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CASE REPORT
Peripheral Nerve

Novel Utilization of the Regenerative Peripheral Nerve Interface Technique after Unsuccessful Nerve Release for Bilateral Frontal Migraines

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Summary: Regenerative peripheral nerve interface (RPNI) is a surgical technique whose indications include preventing or treating painful neuromas after amputation or peripheral nerve injuries. The procedure involves implanting the distal end of a transected peripheral nerve containing sensory fibers into a selected free muscle graft. Although RPNI procedures have primarily been used after limb amputations, select case reports detail the potential for RPNI to mitigate other sources of neuropathic pain, introducing novel uses to its clinical utility. We present the case of a 49-year-old woman who presented to our clinic in June 2021 with chronic frontal migraines with right retro-orbital pain. Bilateral supraorbital and supratrochlear nerve releases with fat grafting were performed in August 2018 via a blepharoplasty approach; however, this procedure was unsuccessful in reducing her neuropathic pain. After discussion with the patient, we elected to proceed with transection of bilateral supraorbital and supratrochlear nerves with RPNI. The postoperative course was uneventful. Follow-up visits up to 1-year postoperative revealed that she had adequate pain control, discontinued her migraine medications, and reported satisfaction with the procedure. The novel RPNI surgical technique may be a low-risk adjunctive option in the surgical management of refractory supraorbital and supratrochlear neuralgia. Future studies should include a prospective randomized controlled trial comparing supraorbital and supratrochlear neurectomy alone to neurectomy with RPNI in refractory supraorbital and supratrochlear neuralgia management. Further exploration of RPNI may reveal additional uses and modifications, which may revolutionize the treatment of neuralgia and other similar ailments. *(Plast Reconstr Surg Glob Open 2024; 12:e5769; doi: 10.1097/GOX.0000000000005769; Published online 29 April 2024.)*

Frontal migraines are thought to occur due to compression of the supratrochlear and supraorbital nerves and, to a lesser extent, the zygomaticotemporal nerve.[1] The conventional sequence of surgical interventions for frontal migraine begins with nerve release.[1] Surgeons may consider a secondary nerve transection as their best next option when such measures yield suboptimal outcomes.[2,3] However, the limitation of nerve transection lies in the unpredictable process of peripheral nerve regeneration that frequently results in the formation of neuromas.[4] Patients with chronic migraines experience lower health-related quality of life and increased healthcare resource utilization, which underscores the need for alternative effective migraine treatments.[5]

Regenerative peripheral nerve interface (RPNI) is a surgical technique whose indications include the prevention or treatment of painful neuromas after amputation or peripheral nerve injuries.[6] The procedure involves implanting the distal end of a transected peripheral nerve containing sensory fibers into a selected free muscle graft.[7] This mitigates the random pattern of peripheral nerve regeneration by localizing the nerve to the boundaries of the muscle graft, ultimately leading to decreased neuroma formation and, thus, decreased pain.[6]

RPNI has been shown in retrospective reviews to reduce neurogenic-related pain and potentially enhance

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prosthetic device control.[6,8] Although RPNI procedures have primarily been used after limb amputations, select case reports detail the potential for RPNI to mitigate other sources of neuropathic pain, introducing novel uses to its clinical utility.[2,9]

Here, we present a case of refractory frontal migraine successfully treated with bilateral supraorbital and supratrochlear nerve RPNI surgery.

CASE PRESENTATION

A 49-year-old woman presented in June 2021 with chronic frontal migraines with right retro-orbital pain. Exacerbating factors included activities of daily living, light, noise, and sexual intercourse. Pain became constant 7 years prior. She denied a history of trauma and vision changes. Previous interventions included trigger point injections, occipital stimulators, Botox injections, and prescription medications, including gabapentin and topiramate, without relief. Bilateral supraorbital and supratrochlear nerve releases with fat grafting were performed in August 2018 via a blepharoplasty approach; however, this procedure was unsuccessful in reducing her neuropathic pain. After computed tomography of her sinuses ruled out craniofacial abnormalities as an etiology of her neuralgia, we planned to perform a transection of the bilateral supratrochlear and supraorbital nerves with RPNI in December 2022.

SURGICAL TECHNIQUE AND CLINICAL COURSE

The previous incision from the blepharoplasty approach in 2018 was used (Fig. 1). Surgical dissection into the orbit provided visualization of the right supraorbital and supratrochlear neurovascular bundle, which were dissected 2 cm proximal to the bony orbital rim (Fig. 2). The associated vessels were taken with bipolar electrocautery, and the nerves were controlled with vessel loops. Small muscle grafts (1 cm × 1 cm × 3 mm) were taken from the superficial aspect of the brachioradialis muscle. Other possible donor sites include vastus lateralis, flexor digitorum superficialis, gracilis, and sartorius. The brachioradialis was chosen, as it has a broad, long muscle belly with adequate tissue for graft harvest. Additionally, it has superficial surgical access with inconsequential morbidity.[10] The muscle graft was subsequently wrapped around the 2.5 cm transected ends of both the supraorbital and supratrochlear nerves separately. The nerve-muscle graft constructs were left in the superficial superior orbit. We then focused on the contralateral side and performed a mirror image operation.

The patient returned for follow-up 6 weeks after the bilateral RPNI in early February 2023. At this appointment, she reported improved pain and decreased migraine medication use. Other than a foreign body sensation in her right upper eyelid, she was doing very well. She returned in late March 2023 for a follow-up visit and reported no migraines but had numbness from the level of her eyebrows and up. She denied the sensation of pins and needles, reported no vision changes, and had symmetric eye-opening. At this March 2023 appointment, she reported discontinuing her migraine medication and was very happy with the results of the RPNI. She continues to have no complaints 12 months postoperatively (Fig. 3).

Fig. 1. Preoperative markings.

Fig. 2. Vessel loop identifying left supraorbital nerve.

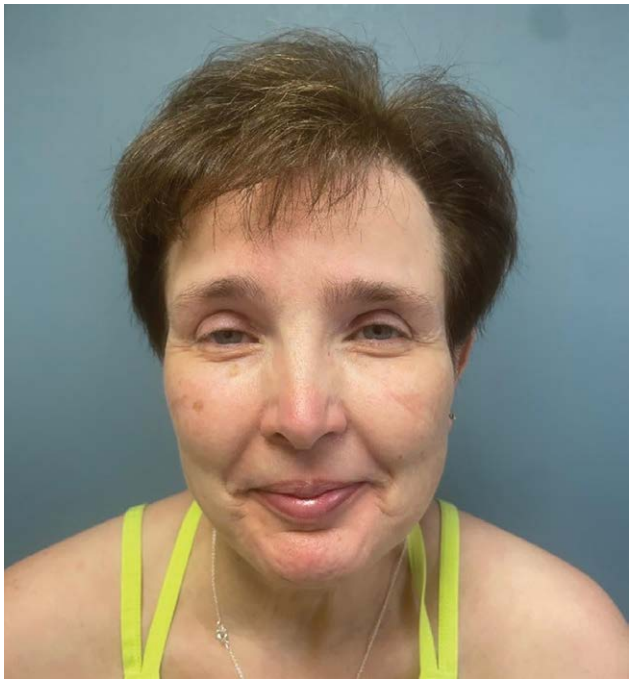

Fig. 3. Patient at last postoperative visit, with surgical scars well healed and hidden.

CONCLUSIONS

The bilateral supraorbital and supratrochlear neurectomy with RPNI surgical technique successfully provided near-total relief of our patient's frontal migraines. This relief persisted from the immediate postoperative setting to her follow-up appointment 9 months later. Although she experienced a transient foreign body sensation and persistent numbness in her forehead, her near-total migraine relief and overall satisfaction with the technique speak positively to this procedure's long-term efficacy and safety. The novel RPNI surgical technique may be a low-risk adjunctive option in the surgical management of refractory supraorbital and supratrochlear neuralgia.

Future studies should include a prospective randomized controlled trial comparing supraorbital and supratrochlear neurectomy alone to neurectomy with RPNI in refractory supraorbital and supratrochlear neuralgia management. Further exploration of RPNI may reveal additional uses and modifications, which may revolutionize the treatment of neuralgia and other similar ailments.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

The patient provided written consent for the use of her image.

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