Journal of Neurological Sciences [Turkish] **33:(2)**# 48; 331-340, 2016
http://www.jns.dergisi.org/text.php3?id=976
Research Article

The Importance of Differential Diagnosis In Trigeminal Neuralgia

Veli CİTİSLİ[1], Feridun ACAR[1], Müge BALSEVEN[2], Canan ÖNDER[3], Serkan CİVLAN[1], Hande ŞENOL[4]

[1]Pamukkale University Medical Faculty, Neurosurgery, Denizli, Turkey [2]Pamukkale University Faculty of Dentistry, Periodontology, Denizli, Turkey [3]Ankara University Faculty Of Dentistry faculty, Periodontology, Ankara, Turkey [4]Pamukkale University medical faculty, Bioistatistics, Denizli, Turkey

Summary

Purpose: Trigeminal neuralgia (TN), is a disease that is located along one or more of the trigeminal nerve branch which is usually characterized by repetitive pain in the form of knife stab and is triggered by chewing and manipulation of gingiva. The initial atypical symptoms of TN pains are called pre-trigeminal neuralgia (PTN). The purpose of this study is by defining symptoms of oral PTN better, to understand the difference between PTN and odontogenic toothache and to evaluate the effectiveness of treatment of microvascular decompression (MVD) method in TN.
Method: A total of 11 patients previously diagnosed with TN (4 women, 7 men; mean age: 57.72) were retrospectively reviewed. In the neurosurgery clinic Pamukkale University School of Medicine, those 11 patients were conducted MVD operation.
Results: A total of 11 patients underwent MVD operation which had previously been diagnosed with TN in our clinic. Pain of 90% of patients who underwent MVD were recovered. In the 2-year follow-up of 3 patients, the 3-year follow-up of 3 patients, 1-year follow-up of 4 patients , it was seen that the pain was not repeated. Only in 1 patient, pain was recurred in the same area in the 4th year and it was decided to reoperate the patient.
Discussion: Although TN is a disease can be diagnosed by any physician, especially the recognition of PTN and dentists to be knowledgeable about differential diagnosis are very important for the treatment of patients and getting rid of their pain. MVD which is heretofore known the best treatment method in TN, is a treatment method which allows the patients to get rid of their pain completely. In this study, it has been shown a painless life is provided for patients with MVD.

Key words: Trigeminal neuralgia, Oral Pre-Trigeminal Neuralgia, Microvascular decompression

Trigeminal Nevraljide Ayırıcı Tanının Önemi

Özet

Trigeminal nevralji (TN), trigeminal sinirin bir veya daha fazla dalı boyunca uzanan, tekrarlayan bıçak saplanması şeklindeki ağrılarla karakterize ve çoğunlukla çiğneme ya da dişetlerinin manüplasyonu ile tetiklenen bir hastalıktır. TN ağrılarının başlangıçtaki atipik semptomları pre-trigeminal nevralji (PTN) olarak adlandırılır. Bu çalışmanın amacı, oral PTN semptomlarının daha iyi tanımlanarak, PTN ve odontojenik diş ağrısı arasındaki farkların anlaşılabilmesi ve mikrovasküler dekompresyon (MVD) yönteminin TN tedavisindeki etkinliğinin değerlendirilmesidir. Daha önce TN tanısı konmuş toplam 11 hasta (4 kadın, 7 erkek; ortalama yaş: 57,72) retrospektif olarak incelendi. Pamukkale Üniversitesi Tıp Fakültesi Nöroşirürji Kliniği'nde bu 11 hastaya MVD operasyonu yapıldı. TN her hekim

tarafından tanısı konabilecek bir hastalık olmakla birlikte özellikle PTN'nin tanınması ve diş hekimlerinin ayırıcı tanı konusunda bilgili olmaları hastaların tedavilerinin yapılması ve ağrılarından kurtulmaları açısınan çok önemlidir. TN tedavisinde şu ana kadar bilinen en iyi tedavi metodu olan MVD yöntemi, hastaların ağrılarının tamamen geçmesini sağlayan bir tedavi yöntemidir. Çalışmamızda, MVD'nin hastalara ağrısız bir hayat sunduğu gösterilmiştir.

Anahtar Kelimeler: Trigeminal nevralji, Oral Pre-Trigeminal Nevralji, Mikrovasküler dekompresyon

INTRODUCTION

Trigeminal neuralgia (TN) is the most common craniofacial pain syndrome. Although trigeminal neuralgia is known for centuries as the trigeminal clinical event, in 1756 its clinic symptoms were first defined as Tic douloureux by Andre Tiger Nıcolous. Today a large number of scientists are working on defining of the disease and its pathophysiology[1]

TN is usually a paroxysmal pain on one side of the face, such as electric shock or lightning occurring, with a sudden start and can be triggered by external stimuli. Pain lasts a few seconds, but may be extended for a few minutes. Attacks occur spontaneously, but it usually starts with the tactile stimulation of orofacial movements of trigger area or temperature changes. Pain occurs in one or more facial distribution of trigeminal nerve and usually holds 2nd and 3rd branch, rarely holds the 1st branch. Attacks rarely occur when individual is sleeping, following attacks, there would be persistent periods ranging from seconds to hours, an attack does not occur during these periods[5,19,26]. It is usually unilateral, and is more common on the right side[34] When it develops bilaterally, multiple sclerosis develops, in systemic diseases it developes as secondary[11,34].

TNI is extremely rare and average age of start is around 50 years. 90% of the TF begins above 40 years of age[23]. But sometimes it is observed in young adults[12,22]. The female/male ratio is 1.5:1[23].

TN is classified as classic and symptomatic (secondary)[25]. Classic definition of TN is used for idiopathic or vascular compression, symptomatic TN definition is used for the cases caused by structural defects. Structural causes are tumors located in the posterior fossa (such as squamous), brain stem infarction and multiple sclerosis plaques formed in the brain stem[10]. Typically pain is started in the painful area (trigger point) stimuli such as touching, face washing, shaving and brushing teeth.

Treatment of trigeminal neuralgia is a medical treatment. Conventional painkillers and anti-inflammatories does not reduce the pain of TN, but anticonvulsants (carbamazepine, phenytoin and baclofen), are often successful, however cause unwanted side effects[5,19,26]. In cases where medical treatment is inadequate and can not be tolerated, the surgical applications are added to the treatment[1]. As the use of radiofrequency, balloon compression, microvascular decompression and gamma-knife implementation and glycerol practicesbecause have more late side effects than other percutaneous methods, their use have fallen dramatically today when compared to 1980s and 1990s[4].

MVD is an highly preferred surgical method for patients whose pain can not be controlled with medication and quality of life is impaired[36]. The decrease in pain after this procedure is usually very quick[35]. The most important side effect of the procedure is ipsilateral hearing loss which is usually temporary (less than 5%). The therapeutic effect is quite high. While the immediate cessation of pain happens in 70-80% of patients; in 60-70% of patients cessation of pain happens occurs 10-20

years after the surgery. MVD in some patients (eg, in patients that antiepileptic drugs may have more side effects and who are intolerant to these side effects) should be considered as first-line treatment. However, MVD, where the trigeminal neuralgia associated with multiple sclerosis, is not considered aa a first-line treatment and success rate is low[35].

Average 20% of TN patients reported that the TN pain did not show initially typical characteristics of TN pain[2,5,24]. This initial atypical symptoms were first reported in 1949 and identified as pre-trigeminal neuralgia (PTN). PTN pain is usually localized in tooth, alveolar bone and / or in the sinus. In the literature pain was reported as sharp knife stabbing[2,3,28]. The duration of the pain is continuous or episodical, the kind that can take up from minutes to hours. PTN is a pain that can take up to days to years before TN symptoms of pain typically occurs[2,3,5,7,19,20,24,26,28].

PTN is often perceived as a tooth pain and average 25-67% of patients refers to the dentist because of this pain[2,3,6,7,20,24,28]. PTN pain also increases with a hot or cold drink or talking[6,8,15] and though there is no dental pathology, patients refer to the dentist to relieve their pain.

It is is very difficult for practitioners those with less general knowledge of oral PTN to differentiate PTN and odontogenic pain. The physician should know oral PTN symptoms very well so he/she can distinguish these two from each other.

The purpose of this study by defining oral PTN symptoms better; is to understand the difference between PTN and odontogenic toothache and to emphasize the importance of accurate diagnosis in dentistry and brain surgery, but also to evaluate the effectiveness of microvascular decompression (MVD) method in treatment of TN.

MATERIAL AND METHODS

In our study, 11 patients (7 males, 4 females) were studied retrospectively in Pamukkale University Faculty of Medicine Department of Neurosurgery Clinic in October 2004 - August 2015, presenting with pain like lightning on the face which was not recovered. MVD operation was planned for the patients regarding their paroxysmal pain like lightning pain which was not recovered with medicine treatment and MVD operation was performed in 11 patients. Before coming to our clinic all patients were examined by a dentist, even after tooth extraction, pain has not been ended in 50% of patients. The mean age of the patients was 57.72 ± 15.19.

MVD surgery is performed in such patients after cranial MRI performed to be determine trigeminal nerve pathology. MVD patients, under general endotracheal anesthesia, were taken to operation with head moderately raised, slightly stretched and rotated 15º to the contralateral side, in contralateral decubitus position in mayfield cap. Retromastoid suboccipital craniotomy was made and inferior border of the transverse sinus and secondly posterior border of sigmoid sinus was taken outside. Trigeminal nerve was reached by infratentorial-supracerebellar. Once vascular compression was seen, compressing vessel was removed from the the trigeminal nerve with teflon and teflon was put inbetween. Post op. patients were discharged to control one month later after 2 days follow-up.

RESULTS

Demographic data of the patients are shown in Table 1. According to this; in 5 patients (1K/4E) typical TN pain was determined on right side of the lower half, in 6 (3 K / 3 E) in the lower half of the left face. 2 patients had diabetes mellitus (DM), 1 patient had hypertension (HT) and 1 patient was using cigarette. In operation of 8 patients Teflon* weas put between with trigeminal nerve and compressing

blood vessels, and in 3 patients nerves were decompressed.

Data showing the relationship of pathology detected during the operation of the complaints of Trigeminal Neuralgia patients who have undergone surgery MVD are summarized in Table 3.

When the causes of compression on 5th nerves of patients during the operation are observed: it was determined that in 1 patient pial band compresses the nerve, in 1 patient fibrotic tissue wraps the nerve due to a surgery performed 3 years ago, they were opened with microsurgery, the nerve was decompressed and Teflon was not used. In other patients, PSA Sup.Petrozal Ven compression, Sup.Serebel Artery compression were determined and Teflon was put between nerve and compressing vessel between made (Table 1, 2,4).

Postoperative complications were observed in any patient after application of MVD. TN typical pain in 10 of the patients weas completely ended.

In the 2-year follow-up of 3 patients, 3 year follow-up of 3, 1 year follow-up of 4 year follow-up, no recurrence of pain was seen; in 1 patient the pain repeated in the same area after 4 years and he was decided to be reoperated.

Table 1: Demographic Data of Trigeminal Neuralgia Patients that MVD (microvascular decompression) Applied. (HT: hypertension), (DM: Diabetes Mellitus) (PSE: Posterior Cerebellar Artery), (SPET V: Superior Petrosal Ven), (Super S: Superior cerebellar artery)

		average ± std. deviation	**median (min - max)**
Age		57,73 ± 15,19	67 (37 - 77)
		Number (n)	**Percentage (%)**
Gender	Male	7	63,6
	Female	4	36,4
HT Presence	No	9	81,8
	Yes	2	18,2
DM Presence	No	10	90,9
	Yes	1	9,1
Smoking	No	10	90,9
	Yes	1	9,1
Admission Complaint	Right lower face pain	5	45,5
	Left lower face pain	5	45,5
	Pain surrounding left eye	1	9,1
Pathology determined in operation	PSA compression on 5th nerve	6	54,5
	SPetV compression on 5th nerve	1	9,1
	Sup S A compression on 5th nerve	2	18,2
	5th nerve pial traction	1	9,1
	5th nerve fibrosis compression	1	9,1
Treatment applied	MVD-Teflon (+)	8	72,7
	MVD-Teflon (-)	3	27,3
Number of patients admitted to Dentist		11	100,0
Number of patients without complications		11	100,0
Total		**11**	**100,0**

Table 2: Table showing relationship between using Teflon in MVD surgery and pathology of the patients diagnosed during surgery for Trigeminal Neuralgia patients. (PSA: Posterior Cerebellar Artery), (SPetV: Superior Petrosal Ven) (Sup.S.A:Superior Cerebellar Artery)

Treatment Applied		Pathology Determined in Operation					
		PSA compression on 5th nerve	SPetV compression on 5th nerve	Sup S A compression on 5th nerve	5th nerve pial traction	5th nerve fibrosis compression	Total
MVD-Teflon (+)	Number (n) For applied treatment	6	0	2	0	0	8
	%	%75,0	%0,0	%25,0	%0,0	%0,0	%100,0
	Determined in Operation For Patology%	%100,0	%0,0	%100,0	%0,0	%0,0	%72,7
MVD-Teflon(-)	Number (n)	0	1	0	1	1	3
	For applied treatment%	%0,0	%33,3	%0,0	%33,3	%33,3	%100,0
	Determined in Operation For Patology%	%0,0	%100,0	%0,0	%100,0	%100,0	%27,3
Total	Number (n)	6	1	2	1	1	11
	For applied treatment%	%54,5	%9,1	%18,2	%9,1	%9,1	%100,0
	Determined in Operation For Patology%	%100,0	%100,0	%100,0	%100,0	%100,0	%100,0

Table 3: Table showing relationship between the admission complaints and pathology of the patients diagnosed during surgery for Trigeminal Neuralgia patients. (PSA: Posterior Cerebellar Artery), (SPetV: Superior Petrosal Ven) (Sup.S.A:Superior Cerebellar Artery)

Treatment Applied		Pathology Determined in Operation					
		PSA compression on 5th nerve	SPetV compression on 5th nerve	Sup S A compression on 5th nerve	5th nerve pial traction	5th nerve fibrosis compression	Total
Right lower face pain	Number (n)	2	1	2	0	0	5
	For applied treatment%	%40,0	%20,0	%40,0	%0,0	%0,0	%100,0
	Determined in Operation For Patology%	%33,3	%100,0	%100,0	%0,0	%0,0	%45,5
Left lower face pain	Number (n)	4	0	0	0	1	5
	For applied treatment%	%80,0	%0,0	%0,0	%0,0	%20,0	%100,0
	Determined in Operation For Patology%	%66,7	%0,0	%0,0	%0,0	%100,0	%45,5
Pain surrounding left eye	Number (n)	0	0	0	1	0	1
	For applied treatment%	%0,0	%0,0	%0,0	%100,0	%0,0	%100,0
	Determined in Operation For Patology%	%0,0	%0,0	%0,0	%100,0	%0,0	%9,1
Total	Number (n)	6	1	2	1	1	11
	For applied treatment%	%54,5	%9,1	%18,2	%9,1	%9,1	%100,0
	Determined in Operation For Patology%	%100,0	%100,0	%100,0	%100,0	%100,0	%100,0

Table 4: Table showing the distribution of pathological reasons determined in patients with Trigeminal Neuralgia by gender who underwent MVD Surgery. (PSA: Posterior Cerebellar Artery), (SPetV: Superior Petrosal Ven) (Sup.S.A:Superior Cerebellar Artery)

Gender		Pathology Determined in Operation					
		PSA compression on 5th nerve	SPetV compression on 5th nerve	Sup S A compression on 5th nerve	5th nerve pial traction	5th nerve fibrosis compression	Total
Male	Number (n)	3	1	2	1	0	7
	For gender %	%42,9	%14,3	%28,6	%14,3	%0,0	%100,0
	Pathology determined during operation %	%50,0	%100,0	%100,0	%100,0	%0,0	%63,6
Female	Number (n)	3	0	0	0	1	4
	For gender %	%75,0	%0,0	%0,0	%0,0	%25,0	%100,0
	Pathology determined during operation %	%50,0	%0,0	%0,0	%0,0	%100,0	%36,4
Total	Number (n)	6	1	2	1	1	11
	For gender %	%54,5	%9,1	%18,2	%9,1	%9,1	%100,0
	Pathology determined during operation %	%100,0	%100,0	%100,0	%100,0	%100,0	%100,0

Table 5: Table Showing the Distribution of Teflon Use by Gender in MVD (microvascular decompression) Surgery Applied to Men and Women Patients with Trigeminal Neuralgia Diagnosis

Gender		Treatment Applied		Total
		MVD-Teflon (+)	MVD-Teflon (-)	
Male	Number (n)	5	2	7
	For gender %	%71,4	%28,6	%100,0
	For applied treatment%	%62,5	%66,7	%63,6
Female	Number (n)	3	1	4
	For gender %	%75,0	%25,0	%100,0
	For applied treatment%	%37,5	%33,3	%36,4
Total	Number (n)	8	3	11
	For gender %	%72,7	%27,3	%100,0
	For applied treatment%	%100,0	%100,0	%100,0

DISCUSSION

In this study, a total of 11 patients who adimitted to the Neurosurgery Clinic of Pamukkale University School of Medicine were conducted MVD operation; no postoperative complications were observed in any patient who underwent MVD. TN typical pain in 10 of the patients were completely recovered.

TN classic definition includes idiopathic and vascular compression. In classic TN in the trigeminal nerve root entry zone, often superior cerebellar artery compression appears. But dolichoectatic basilar artery and persistent trigeminal artery can cause compression. The definition symptomatic TN is used for cases arise due to structural defects. Tumors, brain stem infarction, multiple sclerosis have been reported among these[10]. Sensory deficits of the trigeminal nerve and bilateral symptoms should be particularly stimulating for structural disorders[9,10]. Abnormal trigeminal reflex has a high sensitivity and specificity for symptomatic TN. Trigeminal neuralgia associated with epidermoid tumors is seen in younger

patients, the symptoms are longer and there is persistent pain[10,27]. There are articles reporting that in cerebellopontine angle epidermoid tumors often 8th nerve dysfunction, secondarily TN was seen[10,14,27]. TN is rarely present with symptomatic intracranial tumors[10]. Although these tumors are usually posterior fossa meningiomas such as vestibular schwannoma, epidermoid tumors; it has been reported in the literature that some middle fossa tumors such as meningioma, schwannoma, pituitary adenomas can lead to this[10]. Cerebellopontine angle epidermoid tumors localized in the trigeminal neuralgia patients were reported between 0.2 to 5.5%[10,14]. Important neural and vascular structures in this region complicate surgery. Cranial nerve dysfunction and aseptic meningitis are the most common complications of surgery[17].

Pre-trigeminal neuralgia (PTN) is referred to as atypical pain occurring at the start of the RTN pain. The pain is usually in the tooth, alveolar bone and/or localized in the sinus region. In the literature, pain is reported as dull pain, sharp knife stabbing[2,3,28].

When patients with oral PTN pain underwent with neurological assessment, examinations were found normal, computed tomography, MRI exams performed on these patients showed that they were completely normal, it was found that their pain was completely removed with conventional anticonvulsant therapy used in TN[5,7,15].

In retrospective studies, 33-67's% of patients received dental care who consulted to a dentist because of pain and it has been shown that up to 12% of remains toothless. Some dentists, say that after treatment of PTN pain, pain starts in the same quadra migrated to another tooth[18].

If patient localizes pain, especially for one tooth, it is difficult to find the actual source of pain. The source of the pain may be pulpal, periodontal or from sinuses. The most important information to find the source of pain are the patient's symptoms. Patient with tooth ache usually defines this as dull pain, throbbing or sharp pain. Factors reducing and increasing pain usually help in finding the source of the pain. Making anesthesia to painful tooth reduces pain in some cases; but it does not affect in some cases[3,8,18,28]. Thus, anesthesia test is not satisfactory to differentiate PTN and odontogenic pain.

If there is no dental pathology such as pulpal, periodontal or tooth fracture and occlusion is normal; physician may think that the pain may come from heavy parafunctional forces. In such a case, the tendency to percussion increases in many teeth[29,32].

If the patient is suffering from pain in maxillary tooth or alveolar bone, this pain may be induced from maxillary sinus, sinus congestion or flu may be newly recovered.

Physicians, in cases of tooth or bone pain, should suspect from muscles and temporo mandibular joint (TME). In this case the pain may increase with palpation of masticatory and cervical muscles. Pain in the posterior maxillary region, may initiate a compression for 5 seconds on tender nodule located on the superior of masseter muscle. Pain in the mandibular posterior region can be started again with the oppression on the inferior of the masseter muscle[30]. TME pain, appears in the form of direct dental pain, anesthesia in auriculatemporal nerve[21].

It is very difficult for family health physicians, dentists who have pain no information about TN pain and oral PTN, PTN pain, odontogenic pain and TN pain. For proper diagnosis and treatment, physicians need to have very good knowledge about these diseases. In a study made by the Wright et al (2014), 21-item questionnaire was filled out online by TN patients whom PTN was observed

previously[33]. One of the criteria for participants to be included in the study is PTN dental pain have been identified as having begun in the teeth and/or gingival. 94 patients participated in the survey, the patients having PTN pain for 1 and more hours were included in the study and 49 patients were examined. Considering the results of these patients; the start age of PTN pain was determined as 30-49 age, the period lasting from PTN up to TN was less than 6 months-more than10 years, it was determined that the pain continued between 2-10 years in 41.6% of them. It was determined that in 46 of 49 patients dental pain, in 31 gingival pain and in 28 both tooth and gingival pain and PTN started. These participants were treated with various dental treatments such as mostly root canal treatment, tooth extractions and fillings. It was determined that in 24 patients, PTN pain increased with cold foods and beverages and in 31 pain the individual described the pain as throbbing, in 9 out of 30 patients who accepted anesthesia, mentioned that anesthesia never made them painless, 14 of them were a little relaxed, and in 7 the pain was recovered. Another thing that could be interesting in this study is that only 9 patients were diagnosed with PTN.

In a retrospective study that Keller et al (2012) have conducted, 110.104 chronic periodontitis (CP) patients were examined. In 5-year follow-up period TN incidence rate of 4.40 was found in 10,000 people[13]. In this study patients with CP and subsequently having TN, high risk was observed according to the controls; it as found that the rate of TN diagnosis in patient with CP was 1.65 times more than those without CP. Interestingly, an increased risk of later TN was observed in the patients who undergo surgical periodontal therapy (gingivectomy or flap).

Only a single case has been reported in the literature that TN was subsequently developed in a patient with CP[16]. In this case, superior alveolar nerve as one of the 3 branches of the trigeminal nerve, has been irritated with periodontitis stimulation and it was argued that started TF.

The medical history of the patient is a very important guide to find the source of the pain and to start the differential diagnosis. Patients define their toothache as dull, throbbing or a sharp pain. Besides, testing the factors which increase and decrease pain or the patient expressing them also helps us to find the source of the pain and make the diagnosis.

Despite the pain like an electric shock is not a common form of toothache, 29% of PTN patients expressed such a pain. To understand whether the pain is from tooth, intraligamentous- anesthesia may be apllied to tooth. If the pain is partly reduced, pain is from tooth, if not it is not from tooth. However, physician should be aware that this anesthesia would lead to anesthesia in more teeth by spreading in two or more adjacent tooth[31].

CONCLUSION

The trigeminal nerve sense deficits, bilateral complaints, abnormal trigeminal reflex, young age and constant pain should suggest symptomatic trigeminal neuralgia. A detailed radiological examination should be done especially for the posterior fossa. For PTN, TN and tooth induced differential diagnosis, dentists, neurologists, neurosurgeons must collaborate. If dentists do not determine dental pathology in patients examined due to dental pain, they should necessarily seek consultation from the neurologist or brain surgery. If there are no patologies in the teeth, the dentist should consider other possible etiologies, including PTN. In order to understand the difference between PTN and odontogenic toothache more clearly further studies are needed.

Correspondence to:
Veli Citisli
E-mail: vcitisli@gmail.com

Received by: 13 November 2015
Accepted: 28 December 2015

The Online Journal of Neurological Sciences (Turkish) 1984-2016
This e-journal is run by Ege University Faculty of Medicine,
Dept. of Neurological Surgery, Bornova, Izmir-35100TR
as part of the Ege Neurological Surgery World Wide Web service.
Comments and feedback:
E-mail: editor@jns.dergisi.org
URL: http://www.jns.dergisi.org
Journal of Neurological Sciences (Turkish)
Abbr: J. Neurol. Sci.[Turk]
ISSNe 1302-1664

REFERENCES

1. *Andres M: The pathophysiology of trigemina neuralgia. Lozano PG, Tasker RR (ed), Berlin:Springer, 2009.*
2. *Benoliel R, Eliav E. Neuropathic orofacial pain. Alpha Omegan. 2012;105(3–4):66–74.*
3. *Blakeslee B. Mistaking neuralgia for a toothache [document on the Internet]. Los Angeles (CA): Futuredontics, Inc. [cited 2013 Sep 16]. Available from: http://www.dentistry.com/articles/Mistaking_Neuralgia_for_a_Toothache.aspx.*
4. *Cheng JS, Lim DA, Chang EF, Barbaro NM: A review of percutaneous treatments for trigeminal neuralgia. Neurosurgery, 2013 (Epub ahead of print)*
5. *de Leeuw R, Klasser GD, editors. Orofacial pain: guidelines for assessment, diagnosis and management. 5th ed. Chicago (IL): Quintessence Publishing Co.; 2013. p. 84–9.*
6. *de Siqueira SR, Nobrega JC, Valle LB, Teixeira MJ, de Siqueira JT. Idiopathic trigeminal neuralgia: clinical aspects and dental procedures. Oral Surg Oral Med Oral Pathol OralRadiol Endod. 2004;98(3):311–5.*
7. *Evans RW, Graff-Radford SB, Bassiur JP. Pretrigeminal neuralgia. Headache. 2005;45(3):242–4.*
8. *Fromm GH, Graff-Radford SB, Terrence CF, Sweet WH. Pretrigeminal neuralgia. Neurology. 1990;40(10):1493–5.*
9. *Gronseth G, Cruccu G, Alksne J, Argoff C, Brainin M, Burchiel K, Nurmikko T, Zakrzewska JM. Practice parameter: the diagnostic evaluation and treatment of trigeminal neuralgia (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology and the European Federation of Neurological Societies. Neurology 2008;71:1183- 1190.*
10. *Hung LC, Wu CS, Lin CC, Fang WK, Hsu YC. Epidermoid cyst presenting as isolated trigeminal neuralgia – two case reports. Acta Neurol Taiwan 2013;22:133-137.*
11. *Kabatas S, Karasu A, Civelek E, Sabanci AP, Hepgul KT, Teng YD: Microvascular decompression as a surgical management for trigeminal neuralgia: Long-term follow-up and review of the literature. Neurosurg Rev 32:87-93; discussion 93-84, 2009.*
12. *Katusic, S., Beard, C. M., Bergstralh, E. & Kurland, L. T. (1990) Incidence and clinical features of trigeminal neuralgia, Rochester, Minnesota, 1945–84. Annals of Neurology 27,89–95.*
13. *Keller JJ, Sheu JJ, Lin HC. Chronic periodontitis and the subsequent risk of trigeminal neuralgia: a 5-year follow-up study. J Clin Periodontol. 2012 Nov;39(11):1017-23.*
14. *Kobata H, Kondo A, Iwasaki K. Cerebellopontine angle epidermoids presenting with cranial nerve hyperactive dysfunction: pathogenesis and longterm surgical results in 30 patients. Neurosurgery 2002;50:276-285.*
15. *Konzelman JL, Jr, Herman WW, Comer RW. Enigmatic pain referred to the teeth and jaws. Gen Dent. 2001;49(2):182–6.*
16. *Kumar PD. Trigeminal neuralgia caused by periodontal disease. Trop Doct. 1997 Oct;27(4):250-1.*
17. *Meng L, Yuguang L, Feng L, Wandong S, Shugan Z, Chengyuan W. Cerebellopontine angle epidermoids presenting with trigeminal neuralgia. J Clin Neurosci 2005;12:784-786.*
18. *Merrill RL, Graff-Radford SB. Trigeminal neuralgia: how to rule out the wrong treatment. J Am Dent Assoc. 1992;123(2): 63–8.*
19. *Moazzam AA, Habibian M. Patients appearing to dental professionals with orofacial pain arising from intracranial tumors: a literature review. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012;114(6):749–55.*
20. *Okeson JP. Differential diagnosis of toothache: odontogenic versus nonodontogenic pain. In: Hargreaves KM, Goodis HE, Tay FR, editors. Seltzer and Bender's dental pulp. 2nd ed. Chicago (IL): Quintessence; 2012. p. 447–69.*
21. *Okeson JP. Management of temporomandibular disorders and occlusion. 7th ed. St Louis (MO): Mosby Co.; 2013. p. 229–30. Wright and Evans Oral pre-trigeminal neuralgia pain 198 cranioh:*
22. *Resnick, D. K., Levy, E. I. & Jannetta, P. J. (1998) Microvascular decompression for pediatric onset trigeminal neuralgia. Neurosurgery 43, 804–807.*
23. *Rozen, T. D. (2004) Trigeminal neuralgia and glossopharyngeal neuralgia. Neurologic Clinics 222, 185–206.*
24. *Sharav Y. Orofacial pain: how much is it a local phenomenon? J Am Dent Assoc. 2005;136(4):432–3.*

25. *Shulev Y, Trashin A, Gordienko K. Secondary trigeminal neuralgia in cerebellopontine angle tumors. Skull Base 2011;21:287-294.*
26. *Siqueira SR, Teixeira MJ, Siqueira JT. Clinical characteristics of patients with trigeminal neuralgia referred to neurosurgery. Eur J Dent. 2009;3(3):207–12.*
27. *Son DW, Choi CH, Cha SH. Epidermoid tumors in the cerebellopontine angle presenting with trigeminal neuralgia. J Korean Neurosurg Soc 2010;47:271- 277.*
28. *Spencer CJ, Gremillion HA. Neuropathic orofacial pain: proposed mechanisms, diagnosis, and treatment considerations. Dent Clin North Am. 2007;51(1):209–24.*
29. *Wilson TG. Bruxism and cold sensitivity. Quintessence Int. 2002;38(8):559.*
30. *Wright EF. Referred craniofacial pain patterns in patients with temporomandibular disorders. J Am Dent Assoc. 2000; 131(9): 1307–15.*
31. *Wright EF. Manual of temporomandibular disorders. 2nd ed. Ames (IA): Wiley-Blackwell Publishing Co.; 2010. p. 55–8.*
32. *Wright EF, Bartoloni JA. Diagnosing, managing, and preventing cracked tooth syndrome. Gen Dent. 2012; 60(5):e302–7.*
33. *Wright E, Evans J.Cranio. (2014) Oral pre-trigeminal neuralgia pain: clinical differential diagnosis and descriptive study results. Jul;32(3):193-8.*
34. *Yadav S, Mittal HC, Sachdeva A, Verma A, Dhupar V, Dhupar A. A retrospective study of 72 cases diagnosed with idiopathic trigeminal neuralgia in indian populace. J Clin Exp Dent. 2015 Feb 1;7(1):e40-4.*
35. *Zakrzewska JM, Linskey ME. Trigeminal neuralgia. Clin Evid 2014; 10:1207.*
36. *Zakrzewska JM, Linskey ME. Trigeminal neuralgia. BMJ. 2015 Mar 12;350:h1238.*