

# Damaged Insulation Mimicked Symptoms of Occipital Stimulator Lead Migration

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**Introduction:** The use of occipital nerve stimulators for the treatment of migraines has recently been suggested. However, there have been reports of complications, including lead migration causing local muscle stimulation and spasm with local burning sensation and loss of successful neuromodulation.

**Case:** We report a case of a patient who had successful permanent implantation and then presented with suspicion of lead migration. Upon examination of the lead at time of repositioning it was found that the insulation had eroded and the conducting wires exposed at the anchor site.

**Discussion:** Disruption of occipital nerve stimulator lead insulation may mimic lead migration with failure of neuromodulation, spasm, and local burning sensations. Prior to reimplanting, a lead should be thoroughly inspected to ensure there is no mechanical failure. Anchoring should be performed with gentle direct suturing or the use of a protective anchoring device.

**Keywords:** Anchoring, case report, complications, electrodes, headache, lead migration, occipital nerve stimulation

**Conflict of Interest:** Dr. Billy Huh is a member of the speakers' bureau for St. Jude Neuromodulation. The other authors reported no conflicts of interest.

## INTRODUCTION

Chronic daily headache continues to present a management issue to patients and physicians alike. For patients with medically intractable migraines the management options remain limited. In recent years there has been interest, and literature, to support the use of peripheral neuromodulation techniques for the management of chronic primary headache syndromes (1). In particular, it has been suggested that the use of occipital nerve stimulation may play a role in the management of both chronic and transformed migraines (2,3). With the increased application of this modality, reports of complications have followed. Falowski and colleagues followed 28 patients at a single center following occipital nerve stimulator implant and noted a 32% revision rate for lead migration or dislodgement and a 3.6% infection rate (4). Other reviews support this complication rate and comment on the occasional occurrence of localized pain at the lead or generator site (5,6). Hayek et al. have described cases of inadvertent muscle stimulation or spasm, which require lead repositioning (7). We present a case in which a patient who was receiving successful neuromodulation for chronic migraine developed muscle spasm and burning sensation to her left posterior neck triangle. This coincided with the return of her left sided migraine. Upon revision of the lead it was discovered that the lead insulation had been eroded by anchoring sutures, exposing the conducting surface, thus accounting for the symptomology.

## CASE REPORT

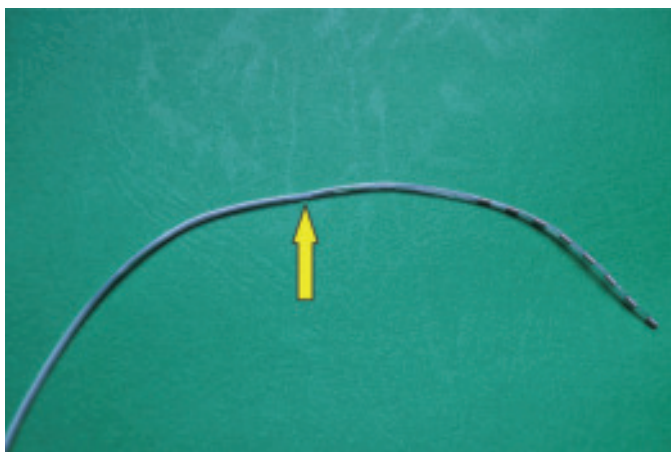
A 19-year-old female patient who had suffered from recurrent bilateral migraine symptoms presented to clinic 28 days after bilateral occipital nerve stimulator implantation (Eon mini<sup>®</sup>, St. Jude Medical, Plano, TX, USA). The patient's chief complaint at this time was loss of

left sided stimulation. The patient continued to report excellent pain relief from her right sided stimulation. Coinciding with analgesic failure was the onset of intermittent left posterior neck triangle muscle spasm and associated burning sensations. Interrogation of the device did not show any alteration to impedance, with the range being from 427 to 557 Ohms. Stimulation settings were 00+–+00, frequency 120 Hz, pulse width 280  $\mu$ sec. Plain film X-ray of the lead sites did not demonstrate any significant migration of the lead from the original positioning. In light of the patient's symptoms the decision was made to optimize lead placement via revision. Following informed consent, the surgery was performed under combination of local anesthesia and intravenous sedation with the patient in prone position with the head slightly flexed. Following dissection through the previous anchor site, fluoroscopy guidance was utilized to isolate the left occipital lead (Octrode<sup>®</sup> 3181, St. Jude Medical, Plano, TX, USA). The lead had been anchored directly with a 2–0 silk suture to fascia in a similar manner to securing a chest tube. This had been a technique chosen in patients with thin cutaneous layers to decrease the bulk of the anchor site. The lead was removed and inspected. It was observed that the insulation at the anchor site had eroded, completely exposing the internal conducting wire (Figs. 1 and 2). A new occipital lead of the same model (Octrode 3181) was

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**Figure 1.** The Octrode lead with arrow demonstrating the point of insulation erosion exposing the internal wires.



**Figure 2.** Close up view of the exposed internal wires at the site of insulation disruption.

tunneled from the fluoroscopic view of the dens along the occipital ridge, superiolaterally, to the inferiolateral border of the left orbit projection, utilizing a 14-gauge Touhy needle. Intraoperative testing was performed, which yielded excellent coverage of the patient's headache and no return of the previous aggravating symptoms. The lead was anchored to the fascia using 2-0 silk and a butterfly anchor. A 1 cm left paramedian incision was then made and the lead was tunneled from the cervical area to the superior gluteal region where the implanted pulse generator was re-exposed, the old lead removed, and the new lead connected. All surgical incisions were then closed and the patient was taken to the recovery room. One hour following the procedure the patient reported excellent analgesia and again denied having the muscle spasm or burning sensation. Stimulation settings were again set to 00+--+00, frequency 120 Hz, pulse width 280  $\mu$ sec. The settings were maintained before and after revision.

## DISCUSSION

The ability to offer surgical options to headache patients that have failed medical management is exciting for pain physicians. First

being reported in 1999, the use of peripheral occipital nerve stimulators is a recent advent into the literature (8). An infrequent but reported complication of this procedure is the inadvertent stimulation of muscles within the posterior neck triangle that is not remedied by reprogramming. In these cases lead repositioning is indicated (7). The authors suggest that prior to proceeding to the operating room the following be performed. First, ensure the impedance of the electrodes is within normal limits. Furthermore, different stimulation settings should be trialed to regain analgesia and avoid aberrant stimulation. Finally, plain films of the leads should be attained to look for migration or fracture. In the aforementioned case, it was felt that lead migration was the cause of the failure of analgesia, muscle cramping, and burning sensation. Without adequate inspection of the anchor site the lead may have been repositioned and the cause of the malfunction may have taken longer to identify. The most likely cause of the insulation breakdown was a combination of the force used for fixation of the knot at the anchor site and the flexion and extension of the cervical spine creating tension at this site. It is suggested that failed leads receive thorough inspection at anchor sites and that protective anchors or gentle direct fixation (avoiding strangulation of insulation) be employed.

The use of occipital nerve electric stimulation can be an effective modality for the management of chronic daily headaches. Like all other neuromodulation techniques, meticulous patient selection, implantation, and management of complications are paramount to providing patients the highest level of care.

## Authorship Statements

Drs. Clarke, Azari, and Huh were all personally involved with the management of the patient from the onset and within the operating theater. Dr. Clarke prepared the manuscript draft with important intellectual input from Drs. Azari and Huh. Drs. Azari and Huh provided significant input for editorial review during preparation of this manuscript. All authors approved the final manuscript.

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## COMMENTS

The revision and complication rate for occipital nerve stimulation remains high even in the most experienced hands. One major reason is that the hardware, including leads, anchors, and extensions, were designed for epidural spinal cord stimulation, rather than stimulation of the subcutaneous peripheral nerve branches. As such, the decreased risk of lead migration via use of standard SCS anchors must be weighed against the potential of these superficial anchors eroding through the skin, or at the very least being uncomfortable or aesthetically displeasing. In this case, anchors were not used and the lead was sutured directly to the fascia. While the authors had initially suspected lead migration when the stimulation pattern changed and the impedances were normal, surgical exploration revealed an erosion of the lead insulation due to the anchoring suture.

This case report suggests that, in such cases, imaging and impedance readings may be non-diagnostic, in that device malfunction can occur in the absence of an overt lead migration or impedance problem. Surgical exploration is thus always warranted in such cases where successful paresthesia coverage and analgesia is lost, despite normal appearing x-rays and normal impedance values. Furthermore, this report is further confirmation that the perfect anchoring technique for occipital nerve stimulation remains elusive.

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The paper illustrates an important issue that plagues the field of peripheral nerve stimulation—the lack of dedicated hardware for this kind of procedures. For almost two decades we have been using devices designed (and approved) for spinal cord stimulation for peripheral nerve stimulation (PNS) applications. Absence of curved and blunt needles, inappropriate rigidity of electrode lead tips and, as documented here, lack of low profile anchors contribute to extremely high rate of complications and revisions. Once this clinical demand is answered and technical issues are resolved, one may expect PNS to become one of the safer, if not the safest, areas of neuromodulation.

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The authors of this case report describe an interesting phenomenon of a burning pain and muscle spasms shortly after uneventful implantation of the occipital stimulation lead.

Usually those symptoms correspond with an intramuscular placement or subsequent lead migration. In this case the cause was broken insulation. It appears odd that an impedance check did not reveal any abnormality. The erosion happened at the anchor site. Direct suturing, without using specialized anchors, is not recommended by manufacturers. However, this is a usual practice in peripheral nerve stimulating lead implantation. It is unlikely that the damage was caused by tension. This would have probably resulted in the lead dislodgement. The described damage could happen, for instance, due to direct needle trauma. Nonetheless, in spite of the fact that the exact cause of the complication remains unclear, the discussion concerning the diversity of complications of neuromodulation is warranted and the authors offer a valuable troubleshooting checklist.

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Comments not included in the Early View version of this paper.