



Trigeminal Neuralgia and Radiofrequency

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ABSTRACT Trigeminal neuralgia is a painful neurological disorder often mistaken for pain of dental origin by the patient and dentist. Dentists should be acquainted with TN to differentiate it from orofacial pain and prevent unnecessary tooth extraction. TN pain-alleviating modalities are numerous, yet not uniformly effective. Radiofrequency, known for 25 years, is a minimally invasive outpatient procedure used for TN when drugs are ineffective. The authors evaluate RF in TN patients referred from the dental office.

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Trigeminal neuralgia, TN, is an excruciatingly painful neurological disorder often confused with dental pain. Dentists are often the first clinicians confronted by patients with TN. Differentiating this type of pain from dental pain may be difficult for dentists. Examples of patients whose teeth have been needlessly extracted by dentists in hope of a cure are not uncommon. Management of trigeminal neuralgia consists of a variety of different treatment modalities, each having its own success rate in alleviation of the signs and symptoms depending both on the type of TN and characteristics of the patient (i.e., age, coexisting problems, etc.). Modalities of treatment are numerous, yet not without complications and not uniformly successful in alleviating the painful symptoms of this disease. The management of TN has

been challenging for clinicians who are often confronted primarily with these patients. Furthermore, due to the high number of complications following surgical and nonsurgical ablative approaches for TN, the authors aimed to assess the success and complication rate of radiofrequency, RF, in the management of TN patients referred by dentists in a six-year study. This article seeks to acquaint the practitioner with TN and present diagnosis and treatment modalities.

Materials and Methods

From 2000 to 2006, a six-year retrospective study was conducted based on data from 65 patients treated for clinically documented TN (according to Winn's criteria: the presence of 1) unilateral paroxysmal stabbing pain limited to the branches of the trigeminal nerve; 2) tender trigger zones; 3) frequent pain-

free intervals between pain sessions; 4) response to anticonvulsants; and 5) the absence of neurological defect) at the department of neurosurgery.¹

Patients with a history of surgery or pathological conditions (i.e., tumors, etc.) were excluded. All patients had previously undergone pharmacologic treatment protocols (carbamazepine, antiepileptic drugs such as gabapentin, as well as cannabinoids etc., for several months to a year), which were or had become ineffective.

Informed consents from the patients were included in the documents of all 65 patients. File data including patient demographics, gender, age, presence of trigger zone, side of involvement, nerve branch involved, total/partial success, frequency of RF, and post-treatment complications were assessed. All diagnoses and treatment procedures were done by one neurosurgeon. All patients were treated as outpatients.

RF was repeated in cases with persisting pain despite the use of 600 mg of carbamazepine daily during the first month following RF therapy (due to the ineffectiveness of the first RF treatment). Settings of the RF unit were as follows: temperature 70- to 90- degrees Celsius, time length 80-90s, current intensity of 40-130mA, and voltage of 15-60V.

Straight electrodes were preferred for neuralgia of the third branch and curved electrodes for neuralgia of the first and second branches of the trigeminal nerve.

In the authors' study, total success was defined as complete pain relief with no need for further pharmacologic intervention. Partial success was defined as significant pain relief that could be further managed by medication (a maximum of 600 mg carbamazepine daily), and failure as the presence of the same level of pain immediately following RF or recurrence of the same level of pain within a month

after RF not managed by medication.

The data was recorded, classified using SPSS software, and statistically analyzed using the Pearson chi-square, odds-ratio and Fisher's exact tests. Values were considered significant if $p \leq 0.05$.

Results

Sixty-five patients 36 (55.4 percent) females and 29 (44.6 percent) males with a mean age of 52.4 ± 14.4 (ranging from 21-75) years were studied. A total of 51 (78.5 percent) patients were successfully treated; 14 (21.5 percent) were unsuccessful (TABLE 1). TN was more common in patients 50 years or over in 41 (63.1 percent) cases ($p \leq 0.05$). TN was unilateral 63 (96.9 percent) and bilateral in 2 (3.1 percent) cases, respectively ($p \leq 0.05$). In addition, it was of the typical type in 52 (80 percent) patients and atypical in 13 (20 percent) cases ($p \leq 0.05$). Separate involvement of V1, V2, and V3 branches was observed in 4.6 percent ($n=3$); 32.3 percent ($n=21$); and 40 percent ($n=26$) of the cases, respectively.

Combined involvement of V1 + V2, V1 + V3, and V2 + V3 was seen in 3.1 percent ($n=2$), none, and 13.8 percent ($n=9$) of the cases, respectively. Involvement of all three branches was seen in 6.2 percent ($n=4$) of the cases. The success rate was significantly higher for patients with defined trigger zones (74.5 percent), compared to those without trigger zones (25.5 percent). There was no need to repeat RF for the majority (72.3 percent) of the patients ($p \leq 0.05$).

Discussion

Diagnostic Comparison and Differentiation of Dental Pain and Trigeminal Neuralgia

Dental pain. Severe dental pain can result from pulpitis or periapical infection. In the case of pulpitis, the patient often has nocturnal pain exacerbated by

heat as well as radiographic findings such as caries or deep restorations. Pain from a periapical infection not yet apparent on X-ray can result in a patient with the previously mentioned radiographic findings or a patient with endodontic treatment. In this condition, the tooth is felt to be extruded, painful upon percussion, and painful to palpation in the vestibule over the apex of the tooth root; however, pain does not involve the face or skin. In dental pain, the facial skin is not involved and the cause is often apparent and the pain usually responds to analgesics. Radiographic findings are usually diagnostic and the origin of pain can be traced to the oral cavity, tooth or gum via clinical and paraclinical examination.

TN pain. TN is an excruciatingly painful, neuropathic, facial disorder typically presenting as paroxysmal or abrupt pain lasting from several seconds to one or more minutes and rarely up to several hours.

The pain from TN is said to feel like stabbing, electric shocks occurring spontaneously or following stimulation of a trigger zone.¹ Idiopathic trigeminal neuralgia occurs in 1/100,000 people and is found more frequently in patients over 50 years of age.² It may be typical (i.e., with paroxysmal pain only) or atypical (i.e., with association of a permanent background of pain). The skin of the face is painful upon TN attacks in the area innervated by V1, V2 or V3 of the trigeminal nerve; radiographic findings are lacking and pain is not necessarily nocturnal. An etiology often cannot be found. The pain is severe and may ensue even by talking or swallowing. Analgesics are usually ineffective. Radiographic findings are not diagnostic and the origin of pain cannot be traced to the oral cavity via clinical and paraclinical examination. However, there may be a trigger point in the oral cavity that sparks the attack.

TABLE 1

Demographics and Characteristics of TN Patients and the Results of RF Therapy

P-values ≤ 0.05 are significant. An odds ratio greater than 1 indicates that the condition or event is more likely in the first group. As can be seen from the data, TN was typical in 80 percent, involved V3 in 50 percent, and had trigger zone in 74.5 percent ($p < 0.05$). RF was successful in 78.5 percent, and done once in 72.3 percent of the patients ($p < 0.05$).

Characteristics N=65		The Results of RF Therapy		Test Results P-Value	Odds Ratio
		Successful (n=51) 78.5%	Unsuccessful (n=14) 21.5%		
Gender	Male 29	49% (25/51)	28.6% (4/14)	0.230	
	Female 36	51% (26/51)	71.4% (10/14)		
Age Mean 52.4 (21-75 yrs.)	Under 50 years	29.5% (15/51)	64.3% (9/14)	0.017	4
	50 years and older	70.5% (36/51)	35.7% (5/14)		
Side	Unilateral	96% (49/51)	100% (14/14)	1.00	
	Bilateral	4% (2/51)	0% (0/14)		
Type	Typical 80%	92.2% (47/51)	35.7% (5/14)	0.00	21
	Atypical 20%	7.8% (4/51)	64.3% (9/14)		
Involved nerve branch	V1 and V2	2% (1/51)	7.1% (1/14)	0.077	
	V1, V2 and V3 3.1%	2% (1/51)	21.4% (3/14)		
	V2 and V3 13.8%	13.7% (7/51)	14.3% (2/14)		
	V1 4.6%	3.9% (2/51)	7.1% (1/14)		
	V2 32.3%	31.4% (16/51)	35.8% (5/14)		
Side	V3 40%	47% (24/51)	14.3% (2/14)	0.06	
	Right	70.6% (36/51)	28.6% (4/14)		
Defined trigger zone	Left	29.4% (15/51)	71.4% (10/14)	0.00	17
	Present 74.5%	74.5% (38/51)	14.3% (2/14)		
Radio frequency	Not present 25.5%	25.5% (13/51)	87.5% (12/14)	0.507	
	Twice	25.5% (13/51)	35.7% (5/14)		
	Once 72.3%	74.5% (38/51)	64.3% (9/14)		

Temporomandibular Joint Pain. TMJ pain is found over the joint in the area of the tragus; it is often seen with signs and symptoms such as clicking, locking, difficulty in mastication, limited mouth opening, bruxism, and pain in the muscles of mastication. The pain is not a stabbing or shocking pain and can be elicited by palpating the joint. The patient often complains of pain in the ears and often seeks treatment from an oto-

laryngologist. Clinical and MRI examination often reveals the joint disorder.

Treatment

Treatment of TN Is Possible via Both Surgery and Medication

Medical approach. The medical approach is usually employed first in an attempt to treat TN noninvasively. This is usually accomplished using anticon-

vulsants. Carbamazepine is the classic medication of choice for this purpose. Long-term studies, however, have shown a gradual decrease in its efficiency over time. Initial response to this medication approximates 80 percent. After 10 years however, its effectiveness decreases to 50 percent.³ Other antiepileptic drugs such as gabapentin, as well as cannabinoids, have also been used.

Other methods. Another method by

which to manage TN is neurectomy. It has been reported to be successful in 88.2 percent of the patients but also has been reported to cause facial anesthesia in 2.7 percent of the patients.² Balloon compression is another method used to treat TN patients in which initial pain relief prevalence has been reported in 93 percent, but, unilateral facial sensory loss has been reported in 61 percent of the patients.⁴ Use of microvascular decompression, MVD, for TN caused by venous pressure is another effective method of treatment in which the pain recurrence ranges from 31.0 percent to 75 percent, within one to three years after the initial operation due to development of new veins around the nerve root in 87.5 percent of the cases.⁵ This is a major neurosurgical operation that may have serious complications, as well as prolonged convalescence.

Radiofrequency. RF is a well-known treatment modality to manage TN.

It is a form of electromagnetic energy waves that move together at the speed of light.⁶ Based on the studies of Kanpolat (1,600 patients treated during 25 years), Scrivani (250 patients treated during five years), Choudhury (40 patients treated during two years), and Ernest (258 patients treated during four years), RF proved successful in 97.6 percent, 92 percent, 77.7 percent, and 87 percent of TN cases, respectively.⁷⁻¹⁰

RF, although a modality of management known for 25 years, is still used by many. It is a short outpatient procedure with minimal side effects. Various reports regarding the success rate of this type of treatment have been published.

This study evaluated treatment results following RF in patients suffering from TN referred by dentists. In the authors' study, TN involved both genders almost equally which is approximately consistent with the findings of Kanpolat, Scrivani, and Taha who reported the female predi-

lection to be 62.1 percent, 69 percent, 65 percent respectively.^{7,8,10} In the authors' series, patients 50 years or older were more frequently involved (63.1 percent). This proved consistent with the findings of Katusic.² The mean age was 52 years, which is similar to the findings of Kanpolat (56 years) and younger than Taha (63 years).^{7,10}

RF proved also to be more successful in patients of 50 years or older (70.5 percent) compared to younger cases ($p \leq .05$). Unfortunately, the authors have not found an assessment on the success rate of RF according to age groups. Therefore, it was not possible to compare the accuracy of the authors' results. TN was

IT IS A SHORT outpatient procedure with minimal side effects.

unilateral in 96.9 percent of the cases in the authors' series ($p \leq .05$), which is supported by Kanpolat's study (96 percent).⁷

In the authors' study, the typical type of the disease was four times more frequent (80 percent) than the atypical type. Fromm and Sweet had also claimed the typical form to be more common.^{13,14} The authors found that RF therapy in the typical form of the disease results in significantly more successful outcomes (92.2 percent). V₃ was the most frequently involved branch (40 percent). Scrivani measured this value to be 38 percent, which is consistent with the authors' findings.⁸ On the other hand, Taha and Tew found V₂ and V₃ to be the most frequently involved branches (40 percent).^{10,12}

In the authors' series, TN involved

both sides of the face almost equally (61.5 percent on right), which was similar to the findings of Kanpolat (65 percent on right) and Tew (60 percent on right).^{7,11} This value was found to be 67.5 percent by Taha.⁹

The success rate in patients with defined trigger zones (74.5 percent) was significantly higher compared to those without trigger zones (25.5 percent). RF was not repeated in 72.3 percent of the cases. This is in line with the findings of Kanpolat (76 percent) and Gusmao (75 percent).^{7,15} Scrivani however, measured this value to be 89 percent.⁸

In the authors' study, RF was successful in 78.5 percent of the cases, which is close to the findings of Choudhury (77.7 percent).⁹ This value was reported to be 87 percent by Scrivani.⁸

Other modalities have also been employed for TN. Sheehan reported that the use of gamma knife surgery for TN effected pain relief in 44 percent of 151 patients.¹⁶ Erdine's study demonstrated that unlike RF, pulsed RF when used was not an effective method of pain treatment for idiopathic TN.¹⁷ RF is not free of complications, however. The development of dysesthesia is one of the complications following RF therapy. In its most severe state, it appears as anesthesia dolorosa (burning sensation of the face, eyes, or mouth and its management is very difficult); Kanpolat had 0.8 percent, and Scrivani 0.9 percent.^{7,8} Fortunately, the authors did not have any cases of anesthesia dolorosa.

In the authors' series, they encountered arterial puncture in 7.7 percent of the cases, while it has been reported to be 0.8 percent and 0 percent by Kanpolat and Scrivani, respectively.^{7,8} This may be due to the fact that although the authors used fluoroscopy, in some cases, guiding the needle was difficult. In this complication, the authors aborted the procedure on that day. There was corneal analgesia in 3.1 percent of the patients. This was

reported to be 2.3 percent, and 4.4 percent by Scrivani, and Gusmao, respectively.^{8,15}

The absence of corneal reflex is also possible, occasionally resulting in neuroparalytic keratitis, which has the potential to cause blindness.⁷ Absence of corneal reflex was not recorded in the authors' series. Kanpolat, Sweet, and Taha, however, reported this to be 1 percent, 5.7 percent, and 6 percent, respectively.^{7,14,18,19} The authors did not encounter any cases of neuroparalytic keratitis, and neither did Scrivani and Gusmao.^{8,15} Kanpolat, however, reported a 0.13 percent rate.⁷ Hypertensive crisis occurred in 3.1 percent of the authors' patients, controversially in 19 percent of the cases in the study of Kanpolat, and none in the studies of Scrivani.^{7,8} There were no mortalities. Masseter weakness was not encountered in the authors' study either.

Conclusion

TN was typical in 80 percent, involved V3 in 50 percent, and had trigger zone in 74.5 percent ($p < 0.05$). RF was successful in 78.5 percent, and done once in 72.3 percent of the patients ($p < 0.05$).

Based on this study, RF is an inexpensive, relatively safe, minimally invasive, and effective method for the treatment for typical TN, especially in patients over the age of 50, which is performed on an outpatient basis and can be repeated if necessary to improve results. Percutaneous radiofrequency thermocoagulation of the trigeminal ganglion, PRTTG, may be regarded as the first interventional treatment choice for most patients with TN because of its relative safety and feasibility.²⁰ All patients are treated as outpatients. Moreover, in the authors' center, it is less invasive in comparison to other modalities of treatment, does not require hospitalization, is not time consuming to perform (30-60 minutes), and has a low complication rate. ■■■■

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