrhea and parotid fistula. For over 30 years, we have been treating facial paralysis with intraparotid dissection of facial nerve branches or partial resection of the parotid or submandibular gland in face lifting surgeries. However, we have never encountered a case of parotid fistula, and we have never injected botulinum toxin into these glands.

In some cases, the remaining few spasms can cause the nasal muscle to contract continually. For these cases, we advise neurotomy. Any patient can be operated on if they are fit for general anesthesia.

Conclusion

Despite the small number of cases, the immediate disappearance of the spams and absence of complications led us to conclude that the nerve compressive stitches technique is highly recommended for treatment of severe benign or secondary essential blepharospasm.

Moreover, the procedure is not very invasive and can be adapted to each patient (variability in the number of points) and repeated as needed.

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