Updated Perspectives on Occipital Nerve Stimulator Lead Migration

Case Report and Literature Review

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Objectives: Patients with occipital neuralgia are often refractory to or intolerant of standard pharmacological and interventional management strategies. Although occipital nerve stimulation (ONS) may provide a unique alternative for such cases, a steep technical learning curve still exists. Lead migration (LM) is among the most challenging issues facing implanters performing ONS implantation. We present an unusual case of LM after ONS implantation and discuss technical aspects for successful revision.

Methods: A retrospective review of medical records and fluoroscopic images was conducted to provide a case report of ONS LM and revision. A PubMed online search for the keywords occipital, stimulation, migration, and revision was also performed for literature review.

Case Report: A 35-year-old man with refractory occipital neuralgia had loss of greater occipital nerve paresthesia coverage and worsened occipital headaches 11 months after ONS implantation using a midline approach. Fluoroscopic imaging confirmed lateral LM. Although most LMs occur in the lateral-to-medial trajectory, this case was unique in that LM occurred from a medial-to-lateral trajectory despite using current standard safeguards.

Discussion: In an era in which reducing health care expenditures is becoming increasingly important, current complication rates could curtail future acceptance and utilization of ONS. This fact and our case report underscore the importance of a continued drive toward technical advances and a reduction in complications associated with this important treatment modality. Further prospective investigation into the mechanism of action, mechanism of complications, optimization of surgical techniques, and long-term efficacy is warranted.

Key Words: occipital neuralgia, occipital nerve stimulation, lead migration, lead revision

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Headache remains among the most debilitating pain conditions, accounting for lost work days, decreased health-related quality of life, profound psychological impact, and increased health care costs.[1] Occipital neuralgia (ON) is a primary headache syndrome defined by the International Headache Society as paroxysmal shooting or stabbing pain in the dermatomes of the greater occipital nerves (GON) or lesser occipital nerves (LON).[2] Although the incidence of ON in the United States has not been reported, it is generally held that ON contributes to considerable pain and disability.[3]

Patients with occipital headache who have failed multiple pharmacological treatments including those for neuropathic pain, and who have significant but short-lasting relief with occipital nerve block or pulsed radiofrequency,[4] are considered candidates for occipital nerve stimulation (ONS). Since 1999, ONS has been an accepted treatment modality for refractory ON.[5–7] Although the precise mechanism of action remains unclear, ONS produces an electric field circumferential to the lead, creating paresthesias in the occipital nerve dermatomes. It has been hypothesized that subsequent blockage of occipital nerve afferent input through stimulation may reduce central sensitization at the level of the C2 dorsal horn, thereby breaking the cycle of trigeminocervical coupling and reducing chronic headache.[8,9]

ONS has been shown to be effective in numerous studies. A systematic review of ONS for ON or transformed migraine revealed a 70% to 100% success rate, although the evidence is limited by the lack of randomized controlled trials.[10] Slavin et al[6] described a 70% success rate in patients undergoing ONS for ON. In a recent study, approximately 90% of patients treated for occipital neuralgiform headache with ONS reported a reduction in medication use, and 64% of patients had reduction in the number of headaches.[7] In addition, ONS for various headache syndromes including chronic migraine shows promise as more prospective studies are conducted.[11]

Nevertheless, it has been documented that by 60 months after implantation, an average of 2 operations are required for patients who have undergone ONS implantation because of complications.[12] Among these complications, lead migration (LM) remains a pervasive problem despite recent advances in technology. In an era in which reducing health care expenditures is becoming increasingly important, current complication rates could curtail future acceptance and utilization of ONS. We highlight a major problem facing ONS implanters by presenting an unusual case of LM after ONS implantation and discuss technical aspects for successful revision.

CASE REPORT

We report a case of LM in a young man with long-standing ON who obtained excellent relief and improved quality of life after ONS revision. We describe the nature of LM, proposed mechanisms, and details regarding the successful revision.

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ONS Implantation

A 35-year-old man with a history of congenital hydrocephalus had intractable right-sided occipital headaches since the age of 14. He underwent surgical resection of a large arachnoid cyst in the right temporal region, as well as multiple shunt revisions. However, the right-sided headaches persisted. Evaluation by his neurosurgeon excluded shunt malfunction. His neurologist referred the patient to our Pain Treatment Center. He had clinical evidence for the diagnosis of ON including positive Tinel sign in both the GON and LON distributions. He ultimately failed trials of medication including naproxen, dexamethasone, gabapentin, duloxetine, tramadol, hydrocodone, oxycodone, hydromorphone, methadone, suboxone, and antiemetics. He then underwent occipital nerve block and 2 subsequent pulsed radiofrequency treatments of the right GON and LON, all providing short-term relief. Given that the headache syndrome continued to progress, interfered with activities of daily living, and decreased the patient's quality of life, he agreed to undergo an ONS trial using a single lead placed on the right side. He obtained > 50% relief of his right occipital head pain. One month later, he underwent ONS implantation (Fig. 1) of 1 Boston Scientific model SC-2208-70 Linear ST 70 cm 8-contact lead using a midline approach. Thereafter, he reported consistent coverage of the desired pain areas and was able to return to work with improved daily functioning and quality of life.

ONS LM

Approximately 11 months later, the patient returned to the clinic reporting an increase in right occipital headaches. Interrogation of the ONS system confirmed that perfect capture of his occipital neuralgiform headaches was no longer possible. Although stimulation paresthesia coverage in the distribution of the LON was obtained, GON coverage was lost. Our clinical experience using the midline approach revealed that most reported migrations with ONS tend to migrate from lateral to medial, toward the midline, resulting in loss of LON coverage and possibly even GON coverage with more significant migration. Surgical planning took into consideration the possibility that the patient's lead may have migrated laterally, as this could be the only real possibility to describe the loss of GON but not LON coverage. A radiograph taken in our clinic seemed to confirm lateral migration of the lead (Fig. 2).

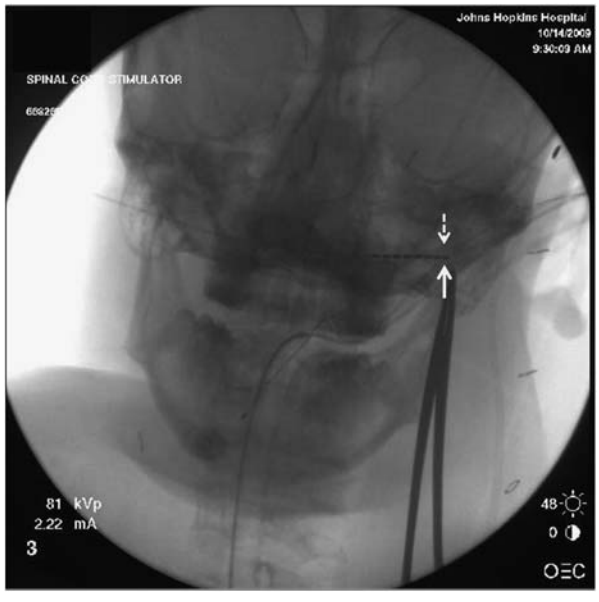

FIGURE 1. Lead placement. Anteroposterior view of octopolar lead tip placement (solid arrow) at the medial edge of the mastoid process (dashed arrow) along the occipital ridge.

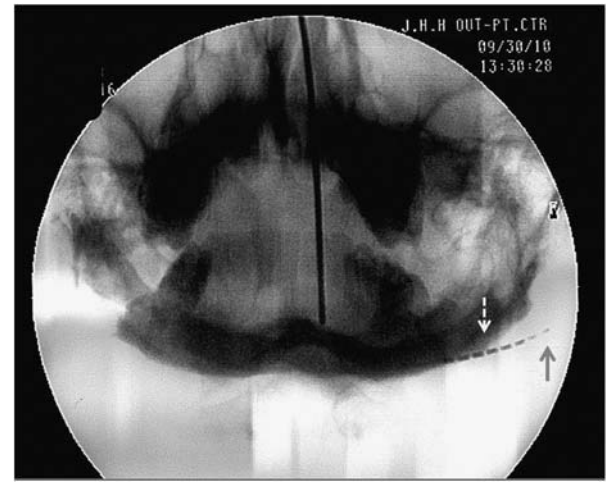

FIGURE 2. Lead migration. Anteroposterior view of lateral migration of the octopolar lead tip (solid arrow) beyond the medial border of the mastoid process (dashed arrow).

ONS Revision

After obtaining written informed consent, induction of general anesthesia and endotracheal intubation were performed, and the patient was placed on the operating room table in a prone position. The patient's occipital area was prepped and draped in the usual sterile manner.

We obtained an anteroposterior (AP) fluoroscopic image to identify the lead position. As originally identified in the clinic, 2 electrodes and interelectrode spaces were identified laterally beyond the desired location, the medial edge of the mastoid process. The distal-most electrode was located beyond the lateral edge of the mastoid process. This became more evident upon direct comparison with fluoroscopic images taken from the previous implantation when concordant paresthesia coverage was obtained.

Next, we infiltrated the scar of the previous occipital incision site with a local anesthetic. A 3-cm vertical incision was made over the previous scar using a 15-blade scalpel, and dissection down to the level of the lead anchor was guided by visual inspection and manual palpation while taking great care to avoid lead encroachment. Meticulous hemostasis was achieved using electrocautery. Upon surgical exposure of the lead-anchor complex, 1 intact 0-ticron suture was identified as being securely tied around the midpoint of the silicone anchor, flanked by 2 0-ticron sutures securing the anchor to the fascia. Next, using blunt dissection, a subcutaneous pocket was undermined to the left to expose 2 cm of the lead proximal to the lead anchor. Upon attempting to tease the lead proximally, initial resistance to lead movement was encountered, suggesting a lead "memory." With careful steady tension using a Kelly clamp with rubber boots, the lead was then found to move within the anchor, enabling lead adjustment. We carefully pulled the lead by 2 cm through the lead anchor proximally. Then, under live fluoroscopy, several attempts of lead adjustment were made until proper lead placement was confirmed. The lead tip was placed at the level of the medial border of the mastoid process, identical to lead placement during the previous implantation (Fig. 3). Next, to secure the lead at the level of the anchor, one 0-ticron suture was tied around the anchor, which was already secured to the occipital fascia. In addition, using an angiocath device, 1 mL of medical-grade glue was carefully applied within the lead anchor encircling the lead itself. Next, the excess lead was carefully tucked within the undermined plane, allowing for strain relief. Repeat fluoroscopy confirmed correct lead placement. We then irrigated the wound with copious amounts of Bibiotic solution and again confirmed hemostasis. The incision edges were easily

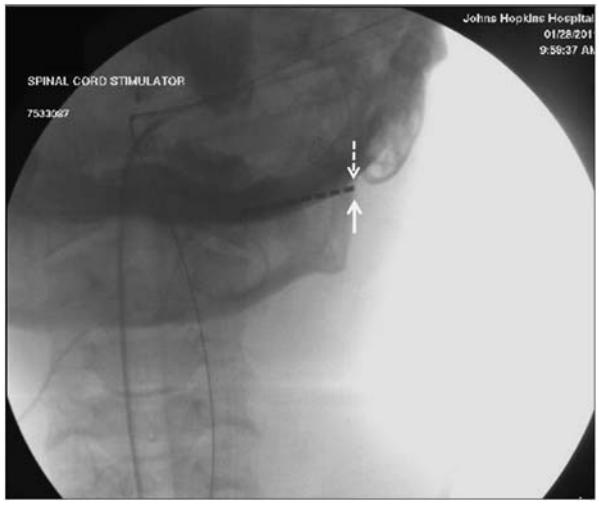

FIGURE 3. Lead revision. Anteroposterior view of octopolar lead tip placement (solid arrow) at the medial edge of the mastoid process (dashed arrow) along the occipital ridge.

approximated, and thus, the wound was closed with 3 horizontal mattress sutures using 2-0 Nylon and sealed with skin glue.

Follow-up

At 8 weeks after revision, the patient continued to report excellent paresthesia coverage over the GON and LON distributions, identical to the benefit received from initial implantation.

DISCUSSION

Technical Aspects of ONS Implantation

The technique of ONS implantation was introduced by Weiner and Reed in 1999.[5] Variations of this technique have since been described by Trentman and Zimmerman[13] in 2008. ONS has been performed under local or general anesthesia.[13] We prefer general anesthesia for ONS implantation to reduce patient discomfort, especially because subcutaneous tunneling is such a noxious stimulus, and also to maximize sterility.

The approach to skin entry using a midline versus lateral incision has been debated, and the rationale for both approaches has been described.[13] In the lateral approach, a skin incision is made in the submastoid region, and a single lead can be inserted from a lateral-to-medial trajectory and advanced across the occipital midline in an effort to provide bilateral stimulation coverage. For the medial approach, skin incision is made in the occipital midline, and the lead (or leads if bilateral placement is desired) is inserted from a medial-to-lateral trajectory toward the mastoid process. Oh et al[14] described a midline or lateral approach depending on the predominant pain location, proposing the midline approach for bilateral transformed migraine and the lateral approach for unilateral ON.[14]

For the midline approach, which is favored in our institution, a 2 to 3 cm vertical midline incision is made with careful dissection down to the occipital fascia. Meticulous hemostasis is especially important, as the occipital scalp region is a highly vascular area, and this helps protect against the risk of hematoma and subsequent infection, a well-described complication of ONS implantation. A subcutaneous pocket is created by undermining the incision. The purpose is 2-fold; the pocket creates an area large enough for anchoring the lead and allows for a strain-relief loop of the lead, both of which are designed to prevent LM.[13]

Generous local anesthetic infiltration creates a wheal along the proposed path of the 14-gauge Tuohy needle. Next, the needle is inserted in a medial-to-lateral trajectory, from the incision along this path to the desired location. It is important to place the lead in the subcutaneous fat, superficial to the fascia. This prevents direct muscle stimulation if the lead is placed too close to the fascia. In contrast, care must be taken to prevent the lead placement from being too superficial, with risk of lead erosion. The mastoid process is the lateral-most fluoroscopic landmark for placement of the needle tip.

Typically, a lead is carefully inserted through the Tuohy needle under live fluoroscopy until resistance is met at the tip of the needle. At this point, the most proximal electrode should be confirmed by AP fluoroscopy at or slightly lateral to the midline. Once lead position is satisfactory, the Tuohy needle is carefully removed under live fluoroscopy, taking care to keep the lead tip at its desired location. Lead placement should overlap the GON and LONs over the occipital ridge.

A silicone anchor is secured to the lead, and the lead-anchor complex is secured to the occipital fascia using nonabsorbable sutures at the lead exit site in the occipital pocket. In addition, medical-grade silicone glue can be administered between the lead and the anchor to form a bond. The lead is looped in the pocket and tunneled toward the implantable pulse generator (IPG) pocket. One or more counter-incisions with strain-relief loops may be used along the path of the tunneled lead to the IPG pocket. The wounds are then copiously irrigated and closed. There is no consensus as to the preferred anchor configurations, suture materials, or suture techniques. After the surgical procedure is completed, a fluoroscopic image should be obtained to document final lead position.

LM in ONS

Major complications with ONS include LM, infection, lead erosion, loss of effect, localized pain, and muscle spasm. Reviews of complications after ONS have been provided.[13] LM is among the most frequent and bothersome complications of ONS. LM is defined as displacement of the wire from its original desired location because of mechanical stress on an ONS component resulting in loss of effective stimulation.

Incidence

Reports on the incidence of LM have been highly variable and conflicting. For example, migrations leading to surgical revision have been reported to range between 9% and 12% of implanted cases,[11,15] whereas higher rates of LM have been reported by Schwedt et al,[16] reaching 100% of their cases by 3 years after implantation. Falowski et al[12] used a midline 2-cm incision, fashioned a subcutaneous pocket above the occipital cervical fascia, anchored the lead to the fascia with 2 neurolon sutures, provided a strain-relief loop, and placed the IPG either in the buttock, chest, or abdomen depending on patient preference. Some of their cases also included an additional paraspinal incision, pocket, and strain-relief loop. In their study, which included 60 months of follow-up, LM occurred in 7 of 28 patients, about which 54% required revision at 8 weeks, 39% by 4 weeks, and 31% by 2 weeks.[12]

Mechanism

The mechanism of ONS LM is still unclear. In one center's experience of the midline approach,[12] some leads were found to slide freely within the anchor. If the lead migrates toward the midline, patients may note a sudden change in their stimulation pattern and have increased cervical pain and spasm. Cervical x-rays typically reveal the lead having migrated medially toward the midline, with the lead coiled in the occipital pocket or having migrated further toward the IPG. Oh et al[14] hypothesized that percutaneous cylindrical electrodes migrated as a result of anchor dislodgement due to muscle spasm at the skull base. In addition, head and neck trauma has been implicated in LM.[12]

Incision Site

Choice of incision site has been implicated in LM. When compared with the lateral approach, it has been suggested that the midline approach may be associated with a lower rate of LM resulting from lead strain with neck flexion and from lateral rotation of the head.[17] This may be partly because of the tensile strength of the occipital fascia, which is accessed by the midline approach, versus that of the submastoid fascia for the lateral approach. There is debate as to which approach ultimately subserves the best outcomes.

Anchors and Sutures

Choice of anchors, suture materials, and suture techniques may also be implicated in LM, although literature addressing these issues is lacking. There is no consensus as to the preferred anchor configurations, device manufacturer, suture materials, or suture techniques at present. Prospective evaluations addressing these issues are warranted.

IPG site

The IPG site has long been a subject of debate as there are no prospective in vivo studies investigating ideal IPG placement and risk of LM. Trentman et al[18] noted that among 10 healthy volunteers performing flexion/extension movements, lead to pocket length changes were significantly less from either the midline or retromastoid incisions to the infraclavicular pocket when compared with periscapular or gluteal pathways. Trentman et al[19] purported that the gluteal region is associated with much greater stress on the lead due to the highly mobile low back, when compared with low abdomen or infraclavicular sites, and describes the retromastoid-to-infraclavicular approach. Patient position has implications for anesthesia management, including choice of airway and the time necessary for patient preparation in the operating room.

Techniques for Preventing LM

Proposed safeguards against LM have included the use of a silicone anchor placed around the lead with nonabsorbable sutures and securing the lead-anchor complex to the occipital fascia using nonabsorbable sutures. Other common techniques include the use of medical-grade silicone glue, which can be administered between the lead and the anchor, and a strain-relief loop tucked into a subcutaneous pocket. In a recent retrospective review of 28 patients who underwent ONS implantation, a second incision with an additional strain-relief loop was associated with a significant reduction in lead revision from 62.5% to 10%.[12] In addition, patients are instructed to minimize head and neck movement after implantation, even with soft collars, to allow time for scarring to occur around the leads and anchors for stability. Nevertheless, there are no reported outcome studies to suggest a preferred technique to minimize the risk of LM.

TABLE 1. Characteristics of Occipital Nerve Stimulator Lead Migration

Authors	Study Design	No. Cases	Diagnosis	Implant Technique (Incision, Lead, IPG)	Incidence of Lead Migration	Time Until Migration	Direction of Lead Migration
Weiner and Reed[5]	CS	13	ON	L, C, various	1/13	> 8 mo	NR
Slavin et al[6]	CS	14	ON	L, C, A	1/14	> 12 mo	NR
Melvin et al[7]	CS	11	Occipital Headache	M/L, C, A	1/11	NR	NR
Popeney and Aló[15]	CS	25	Episodic migraine	M, C, NR	9/25	NR	NR
Magis et al[20]	CS	8	Drug-resistant chronic cluster headache	L, P, A	2/8	Patient 1: 12 mo Patient 2: time not reported	NR
Gofeld[21]	CR	1	ON	L, C, B	1/1	1 wk	Toward incision site (submastoid)
Slavin et al[22]	CS	30	Craniofacial pain	L, C, A	1/30	NR	NR
Schwedt et al[23]	Review	15	Chronic headache	M, C, various	15/15	33% at 6 mo, 60% at 1-2 y, 100% at 3 y	NR
Burns et al[24]	CS	8	Cluster headache	M, C, A	1/8	11 mo	NR

Note the paucity of data on the direction of lead migration. Trentman and Zimmerman[13] illustrated a typical case of lateral-to-medial lead migration using a midline incision approach to implantation. Gofeld[21] reviewed a case of lead migration using the submastoid approach. Apart from this, the direction of lead migration has been underreported.

A indicates anterior (ie, infraclavicular, pectoral, abdominal) IPG; B, buttock IPG; C, cylindrical or percutaneous lead; CR, case report; CS, case series; IPG, implantable pulse generator; L, lateral (retromastoid) incision; M, midline incision; NR, not reported; ON, occipital neuralgia; P, paddle or surgical lead.

CONCLUSIONS

To our knowledge, and based on a literature review (Table 1), this is the first case report of lateral LM after ONS implantation using a midline incision approach. Our patient developed LM approximately 11 months after implantation, well beyond the expected timeframe when scar formation is theorized to enhance security of the lead-anchor-fascial complex. However, studies suggest that LM rates may in fact be higher than commonly reported, as revealed by long-term follow-up.[12,19]

The mechanism of LM in our case is unclear. Head or neck trauma, infection, and muscle spasm did not seem to precede loss of capture and cannot be attributed to migration. The usual safeguards as proposed by previous technical assessments with ONS were followed.[13] During ONS revision, significant resistance was met upon attempting to tease the lead proximally. Only after several attempts with moderate tension were applied was eventual movement of the lead realized. This "lead memory," as achieved with a secure lead-anchor-fascial complex, combined with scar tissue formation, may help explain why proximal LM was less likely to occur in our case. However, during the implantation, it is possible that a track was created too far laterally upon placement of the Tuohy needle, leading to an undesired path of least resistance. This underscores the importance of ensuring a true AP fluoroscopic view to identify the exact lateral boundary where the Tuohy needle and lead tip should be placed, with care not to overshoot the target.

Major lessons that can be learned from this case include the following: (1) LM may occur in either the medial or lateral direction; (2) loss of greater but not LON paresthesias should prompt fluoroscopic evaluation for possible lateral LM; (3) obtaining a true AP view for identifying medial and lateral landmarks for needle and lead placement is paramount; and (4) LM may still occur despite following currently available safeguards.

In summary, it is clear that patients with occipital headache are often refractory to conventional medical and interventional treatments, leading to significant pain and disability. An accurate diagnosis is critical to optimizing the chances for success with treatment. Although ONS may offer an alternative treatment, a steep technical learning curve remains, as exemplified by our case report. LM, the most common complication of ONS, is one of the main barriers to success. It has been documented that by 60 months after implantation, an average of 2 operations are required for patients who have undergone ONS implants.[12] In an era in which reducing health care expenditures is becoming increasingly important, current complication rates could curtail future acceptance and utilization of ONS. This underscores the importance of a continued push toward technical advances to reduce complications associated with this important treatment modality. Further prospective i nvestigation into the mechanism of action, mechanism of complications, optimization of surgical techniques, and long-term efficacy is warranted so that ONS remains a viable treatment option for refractory headache.

REFERENCES

1. Bussone G, Usai S, Grazzi L, et al. Disability and quality of life in different primary headaches: results from Italian studies. *Neurol Sci*. 2004;25(suppl 3):S105–S107.
2. IHC. IHSCS. International Classification of Headache Disorders. The International Classification of Headache Disorders: 2nd edition. *Cephalalgia*. 2004;24:1–160.
3. Hammond SR, Danta G. Occipital neuralgia. *Clin Exp Neurol*. 1978;15:258–270.
4. Vanelderen P, Rouwette T, De Vooght P, et al. Pulsed radiofrequency for the treatment of occipital neuralgia: a prospective study with 6 months of follow-up. *Reg Anesth Pain Med*. 2010;35:148–151.
5. Weiner RL, Reed KL. Peripheral neurostimulation for control of intractable occipital neuralgia. *Neuromodulation*. 1999;2:217–221.
6. Slavin KV, Nersesyan H, Wess C. Peripheral neurostimulation for treatment of intractable occipital neuralgia. *Neurosurgery*. 2006;58:112–119.
7. Melvin EA Jr, Jordan FR, Weiner RL, et al. Using peripheral stimulation to reduce the pain of C2-mediated occipital headaches: a preliminary report. *Pain Physician*. 2007;10:453–460.
8. Bartsch T, Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain*. 2002;125:1496–1509.
9. Bartsch T, Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain*. 2003;126:1801–1813.
10. Jasper J, Hayek S. Implanted occipital nerve stimulators: systematic review. *Pain Physician*. 2008;11:187–200.
11. Saper JR, Dodick DW, Silberstein SD, et al. Occipital nerve stimulation for the treatment of intractable chronic migraine headache: ONSTIM feasibility study. *Cephalalgia*. 2011;31:271–285.
12. Falowski S, Wang D, Sabesan A, et al. Occipital nerve stimulator systems: review of complications and surgical techniques. *Neuromodulation*. 2010;13:121–125.
13. Trentman TL, Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache*. 2008;48:319–327.
14. Oh MY, Ortega J, Bellotte JB, et al. Peripheral nerve stimulation for the treatment of occipital neuralgia and transformed migraine using a C1-2-3 subcutaneous paddle style electrode: a technical report. *Neuromodulation*. 2004;7:103–112.
15. Popeney CA, Aló KM. Peripheral neurostimulation for the treatment of chronic, disabling transformed migraine. *Headache*. 2003;43:369–375.
16. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimulation for chronic headache long-term safety and efficacy. *Cephalalgia*. 2007;27:153–157.
17. Kapural L, Mekhail N, Hayek SM, et al. Occipital nerve electrical stimulation via the midline approach and subcutaneous surgical leads for treatment of severe occipital neuralgia: a pilot study. *Anesth Analg*. 2005;101:171–174.
18. Trentman TL, Mueller JT, Shah DM, et al. Occipital nerve stimulator lead pathway length changes with volunteer movement: an in vitro study. *Pain Pract*. 2010;10:42–48.
19. Trentman TL, Slavin KV, Freeman JA, et al. Occipital nerve stimulator placement via retromastoid approach. *Stereotact Funct Neurosurg*. 2010;88:121–125.
20. Magis D, Allena M, Bolla M, et al. Occipital nerve stimulation for drug-resistant chronic cluster headache: a prospective pilot study. *Lancet Neurol*. 2007;6:314–321.
21. Gofeld M. Anchoring of suboccipital lead: case report and technical note. *Pain Pract*. 2004;4:307–309.
22. Slavin KV, Colpan ME, Munawar N, et al. Trigeminal and occipital peripheral nerve stimulation for craniofacial pain: a single-institution experience and review of the literature. *Neurosurg Focus*. 2006;21:E5.
23. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimulation for chronic headache—long-term safety and efficacy. *Cephalalgia*. 2007;27:153–157.
24. Burns B, Watkins L, Goadsby PJ. Treatment of medically intractable cluster headache by occipital nerve stimulation: long-term follow-up of eight patients. *Lancet*. 2007;369:1099–1106.