



## Radio frequency effects on patients with trigeminal neuralgia

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### ABSTRACT

**Background:** Trigeminal neuralgia is one of the most painful conditions in the head and face. This study was carried out to evaluate the effects and results of RF therapy on patients with trigeminal neuralgia who referred to Amir-alam Hospital.

**Materials and Methods:** In this descriptive study, 84 patients with trigeminal neuralgia pain were studied. Patients were diagnosed based on their medical histories, physical examination, and paraclinical tests. Patients are admitted according to internationally accepted criteria such as the International Headache Society (IHS). The patients responded to the questions in the questionnaire before and after the surgery. In this questionnaire, the pain level of patients is assessed by the Visual Analogue Pain Scale (VAS).

**Results:** The mean pain score before treatment was 7.87, which decreased to 4.83 after the treatment. According to the results obtained in this study, 18 patients (21.4%) felt 4 levels of decrease in pain, as the predominant level of relief. Also, 15 patients (17.9%) did not feel any subtraction of pain after the treatment. Of the 84 patients, only 1 patient experienced the reduction of pain as 9 levels of VAS, after the treatment. There was a significant relationship ( $P=0.000$ ) between the pain severity and the reduction in the amount of pain after the RF in respect to the amount before the treatment. Also, in the regression equation obtained from the study of the effects and role of patients' age, gender, as well as the history of pain in patients before the RF treatment, only the gender of the patients had a significant relationship with the amount of pain reduction and comparison of its pre and post treatment. ( $P=0.054$ ) and ( $B= -0.886$ ) and ( $\beta= -0.216$ ). Also, there was no significant relationship between pain intensity ( $P=0.761$ ), age of patients ( $P=0.829$ ), or history of pain ( $P=0.139$ ) with pain reduction and comparison of pain intensity before and after RF treatment. During the treatment of RF, very few side effects was reported.

**Conclusion:** According to the results, RF treatment is an effective method for reducing pain in both short-term and long-term pain, in patients with trigeminal neuralgia. It is suggested that in patients suffering from the pain resulting caused by trigeminal neuralgia, due to drug resistance or who are intolerance to possible adverse effects, or in patients with lack of response from drug therapy, the therapeutic approach of RF is a valuable way for pain relief.

**Keywords:** Trigeminal neuralgia, Facial pain, Radiofrequency, Interventional approach.

### Introduction

Trigeminal neuralgia is recognized as one of the most painful conditions in the head and face. It is also called TIC-DOULOUREX [1,2], which implies the induction of sudden pain due to the stimula-

tion of the heat or cold or the region's touch [3]. The first writings that refer to the unilateral pain caused by muscle spasms, was in the writings of Aretaeus and Jujani in the 2nd and 11th centuries. Following this Fothagill article in

1773, it spoke of sudden pain and attack caused by trigger zones as its progenitors [4] pain caused by trigeminal neuralgia, from 4 to 5 people per 10,000 involves the person [3]. The main reason for the pain of the disease is compression of the trigeminal nerve root due to arterial flexion or venipuncture, which is adjacent to the brain bridge entry. Also, the pressure caused by some lesions can be the secondary cause, as what should be considered in trigeminal neuralgia [5]. It is said that the pressure from blood vessels on the nerve root causes 90% of spontaneous pain and Electric impulses in the trigeminal neuralgia. However, in some patients, these conditions are due to the age-related processes in which the brain of the patients is atrophied, and the excessive arterial loops that results from it, can cause the nervous pressure [1,2]. Another cause, producing pressure on the trigeminal nerve is the presence of benign tumors in the posterior fossa, such as acoustic neuroma, meningioma, and epidermoid cyst [6,7]. Also another reason for the trigeminal neuralgia are idiopathic agents [1,2].

The pressure on the nerve root can cause the nerve to be demyelinated [1,2]. In areas of the demyelinated nerves, it appears that a number of voltage dependent sodium channels have been altered, and this causes an increase in pain sensation of the area [8]. The disease may occur at any age, although in 90% of cases the patient is older than 40 [9]. The prevalence of trigeminal neuralgia is 2 times higher in women than in men [9,10 and 11].

The pain in the trigeminal neuralgia is usually one-sided, and may occur in a variety of conditions, including pain in the form of a brief electric shock or sharp scald, burning, piercing, or dandy acne, or the appearance of a sharp and hot needle in the body or the feeling of sharp itching in the patients [12,13,14, and 15]. This pain may be specific to one or more regions of the trigeminal nerves and lasts for a few seconds, and in severe conditions for 1-2 minutes. Sometimes it can last for several hours [11,13,15, and 16]. Pain as a sudden attack can involve one or more branches of the trigeminal nerve. This clash usually occurs in the maxillary or mandibular branch [3]. In most cases, only one branch is involved, which is usually maxillary, and in 30% of the case, both maxillary and mandibular branches are involved [17].

Trigeminal neuralgia is usually felt in a defined area of the face called the trigger zone, [10] where a number of factors can trigger this pain, some of these stimuli include washing the face, tooth brushing, etc [2]. Due

to the signs of a disease that is very severe and intolerable, it is not only the patient's body, but also affects the spirit and increases the risk of suicide in these patients [18]. Trigeminal neuralgia detection is usually based on clinical symptoms [6]. The choice therapeutic way to control TN is drug therapy using anticonvulsants [19,20]. This group of drugs, also has several side effects [8,21].

There are different beliefs about the appropriate therapeutic approach in these patients. Some doctors believe in the microvascular decompression (MVD) technique in the brain's fifth neuron, while others find it more appropriate to treat by Glycerol rhizolysis, which is a percutaneous procedure. Other methods include applying radio frequency thermocoagulation (RFT) and balloon compression that damage the terminal part of the trigeminal nerve and prevent the stimulation of the nerve by environmental stimuli [22,23]. Therefore, there are new methods that help with medication. It can reduce or eliminate the pain caused by trigeminal neuralgia, which is currently a type of treatment that uses the radio waves to block the affected part of the nerve and for some time it remains painless. The idea of treatment with this method can be a great help in treating patients who are resistant to drugs, or suffer from the side effects of these medications [24].

RF is a minimally invasive method for tissues, used to treat trigeminal neuralgia [25]. This is an outpatient treatment [26]. The treatment is appropriate for patients who respond well to treating trigeminal ganglion blockage, especially those with a small duration of feeling the pain in each period. The method works by removing the trigeminal ganglion or its roots by the RF. RF therapy is the most commonly used percutaneous surgical procedure for the treatment of trigeminal neuralgia, especially in the elderly [27]. For RF, patients have to stay in MPO at least for 6 hours before surgery. These patients should be given antibiotic prophylaxis 1 hour before surgery. Intravenous access, ECG monitoring, blood pressure and ... should be done routinely. Normally, patients should undergo general anesthesia for surgery [27]. Therefore, we decided to study the therapeutic approach with RF and its efficacy in patients with trigeminal neuralgia pain.

## Materials and Methods

For this descriptive study, 84 patients with trigeminal neuralgia who were referred to the Amir-alam Hospital in Tehran and treated by RF were studied. 84 patients were diagnosed based on history and physical

examination and paraclinical tests. All of these patients were studied regardless of type and severity of pain and only the pain caused by trigeminal neuralgia was considered as the entrance key to this study. This study was conducted in 2016-2017. Patients who will be treated, are approved for diagnosis of trigeminal neuralgia based on internationally accepted criteria such as the International Headache Society (IHS). People who have used other therapies to improve and relieve pain, or use different medications before being referred to the center have been investigated. All of these patients were admitted according to having pain caused by TN, regardless of the age or gender. In this study, a questionnaire was designed in which, in addition to the age and gender of the patients, the time of referral, and the time patient had history of pain before referring to the center were asked. In this questionnaire, patients were asked about the use of drugs or other treatment methods they have had before referring. Also, according to the Visual Analogue Pain Scale (VAS), patients were asked to mark the amount of pain from trigeminal neuralgia before and after RF therapies. In this study, using any calmatives or other methods at post-RF treatment was asked to compare drug usages or other ways patients use to relief pain as well.

## Results

In this study, a total of 84 patients were studied. 44 patients (52.4%) male and 40 (47.6%) female. The youngest patient studied was 30 years and the oldest one was 83. Patient referral time varies from 6 months to 6 years. All of these patients responded fully to the questionnaire and answered all the questions asked. According to SPSS 20 software analysis, out of a total 84 patients, 24 patients (28.6%) had started RF one year before the date of the questionnaire, with the highest number of patients' frequency at the same time. Of the 84 patients, the minimum time of history in pain starts one year before the RF treatment and the maximum time before with a history of pain was 21 years before it, in which the highest frequency of pain initiation before the treatment, was at 5 years before the RF and was reported by 18 patients (21.4%). Of the 84 patients in this study, 38 patients (45.2%) had no pharmaceutical history to relieve the pain caused by TN, and in exchange 46 patients (54.8%), had used at least on painkiller. According to the response of these patients, 16 patients (19%) used at least one other therapeutic method to relieve pain, and 68 patients (81%) did not use any other remedies before RF. In our questionnaire, five types of pain were named, and patients

could identify and describe the type of pain they had by choosing one or more of these options. 33 patients (39.3%) out of 84 patients referred to the "sharp pain" choice. Other choices mostly picked were: stabbing pain (22.6%), pulsar pain (15.5%), radiating pain (13.1%), and dumb pain (8.3%), respectively.

Patients were also to mark if they continued to take medication after the treatment. 64 (76.2%) patients continued to use painkillers after treating RF, but 20 patients (23.8%) did not need to use pain relievers to relieve pain.. Of these patients, 82 patients (97.6%) did not use any other therapies after RF for pain relief, and only 2 (2.4%) patients were using other types of therapeutic approaches in pain relief. In another part of this questionnaire, the pain score was evaluated before and after the treatment. According to the response of the patients, the lowest reported pain rate prior to the RF treatment according to the VAS scale was 3 and the highest was 10. After the treatment, the lowest pain level was reduced to VAS = 1.0, but the highest was still 10. According to these numbers, the mean of pain in the studied population before treatment was 7.87 and after the treatment, this number has fallen to 4.83. (Figure 1).

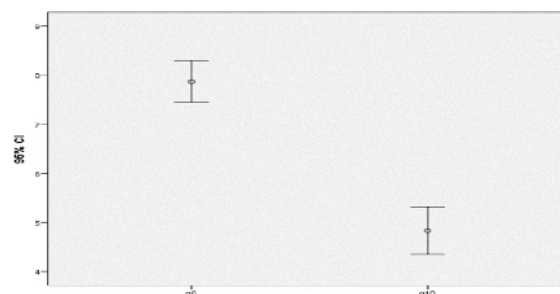


Figure 1. Difference between pain before RF (q6) and after RF (q10).

According to the results of the study, in relation to the frequency in level of pain before RF and after RF, it can be noted that the highest reported pain rate before the treatment was 10 according to the VAS scale, which was 26 patients (31%), But the highest frequency reported by patients after RF treatment was 3 and by 20 patients (23.8%), which significantly shows the reduction of the frequency in pain after treatment among these patients. 18 patients (21.4%) experienced VAS = 4, which had the highest rate of pain reduction in the studied population. Also, 15 patients (17.9%) did not feel any pain reduction after the treatment. 1 patient

reported 9 levels of pain relief according to the VAS scale after the treatment (Figure 2).

It can also be noted that in this study, 26 patients (31%), regardless of the reduction or increasing the amount of pain after treatment, had a more tolerable type of pain after treatment (Pain Tolerability). 58 (69%) patients did not experience any change in type of pain after the treatment, compared to before of it. Interestingly, no one reported a worse feeling after the treatment than before. There was a significant relationship

( $P= 0.000$ ) in the results obtained from study analysis, between pain intensity, and its reduction after the RF. (Table 1).

Also, in the result regression equation from the study of the effects and role of patients' age, gender, and also the history of pain before RF treatment, only the gender of patients had a significant relation with the amount of pain reduction and its comparison to its before the treatment. ( $P= 0.054$ ) and ( $B= -0.886$ ) and ( $\beta= -0.216$ ). (Table 2).

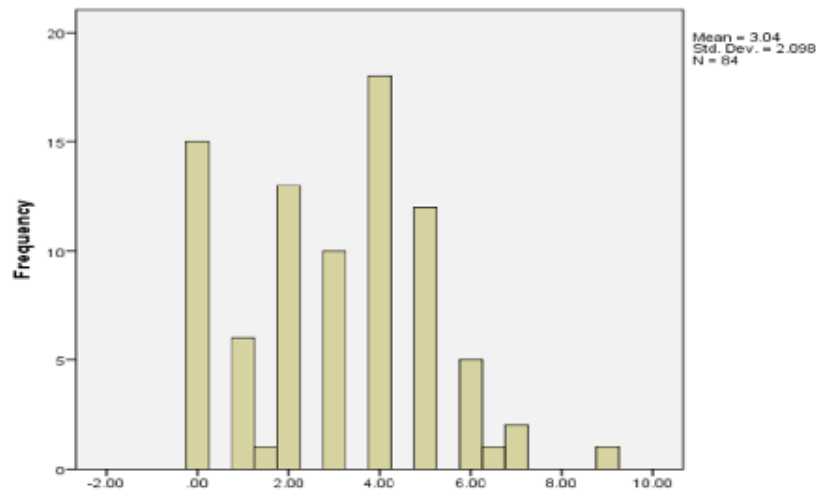


Figure 2. VAS difference of pain intensity between pre-RF and post-RF results.

	<i>q10-q6</i>
Z	-7.249 <sup>b</sup>
Asymp. Sig. (2-tailed)	.000

Table 1.

Model	Beta In	T	Sig.	Partial Correlation	Collinearity Statistics Tolerance
2	Pain.hist	-0.41 <sup>b</sup>	-.305	.761	-.035 .694
3	Pain.hist	-0.21 <sup>c</sup>	-.177	.860	-.020 .870
	age	0.25 <sup>c</sup>	.217	.829	.025 .907
4	Pain.hist	-.072 <sup>d</sup>	-.636	.526	-.072 .968
	age	.054 <sup>d</sup>	.470	.639	.054 .935
	q1	.177 <sup>d</sup>	1.494	.139	.168 .854

- a. Dependent Variable: vas. diff.
- b. Predictors in the Model: (Constans), gender, age, q1.
- c. Predictors in the Model: (Constans), gender, q1.
- d. Predictors in the Model: (Constans), gender.

Table 2.



According to the results, pain changes in females were less than males, and in men more pain reduction was observed after the treatment. No significant relationship between pain intensity ( $P=0.761$ ), age of patients ( $P=0.829$ ), or history of pain ( $P=0.139$ ) with pain reduction and comparison of pain severity before and after RF treatment was seen. During treatment with RF, very few side effects were reported by the patients. Of the 84 patients treated with this method, 3 patients had ecchymosis and 3 patients had hematoma after the surgery. Also, 2 patients suffered from corneal involvements. However, no cases of facial paralysis were reported. Patients with ecchymosis were advised to use ice, patients with hematoma were monitored routinely, and patients with corneal involvement were referred to an ophthalmologist for deliberations, monthly.

## Discussion

The aim of this study was to evaluate the effects of RF treatment on patients with trigeminal neuralgia. The advantage of this study is to have many variables and to examine the relationship between the results of RF treatment and various variables. This disorder affects more than 4-5 in 10,000 people in the world. In our study, the proportion of the genders was 44 men (52.4%) to 40 women (47.4%). The age range of patients who participated in, is 30 to 84 years old. These patients have been referred to the center, for pain caused by trigeminal neuralgia between 6 months to 6 years ago. According to results, before performing RF, patients experienced a VAS score of min. 3 and max. 10, and after the treatment, this reduced to min. 1, while the maximum reported pain rate remained the same as 10. This reduction in pain in the community has been indicative of the success of RF therapy among trigeminal neuralgia patients.

The choice treatment for these patients is drug therapy. Firstly, patients have benefited from many of the anticonvulsants such as carbamazepine, pregabalin, baclofen to control the pain [19 and 20]. Among the problems associated with the use of this class of drugs, side effects such as drowsiness, double vision, inconsistency of the Muscles and Hyponatremia is reported [30,31]. Other problems associated with taking medications include the lack of response from a number of patients to medications, or the drug resistance due to prolonged use of medications, or the intolerance of patients to the drugs [19]. There are also different beliefs about the appropriate therapeutic approach in these patients. Some believe in microvascular decompression (MVD) in the brain's fifth neuron, while others find it more

appropriate to treat by Glycerol rhizolysis, which is a percutaneous procedure. Other methods include radiofrequency thermocoagulation (RFT) and balloon compression, which damages the site of the trigeminal nerves and prevents stimulation of the nerve by environmental stimuli [22,23]. These actions have very little mortality and morbidity rates. Also, the need for complete anesthesia is little in this method [32]. In a study by Benjamin C. Lopez et al. In 2004, out of 175 patients who underwent surgery for pain caused by trigeminal neuralgia, pain relief and healing were reported most frequently in radiofrequency thermocoagulation more than other methods. The report states that nearly three quarters of the patients treated in this way have not experienced any pain after 6 months of treatment.

It was also reported that both long-term results and short-term outcomes of pain relief in RF were found to be significantly better than other surgical methods for the treatment of trigeminal neuralgia [24]. Our results is also from a range of patients who were treated by RF during 6 months to 6 years ago, which makes it comparable to this study. In our study a significant reduction in pain was observed after performing RF in 69 patients. Also, the mean pain of patients after the treatment decreased by VAS=4.83 compared to pre-treatment. Another study by Kanpolat et al in 2001 found that 97.6% of pain was reported immediately after treatment with RF, and this rate was reduced to 40% in the long term follow up [33]. In a study by Wael Fuad et al. In 2011, RF treatment was performed on 312 patients over a 7-year interval. It was seen that the chronic pain in 90% of patients is gone after the treatment and in a long-time follow-up, 58% were still painless.

But paroxysmal attacks remained, which could have been controlled with drug therapy. In this study, the mean age of the disease was 48 years. Since our study came from a widespread 6 years of patients with RF therapy, our results on short-term RF therapy is slightly different from other studies. The mean age of patients in our study is 54 years. In the study of Wael Fuad, side effects were few: initial pain relief was 98%, recurrent pain decreased by 20%, 98% facial anesthesia, minor discomfort of 9% (dysesthesia), anesthesia dolorosa (0.2%), corneal anesthesia 3%, keratitis 0.6%, and finally, no reports of death [34]. In our study, we also had very few side effects. Of the 84 patients treated, 3 patients had ecchymosis (3.5%) and 3 patients had hematoma (3.5%) after the surgery. Also, 2 patients (2.3%) had corneal inflammation (keratitis). However,

no cases of facial paralysis and death was reported. Patients with ecchymosis were advised to use the ice, patients with hematoma complications were monitored routinely, and patients with corneal involvement were referred to an ophthalmologist for deliberations, monthly. The advantage of our study, compared to other studies in the field of pain caused by trigeminal neuralgia, is due to the large number of variables.

In this study, the relationship between the gender and the results from treatment with the RF is measured, which has not been studied in other studies. Also the appropriateness and correlation of the history of pain before RF with the results of treatment is investigated. We also have measured the intensity of pain in patients before treatment and its correlation with post-treatment healings. Our study has a population of high number of patients, which helps to stabilize and produce more reliable results. In our study, no gender limitations nor age limits for patients entering the study were considered, and patients with a wide range of RF times were studied. The dominant results of studies, such as the above, were similar to the results of our study, which all suggest a positive result of the treatment of pain resulting from trigeminal neuralgia by RF.

### Conclusion

According to the results, RF treatment is an effective method for reducing pain in both short-term and long-term patients with pain caused by trigeminal neuralgia. It is suggested that in patients who suffer from pain resulting from trigeminal neuralgia, due to drug resistance or intolerance adverse effects for patients, or lack of response from drug therapy, the therapeutic approach RF is a for pain relief.

### Conflict of Interest

There is no conflict of interest to declare.

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