

# ΘΕΡΑΠΕΙΑ ΙΝΙΑΚΗΣ ΝΕΥΡΑΛΓΙΑΣ ΜΕ ΤΗ ΧΡΗΣΗ ΠΑΛΜΙΚΩΝ ΡΑΔΙΟΣΥΧΝΟΤΗΤΩΝ: ΑΝΑΣΚΟΠΗΣΗ ΒΙΒΛΙΟΓΡΑΦΙΑΣ ΚΑΙ Η ΕΜΠΕΙΡΙΑ ΤΗΣ Β ΝΕΥΡΟΛΟΓΙΚΗΣ ΚΛΙΝΙΚΗΣ ΤΟΥ ΕΚΠΑ

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## Περίληψη:

**Εισαγωγή:** Η αποτελεσματικότητα της συμπτωματικής φαρμακευτικής αγωγής στην ινιακή νευραλγία είναι συχνά περιορισμένη. Η θεραπεία ωστόσο με τη χρήση παλμικών ραδιοσυχνοτήτων, μια ελάχιστα επεμβατική διαδικασία κατά την οποία εφαρμόζονται παλμικές ραδιοσυχνότητες στα ινιακά νεύρα υπό συγκεκριμένες συνθήκες και παραμέτρους, είναι αποτελεσματική με διάρκεια κάποιες φορές πέραν των 6 μηνών. **Μέθοδοι:** Περιγράφουμε τρεις ασθενείς με ινιακή νευραλγία, ανθεκτική στις φαρμακευτικές θεραπείες, οι οποίες υποβλήθηκαν σε θεραπεία με παλμικές ραδιοσυχνότητες (PRF). **Αναφορές Περιστατικών:** Τρεις Καυκάσιες γυναίκες παρουσίασαν επίμονη κεφαλαλγία, συσφικτικού χαρακτήρα εντοπισμένη ή προερχόμενη από την ινιακή περιοχή με παροδική ύφεση του άλγους μετά από τον αποκλεισμό των ινιακών νεύρων. Το σύνολο αυτών των ασθενών έπασχαν από ινιακή νευραλγία πληρώντας τα κριτήρια της 3<sup>ης</sup> έκδοσης της Διεθνούς Εταιρείας Κεφαλαλγίας για την διάγνωσή της. Η αρχική εμφάνιση των συμπτωμάτων ήταν από τουλάχιστον 10 χρόνια πριν. Οι ασθενείς είχαν ήδη δοκιμάσει αντιφλεγμονώδη και μυοχαλαρωτικά, γκαμπαπεντίνη, πρεγκαμπαλίνη και τρικυκλικά αντικαταθλιπτικά (TCA) σε κατάλληλες δόσεις και για αρκετό χρονικό διάστημα χωρίς ικανοποιητική ανταπόκριση. Στην επανεξέταση στους 3 και στους 6 μήνες από την εφαρμογή της θεραπείας με PRF εκτός από τον πόνο και η ευαισθησία στην πίεση και την ψηλάφηση της ινιακής περιοχής ήταν μικρότερη και στις τρεις ασθενείς μας ενώ δεν παρατηρήθηκαν ανεπιθύμητες ενέργειες. Στη συνέχεια η θεραπεία επαναλήφθηκε και αναμένουμε τα νέα αποτελέσματα. **Συμπέρασμα:** Αν και απαιτούνται περαιτέρω μελέτες που να περιλαμβάνουν μεγαλύτερο αριθμό ασθενών με ινιακή νευραλγία, τα ευρήματά μας έδειξαν ότι η εφαρμογή PRF στα ινιακά νεύρα μπορεί να είναι μια αποτελεσματική θεραπευτική επιλογή για τον έλεγχο αυτής της ανθεκτικής μορφής κεφαλαλγίας.

**Λέξεις Ευρετηρίου :** Ινιακά Νεύρα, Ινιακή Νευραλγία, Παλμικές Ραδιοσυχνότητες, Θεραπεία με Παλμικές Ραδιοσυχνότητες

## PULSED RADIOFREQUENCY IN THE TRATMENT OF OCCIPITAL NEURALGIA: LITERATURE REVIEW AND SINGLE-CENTER EXPERIENCE

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## Abstract:

**Introduction:** Even though various medications and procedures are used to treat occipital neuralgia, their effectiveness is sometimes limited. Radiofrequency pulsed therapy is a minimally invasive procedure in which the occipital nerves are treated with radiofrequency waves, a procedure that is effective, drug free and lasts for several months, often in excess of 6 months. **Methods:** We report three cases with occipital neuralgia, resistant to conservative therapies, who underwent pulsed radiofrequency therapy (PRF). **Case**

**Reports:** Three Caucasian women presented with persistent headache, localized or originating in the occipital region. All three patients suffered from occipital neuralgia according the International Headache Society criteria for occipital neuralgia, 3<sup>rd</sup> edition and complained of chronic tight headaches mainly located in the occipital region. Their diagnosis confirmed by undergoing an anesthetic nerve block. The initial onset of the symptoms was more than 10 years ago. The patients had already tried anti-inflammatory drugs and muscle relaxants, gabapentin, pregabalin and tricyclic antidepressants (TCA) in appropriate doses and for a sufficient period of time without satisfactory response. On re-examination at 3 and 6 months respectively, pain as well as sensitivity to pressure and palpation of the occipital region was reduced to all of our patients and no adverse effects were observed. Subsequently, the treatment was repeated and we are waiting for the results. **Conclusion:** Although further studies including a larger number of patients with occipital neuralgia are needed, our findings showed that PRF in occipital nerves may be an effective therapeutic option for the control of refractory headache.

**Key words:** occipital nerves, occipital neuralgia, pulsed radiofrequency, pulsed radiofrequency treatment

## Introduction

Occipital neuralgia is a neurological condition that involves shooting, shocking, throbbing, burning, or aching pain, generally starting at the base of head and spreading along the scalp unilaterally or bilaterally. The scalp may become tender and extremely sensitive to the point where a light touch can cause severe pain (allodynia). Causes of occipital neuralgia include injury, pinched nerve, tight neck muscles, nerve compression, infection or inflammation [1].

Pulsed radiofrequency (PRF) is a minimally interventional pain management technique that has been effective in the treatment of chronic pain. PRF treatment is carried out by delivering a low-energy electrical field in rapid pulsations to target nervous tissue and associated microglia. PRF is not ablative, but instead neuromodulating, treating a variety of chronic neuropathic pain disorders [2].

Herein, we present three Caucasian women diagnosed with occipital neuralgia, displaying moderate or no response to all treatments indicated for their disease.

## Cases description

### Case 1

Patient 1 was a 78-year-old woman who visited our tertiary headache center due to occipital neuralgia over a period of 15 years. She complained of bilateral, pressing tightening pain of moderate intensity in the regions overlying the occipital nerves. She experienced about 12 episodes of headache every month. The patient had a history of arterial hypertension and hyperlipidemia, under treatment. Thorough diagnostic work-up excluded other possible etiologies.

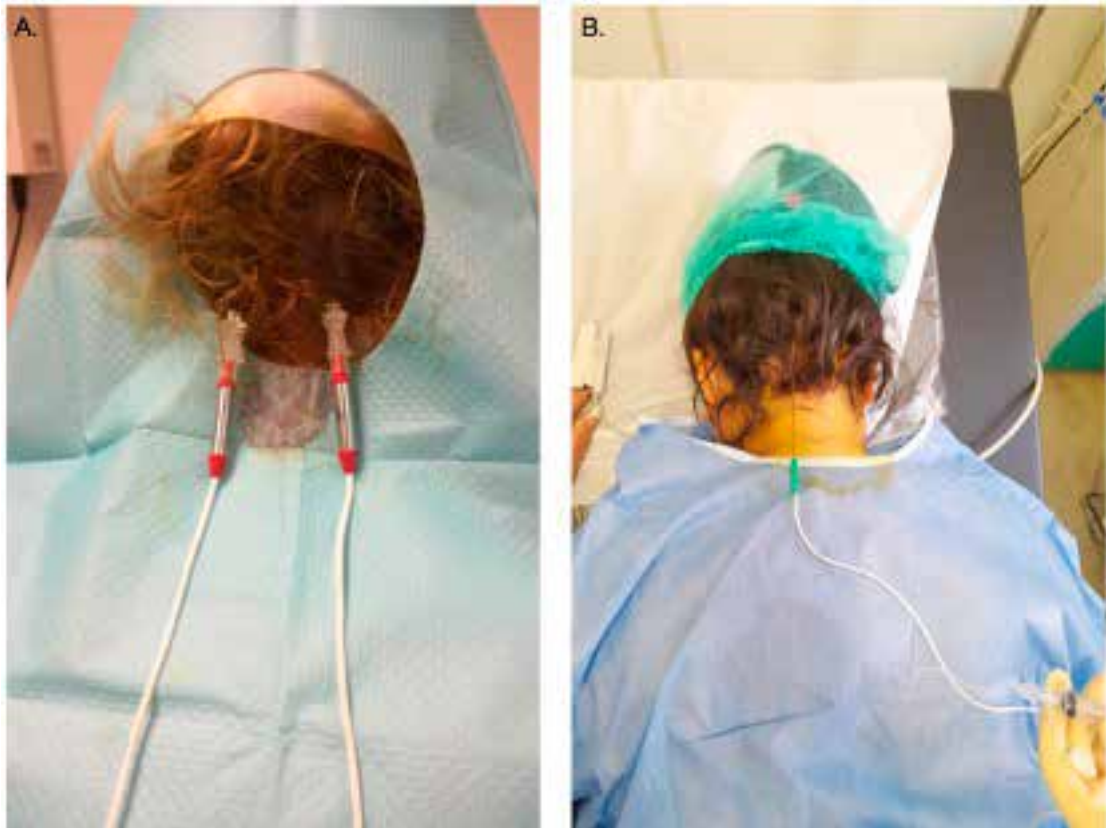
Over the years she tried various therapeutic regimens. Acute drug therapy included simple analgesics

or non-steroidal anti-inflammatory drugs (NSAIDs) such as naproxen, ibuprofen and diclofenac. She had over 10 years received amitriptyline, mirtazapine and venlafaxine without any pain relief.

We performed PRF stimulation on occipital nerves bilateral. The aseptic technique was applied during PRF procedure. The patient was maintained in the prone position. We searched occipital nerves (ON) with anatomical signs. The greater occipital nerve (GON) was found superficial to the obliquus capitis inferior muscle at this level bilaterally. The lesser occipital nerve (LON) was found at the lateral 1/3 of the external occipital protuberance to the mastoid process. After identifying the nerves, the catheter needle was inserted, and the sensory simulation test was carried out using an RF generator. The PRF treatment was administered under the constraint that the temperature of the electrode tips did not exceed 42°C for 4 minutes. This was followed by occipital nerve block with 1.5 ml of 0.5% bupivacaine and 10 mg of dexamethasone and lidocaine (Figure 1A). The patient was followed up for 6 months. There was a substantial improvement that was maintained until the 6th month. No adverse effects of the procedure were reported.

### Case 2

Patient 2 was a 39-year-old woman who presented to our outpatient department for occipital neuralgia for over 10 years that was not responding to usual pharmacological treatment. Pain was sharp and shooting slightly more on the left side. Pain would travel up to the vertex, especially with the lateral bending of head. The patient did not give any history of trauma to the cervical spine or head. Her medical history was unremarkable and her routine laboratory investigations as well as brain Magnetic Resonance Imaging (MRI) were normal. She had been treated with different non-steroidal anti-inflammatory drugs, muscle relaxants as well as antidepressants without



**Figure 1.:** PRF application in our patients

response. Neurological examination showed pain, that could be elicited by pressure on the point of distribution areas of GON.

We performed PRF stimulation on GON bilateral, in the same way as in the previous patient (Figure 1B). There was a great improvement that was maintained during the follow up period of 6 months.

### Case 3

Patient 3 was an 82-year-old woman who suffered from occipital neuralgia, arterial hypertension, Meniere's disease and fibromyalgia as well as interstitial lung disease. She visited our headache center due to occipital neuralgia. She reported bilateral stabbing pain in the posterior part of scalp and apparent allodynia during innocuous stimulation of hair. She had tried various preparations including simple analgesics or non-steroidal anti-inflammatory drugs (NSAIDs) as acute drug therapy and amitriptyline, pregabalin and duloxetine in the context of prophylactic treatment. No pain relief effect had been presented.

The extensive diagnostic workout was negative for secondary causes of headache. We followed the same technique as in our aforementioned patients, without complications. There was a great improvement that was maintained throughout the follow-up period of 6 months.

### Discussion

Occipital neuralgia is a neuralgiform disorder defined as paroxysmal, shooting or sharp pain in the distribution of occipital nerves. The pain originates in suboccipital region and radiates over the vertex. Hypo- or dysesthesia in the dermatome of ON, as well as tenderness to pressure over the course of ON can accompany the pain. The pain intensity is often severe and debilitating, with a negative impact on the quality of life and functionality. Most cases of occipital neuralgia are idiopathic, or in the context of various primary headaches without a clearly identifiable etiology<sup>[3]</sup>. The treatment of occipital neuralgia poses inherent challenges. Conservative treatment options such as physiotherapy and pharmacotherapy are usually tried. When occipital neuralgia is refractory to pharmacotherapy there is the alternative application of PRF to the occipital nerves, showing long-term efficacy.

PRF is a minimally invasive percutaneous technique as exposing the targeted neural structure to a train of short-duration, high-voltage radiofrequency (RF) pulses (500kHz) rather than ablation by a continuous RF current, with zero to minimal neurodegeneration and a favorable side effect profile<sup>[4]</sup>. Nerves are identified following the anatomical landmarks described in the literature, with the target point for the GON

**Table 1.:** Published studies reporting patients with occipital neuralgia, treated with pulsed radiofrequency

Author	Year	Number of Patients	Percentage (%) of patients with pain relief	Duration of follow up (months)
Foska A, et al.	2024	3	100	6
Cohen SP, et al.	2015	17	N/A*	6
Choi HJ, et al.	2012	10	80	7.5
Huang JH, et al.	2012	102	51	3
Vanelderen P, et al.	2010	19	52.6	6
Navani A, et al.	2006	1	100	5

\*: Response was estimated as the relief (mean difference) of occipital pain favors PRF group in 3 months

being one-quarter to one-third of the distance of the line connecting the external occipital protuberance with the mastoid process, medial to the occipital artery. Similarly, for the LON, the target point is located two-thirds of the distance from occipital protuberance up to mastoid process. The accurate position of the needle is confirmed using electrical stimulation, with repeated adjustments in order to maximize nerve stimulation at the lower possible voltage (with target being  $< 0.4\text{mV}$ ) [5].

To date, six studies have evaluated the pain-reducing effects of PRF on occipital nerves, showing overall favorable outcomes (Table 1). Navani et al. in 2006 described a case of a 62-year-old man with a 43-year history of left suboccipital pain where PRF of GON demonstrated 60-70% pain relief that was sustained for 4 months after initial treatment and for 5 months after the second treatment [6]. Vanelderen et al. in 2010 conducted a prospective analysis of 19 patients with ON treated with PRF with just over half of patients reporting a decrease in pain and resultant medication use [7]. In a retrospective analysis, by Huang et al. in 2012, 51% of ON patients treated with PRF reported  $>50\%$  reduction in pain relief at a 3-month follow-up [8]. In a retrospective clinical study, concerning PRF neuromodulation in occipital neuralgia and consisting of ten patients, pain relief for at least 6 months was observed [9]. The efficacy of PRF of the occipital nerves was compared with steroid injections in a multicenter, randomized, double-blind, comparative-effectiveness study published in 2015 [10]. Patients had occipital neuralgia or migraine with occipital nerve tenderness. Forty-two patients received local anesthetic and normal saline followed by three cycles of PRF treatment per targeted nerve. Thirty-nine patients received local anesthetic mixed with steroid and three cycles of sham PRF. Six weeks later, pain reduction was significantly greater in PRF group compared to steroid group; this persisted through the 6 months follow-up [10]. The most recent study was an observational, open-label, prospective study, describing fifty-seven

patients suffering from chronic headache including, chronic migraines, cluster headaches, tension-type headaches, and occipital neuralgia. Participants underwent PRF, which improved the number and the pain intensity of headache episodes per month [11].

The mechanisms underlying the pain relief following PRF stimulation have not been clearly demonstrated. Published data suggest that PRF modulates the early gene c-Fos, which is responsible for the development of the second m-RNA, "preprodinorphan", of the endogenous opioid system. PRFs analgesic properties are also mediated through the noradrenergic, serotonergic, and endogenous opioid inhibitory pain pathway, suggesting peripheral and central modulating action [12]. Another theory suggests that it is achieved by applying a low-intensity electric field around the sensory nerves, conduction in the C- and A-delta fibers is reduced.

In conclusion, we reported 3 patients with occipital neuralgia resistant to conventional therapy, who showed a strong positive effect of PRF on the occipital nerves. Several limitations need to be acknowledged. First, each outcome measure is subjective and dependent on personal interpretation, which limits the objectivity of the study. In addition, the small sample sizes of the published studies limit the power of the reported findings. Moreover, to date, no randomized controlled trials have been conducted in patients with occipital neuralgia [13]. Although further studies involving larger number of participants with occipital neuralgia are still needed, our initial observations showed that PRF in the occipital nerves may be an effective therapeutic option for the control of refractory occipital neuralgia.

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- Consent to publish: The patients have consented to the submission of the case report to the journal.

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