

IS THE THROBBING QUALITY OF TENSION TYPE HEADACHE (TTH) ALTERED BY FREQUENCY, INTENSITY AND DURATION? A CLINICAL STUDY IN A SELECTED POPULATION OF TTH AND CRANIOMANDIBULAR (CMD) INDIVIDUALS.

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SUMMARY

Tension-type headache (TTH) is the most common form of headache in the general population and in clinics of headache and craniomandibular disorders (CMDs). The goal of this study was to assess specific variables of TTH and some factors affecting the throbbing quality of pain. Charts of 111 CMDs individuals with TTH were retrieved and evaluated retrospectively. Data were compared with those in other studies. Mean age of TTH individuals was about 33.4 years. 6.3%, 47.7% and 45.9% of the sample presented infrequent, frequent and chronic TTH. 9%, 65.7%, and 25.2% of the sample presented mild, moderate and severe TTH. Never pulsating, occasionally pulsating and always pulsating were observed in 36 (32.4%), 64 (57.6) and 11 (9.9%) TTH/CMDs individuals respectively. Occasionally pulsating pain was reported in 14.28%, 66% and 54.9% of individuals presenting infrequent, frequent and chronic TTH respectively. Always pulsating pain was observed in 14.28%, 9.4% and 9.8% presenting with infrequent, frequent and chronic TTH respectively. Always pulsating TTH was observed in 9% with mild, in 8.3% with moderate and in 17.8% individuals with severe TTH. We conclude that TTH varies widely in frequency, severity, duration and in the pulsating description of pain.

Keywords: Tension-type headache. Severity. Pulsating.

RESUMO

A dor de cabeça por tensão muscular (DCT) é a dor de cabeça mais frequente na população geral, nas clínicas de dores de cabeça e de distúrbios craniomandibulares (DCMs). O objetivo deste estudo foi avaliar algumas variáveis específicas de indivíduos com DCT e alguns fatores que afetam a qualidade latejante da dor. 111 protocolos de avaliações de pacientes com DCMs e DCT encaminhados de forma consecutiva foram examinados retrospectivamente. Alguns dados foram comparados com aqueles de outros estudos sobre este assunto. A idade média dos indivíduos com DCT foi de 33.4 anos. 6.3%, 47.7% e 45.9% da amostra apresentou as formas clínicas de TTH infrequente, frequente e crônica respectivamente. 9%, 65.7% e 25.2% apresentou DCT leve, moderada e severa respectivamente. Dores nunca latejantes,

ocasionalmente latejantes e sempre latejantes foram observadas em 36, 64 e 11 indivíduos com TTH respectivamente. Dor sempre latejante foi observada em 9%, 8.3% e 17.8% dos indivíduos com TTH leve, com dor moderada e com TTH severa, respectivamente. Conclui-se que a dor na TTH varia muito em frequência, severidade, cronicidade e na descrição pulsante.

Palavras-chave: Dor de cabeça por tensão muscular. Severidade. Latejante.

1 INTRODUCTION

Tension-type headache (TTH) is the most common form of head pain, a pain disorder which has been the source of theoretical controversy (HABER, KUCZMIERCZYK, ADAMS, 1983). TTH formerly called muscle contraction headache, is a common headache pain usually self-treated with over-the-counter (OTC) analgesics (MILLEA-BRODIE, 2002). The main features of TTH include bilateral location, non-throbbing quality, a mild to moderate intensity, pain not aggravated by physical activities and absence of nausea, vomiting and photophobia which if present do not exclude the diagnosis of TTH (BIGAL-LIPTON, 2008). There is compelling evidence pointing to a high prevalence of diverse types of headaches in CMDs patients. CMDs is a collective term used to describe many entities usually associated with dysfunction in the muscles and joints of the masticatory system (MOLINA et al., 1997).

2 REVIEW OF THE LITERATURE

Prevalence rates of tension-type headache vary among studies from 29 to 71 percent of patients examined because of differences in research study designs (MILLEA-BRODIE, 2002). Current knowledge of the nociceptive receptor system suggests that the derivative pain of tension-type headache has a muscular origin and pain tends to be dull and achy, poorly localized and radiating (MILLEA-BRODIE, 2002). Symptoms are also described as tightness, pressure or constriction which vary in intensity, frequency and duration (KREISBERG, 1986). Pain episodes can last from 30 minutes to several days and can be continuous in severe cases. The pain is usually bilateral in the nuchal, occipital, frontal or temporal regions (KREISBERG, 1986).

Patients with chronic daily headache present with the typical pain characteristics of TTH, but have symptoms that occur daily or almost daily (MILLEA-BRODIE, 2002). Such headache can vary in intensity, duration and location, and the symptoms can be more severe than in people who have occasional TTH (THE MIGRAINE TRUST, 2006). TTH occurring at a frequency of less than 15 episodes or days per month is classified as episodic, pain occurring at a frequency of 15 episodes (days) or more per month is classified as chronic (MEHTA, EPSTEIN, GREENE, 2006). The ICD (ICD, 2004) now distinguishes three forms of TTH. Infrequent episodic characterized by less than 1 attack per month, frequent episodic 1-14 attacks per month and chronic, more than 15 attacks per month. TTH can be the result of temporary stress, anxiety, fatigue or anger (ABBOTT et al., 2007) and such pain should not be confused with combination headache which consists of episodes of TTH superimposed with episodes of migraine (PERTES, 1998).

Because clinical studies reveal that there are subgroups of patients with TTH presenting with different clinical descriptions of pain and some patients describe the pain as throbbing which supposedly is not a characteristic of TTH, the goals of this study are the following:

1. Assess the prevalence of infrequent, frequent, chronic, mild, moderate, severe and throbbing pain in patients presenting with CMDs and TTH.

2. Evaluate if duration in years, severity and frequency characteristics of TTH, are correlated with pain described as throbbing.
3. Evaluate which factor (frequency, duration and severity) make the most significant contribution to the throbbing description of pain.

3 MATERIAL AND METHODS

Data for this research were gathered retrospectively from 270 charts of CMDs and bruxing behavior cases referred consecutively to a Center for the Study of those disorders in the years of 2003-2010 and stored by alphabetical order in the University of Gurupi, Dental School. 111 charts of individuals presenting TTH were retrieved consecutively and evaluated regarding variables on TTH. Such charts contain valuable information about miofascial face pain, bruxing behavior, internal derangements of the temporomandibular joints, diverse types of headaches and psychological tested variables including anxiety, depression, hostility, somatization, hysteria and hypochondria.

Inclusion criteria for TTH were the following:

1. Pain should occur bilaterally at the same time and be described as pressing, constricting, tightening or band-like, dull, aching, continuous, lasting hours or days. This inclusion criteria eliminates the possibility of examining individuals with alternating unilateral miofascial pain in epidemiological studies.
2. Pain that could be described as never, occasionally or always pulsating but occurring in both sides of the head at the same time.
3. Nausea, vomiting, photophobia, ocular effects should not be a constant characteristic. Throbbing in one side could not occur and be reported at the same time.

Exclusion Criteria for TTHA

1. Pain occurring in one side or the other of the head which suggests the presence of alternating unilateral miofascial pain.
2. Individuals presenting with bilateral headache, but stronger and always pulsating in one side, suggesting the presence of combination headache.
3. Presence of headache combined with neurological disorders.
4. Presence of migraine with aura, hemicrania paroxistica and/or cervicogenic headache.
5. Presence of bilateral pain with origin in the temporomandibular joints not fulfilling the characteristics of tension-type headache.

Information about age and sex, duration of the complaint of pain, duration of each pain episode, frequency and severity of pain was obtained from the charts so as to retrieve complete data about variables associated with tension type headache. Thus, groups presenting infrequent, frequent, chronic, mild, moderate and severe pain were formed. 111 charts from 270 cases (41.11%) described most characteristics of tension-type headache and were used in this investigation. Individuals were classified as presenting infrequent TTH if they reported less than 1 pain attack per month, frequent TTH if they reported 1-14 attacks per month, and chronic if they reported 15 or more pain attacks in one month. The Visual Analogue Scale (VAS) from 0-10 was used to assess the severity of TTH and patients were classified as presenting mild pain (1-3), moderate pain (4-7), severe pain (8-10).

Statistical analysis used in this study included parametric and non parametric ANOVA, X square analysis, Pearson correlation and multiple regression analysis.

4 RESULTS

The results of this study are presented sequentially in tables I through VII. Table I shows that the mean age of CMDs and TTH individuals was about 33.4 years. Table II demonstrates that the frequencies of infrequent, frequent and chronic TTH were about 6.3% (n=7), 47.7% (n=53) and 45.9% (n=51), respectively. There was a mean of 14.8 pain attacks per month (SD=10.07, range 0.5-30), the mean severity of pain was about 6.07 (SD=2.02, range 2-10), the mean duration of pain complaint was about 7.53 years (SD=8.92, range 0.08-59). Table III demonstrates that the frequencies of mild, moderate and severe pains were about 9% (n=10), 65.7% (n=73) and 25.2% (n=28), respectively. The differences in frequencies were statistically significant (Fisher's exact test $p < 0.0001$). Table IV shows that mean frequencies of pain attacks per month in the infrequent, frequent and chronic groups were about 0.5 (SD=0.0, range 0.5–0.5), 7.39 (SD=3.64, range 2–12), and 25.7 (SD=6.02, range 16–30), respectively. The mean duration of pain of TTH complaint in the infrequent, frequent and chronic groups were about 1.19 (SD=1.04, range 0.08–3), 7.32 (SD=7.53, range 0.16–40), and 8.6 (SD=10.44, range 0.16–59) respectively. Kruskal-Wallis test $p = 0.02$, indicates a very significant difference in the duration of pain. The same table shows that the severities of pain in the same three groups were about 5.57 (SD=2.6, range 2-10), 5.8 (SD=2.0, range 2-10), and 6.4 (SD=1.92, range 2-10), respectively. Kruskal-Wallis non parametric test $p = 0.16$, indicates a non significant difference in the severity of pain complaint between the aforementioned groups, which makes sense since most individuals presented with moderate pain.

Table V demonstrates that the frequencies of never pulsating pain in the infrequent, frequent and chronic groups were about $5/7 = 71.4\%$, $13/53 = 24.5\%$ and $18/51 = 35.3\%$ respectively. The total frequency of never pulsating pain was $36/111 = 32.4\%$. Occasionally pulsating pain was observed in 14.2% (1/7) of the infrequent group, in 66.0% (35/53) of the frequent TTH group and in 54.9% (28/51) of the chronic group. As a whole, 57.6% (64/111) reported occasionally pulsating pain. The same table shows that the frequency of always pulsating pain was 14.2% (1/7) in the infrequent TTH group, 9.4% (5/53) in the frequent group and 9.8% (5/51) in the chronic group. As a whole, frequency of always pulsating pain was about 9.9% (11/111). Table VI describes the frequencies of never pulsating, occasionally pulsating and always pulsating pain in TTH individuals with mild, moderate and severe pain. Such table shows that the frequencies of never pulsating pain were about 72.7% (8/11), 26.4% (19/72) and 32.1% (9/28) in TTH individuals presenting mild, moderate and severe pain respectively. Thus, the frequency of never pulsating pain was about 32.4% (36/111). The same table demonstrates that the frequencies of occasionally pulsating pain were about 36.4% (4/11), 63.8% (46/72), and 50% (14/28) in individuals presenting mild, moderate and severe pain respectively. Thus, the total frequency of occasionally pulsating pain was about 64/111 or 57.6%. The frequencies of always pulsating pain were about 9.0% (1/11), 6.9% (5/72), and 17.8% (5/28) in TTH patients presenting with mild, moderate and severe pain, respectively. Thus, the frequency of always pulsating pain was about $11/111 = 9.9\%$ and increased with the severity of pain.

Pain described as occasionally pulsating was more prevalent in the moderate pain group ($46/72 = 63.8\%$) as compared to the mild pain group ($4/11 = 36.4\%$) and to the severe pain group ($14/28 = 50\%$). Pain described as always pulsating was more prevalent in the severe pain group ($5/28 = 17.8\%$) as compared to the mild pain group ($1/11 = 9\%$) and to the moderate pain group ($5/72 = 6.9\%$). X square analysis for trends $p = 0.06$ not statistically significant, but suggest a trend for pain being described as always pulsating

with the severity of pain. There was no statistically significant difference when comparing always pulsating pain in groups with mild, moderate and severe TTH.

Table VII is a summary of Pearson correlations coefficients showing that frequency-severity and duration (years) - frequency of pain were correlated and the correlations were statistically significant ($p=0.02$). There was no positive correlation between duration and severity. We found a positive correlation between severity and pulsating pain ($r=0.327$, $p=0.0005$), a no positive correlation between frequency and pulsating pain ($r=0.1325$, $p=0.16$) and a positive correlation between duration and pulsating ($r=0.3787$, $p=0.0001$). Multiple regression analysis was carried out to assess the contribution of specific variables like frequency, duration and severity on pain described as pulsating. There was a positive association between these variables and throbbing ($p=0.0004$). Frequency made no significant contribution the throbbing quality of pain ($p=0,84$). However, severity and duration made significant contributions to the throbbing quality of pain ($p=0.0005$ and $p=0.009$) respectively. Such data are reinforced by clinical observations as most patients usually report that pulsating is more evident when the pain is intense and/or unbearable. It is very likely that intensity increase with greater duration of pain.

Table I: Socio-demographic data in 111 craniomandibular (CMDs) individuals presenting with tension-type headache.

GENRE	N	%
Females	102	91.89
Males	9	8.11
Mean Age		33.41
SD		11.86
Range		13----75

Table II: Frequency of three types of TTH, frequency of attacks, severity and duration in 111 individuals presenting with TTH.

Types of TTH (N=111):

Infrequent		Frequent		Chronic	
N	%	N	%	N	%
7	6.3	53	47.74	51	45.94

Frequency of pain attacks per month (N=111):

Mean	14.81
SD	10.07
Range	0.5---30

Severity of pain (VAS=0-10)

Mean	6.07
SD	2.02
Range	2---10

Duration of pain (years)

Mean	7.53
SD	8.92
Range	0.08----59

Table III: Frequencies of mild, moderate and severe pain in 111 individuals presenting with CMDs and TTH and mean severity of pain in the whole sample.

Frequencies	Mild Pain		Moderate Pain		Severe Pain	
	N	%	N	%	N	%
	10	9	73	65.76*	28	25.2**

*There were more individuals presenting moderate as compared to mild pain and the difference was statistically significant (Fisher's exact test $p < 0.0001$).

**There were more individuals presenting with severe as compared to mild pain and the difference was statistically significant (Fisher's exact test $p < 0.0001$).

There were more individuals presenting with moderate as compared to severe pain and the difference was statistically significant (Fisher's exact test $p < 0.0001$).

Table IV: Frequency of pain (per month), duration (in years) and severity of pain (VAS=0-10) in three categories of TTH.

	Infrequent	Frequent	Chronic
	N:7	N:53	N:51
Frequency	Mean:0.5 SD:0.0 Range:0.5—0.5	7.39 3.64 2-12	25.76 6.02 16--30
Duration (years)	Mean: 1.19 SD: 1.04 Range 0.08---3	7.32 7.53 0.16—40	8.61** 10.44 0.16---59
Severity	Mean 5.57 SD 2.6 Range 2---9	5.8 2.0 2—9	6.4 *** 1.92 2---9

**Kruskal-Wallis test $p = 0.002$ very significant difference. Differences were observed between the infrequent and frequent group ($p = 0.01$) and between the infrequent and the chronic groups ($p = 0.01$). A no statistically significant difference in duration was found between the frequent and chronic group.

***Kruskal-Wallis test, $p = 0.16$ considered a non significant difference in pain severity.

Table V: Frequencies of “never pulsating”, “occasionally pulsating” and “always pulsating” pain in three categories of TTH individuals.

	Infrequent TTH		Frequent TTH		Chronic TTH		Totals
	N:7		N:53		N:51		
	n	%	n	%	n	%	
Never pulsating	5	71.4	13	24.5	18	35.3	36
Occasionally pulsating	1	14.2	35	66.0	28	54.9	64
Always pulsating	1	14.28	5	9.4	5	9.8	11
Totals	7	100.00	53	100.0	51	100.0	111

Table VI: Description of never pulsating, occasionally pulsating and always pulsating pain in individuals with mild pain (n=11), moderate pain (n=72) and severe pain (n=28).

Type of pain	Never pulsating N: 36		Occasionally pulsating N:64		Always Pulsating N:11	
	N	%	N	%	N	%
Mild Pain:	8/11	72.7	4/11	36.4	1/11	9.0*
Moderate Pain	19/72	26.4	46/72	63.8	5/72	8.33**
Severe pain	9/28	32.1	14/28	50	5/28	17.8***
Totals	36=32.4%		64=57.6%		11=9.9%	

*Always pulsating pain, difference between mild and moderate Fisher's exact test $p=0.58$, not significant.

**Always pulsating pain difference between mild and severe TTH cases: $p=0.65$, a non significant difference.

***Always pulsating pain, difference between moderate and severe TTH cases. Fisher's exact test $p=0.13$, a non significant difference.

*X square analysis for trends: $p=0.06$: Almost significant, suggesting that there is a trend to an increase in the frequency of "always pulsating" TTH with the severity of pain. The small number of individuals presenting with infrequent TTH, may have decreased the power of the test, as power is a function of the sample size.

Table VII: Correlations coefficients between pairs of variables: Frequency and severity, duration and frequency, duration and severity, severity and pulsating, frequency and pulsating, duration and pulsating.

Pairs of variables	Pearson r	P-Value	Significant?
Frequency and severity	0.2083	0.02	Yes
Duration and frequency	0.2089	0.02	Yes
Duration and severity	0.17	0.07	No
Severity and pulsating	0.327	0.0005	Yes
Frequency and pulsating	0.1325	0.16	No
Duration and pulsating	0.3787	0.0001	Yes

Additionally, multiple regression analysis was carried out to depict the influence of some factors on the severity of pain. Considering that Y (pulsating), as the dependent variable and frequency, severity, and duration as the independent (X) variables, the value $p=0.0004$ indicated a significant relationship between the variables. Frequency made no contribution on the throbbing quality of pain ($p=0.84$), whereas severity ($p=0.0005$) and duration ($p=0.009$) made significant contributions influencing the throbbing quality of pain.

5 DISCUSSION

1.Three types of frequencies of TTH were found in this study

Because we observed TTH individuals presenting infrequent, frequent and chronic pain, the results of this study are in accordance with one investigation (ABBOTT et al., 2007) reporting that TTH occurs either in single episodes or chronically. Because we found a prevalence of 6.3%, 47.7% and 45.9% of infrequent, frequent and chronic TTH, the results of this investigation are also in accordance with the study of the ICD-2 (ICD, 2004) which distinguishes three forms of TTH: infrequent, frequent and chronic. Tension-type headaches occurring at a frequency of less than 15 episodes per month are classified as episodic, whereas those occurring at a frequency of 15 episodes (days) or more per month, are classified as chronic (MEHTA, EPSTEIN, GREENE, 2006). Tension-type headache varies widely in frequency and severity (ABOU-ATME et al., 2007).

2. Severity of pain in the whole sample

The whole sample of 111 TTH patients reported a mean severity of 6.07 (SD=2.02, range 2-10). 9%, 65.7% and 25.2% presented mild, moderate and severe pain respectively. It means that most TTH patients do present moderate headache. Less TTH patients reported mild pain (9%) and most patients reported moderate (65.7%) and severe pain (25.2%). Thus, the results of this study are not in accordance with some investigations (MEHTA, EPSTEIN, FORGIONE, 2006, AYATOLLAHI et al., 2009, BIGAL-LIPTON, 2008) reporting that pain in TTH individuals is described as mild and moderate. However, researchers in that study reported those findings reviewing the literature without experimental data. Moderate pain was reported more frequently in this study, thus such data are substantiated by one investigation (COHEN-MCARTHUR, 1981), reporting that most TTH patients complained of moderate pain. Because severe pain was reported in 25.2% of the cases, the results of this study are in line with one investigation (RASMUSSEN, JENSEN, OLESEN, 1991), who found a frequency of 1.2% severe pain in TTH individuals, suggesting that such a severity can also be reported. In another investigation (MATTA-MOREIRA, 2006), 16% TTH patients reported severe pain. The higher prevalence of severe pain in our study is explained by the fact most of our patients were chronic, whereas MATTA-MOREIRA (2006), examined only cases with episodic TTH. Because we found that most patients reported moderate pain in this study, such results have support in one research (KIRAN et al., 2005) reporting that mean severity of pain in their sample with TTH was about 5.9. Because we found mild, moderate, and severe intensities of pain in this study, the results here presented are in accordance with one study (ABOU-ATME et al., 2007) claiming that TTH varies widely in severity.

3. Different durations of pain were found

In this study we report means durations of pain of about 1.19, 7.32 and 8.6 years in the infrequent, frequent and chronic cases. Such data suggest that most cases are chronic when they are assessed for the first time. Regarding the duration of frequent and chronic cases (7.32 and 8.6 years respectively), the results of this study are reinforced by one investigation (AYATOLLAHI et al., 2009), reporting a duration of about 6.37 years in a large sample of TTH individuals. Additionally, one study (HABER, KUCZMIERCZYK, ADAMS, 1985), reported a mean duration of 7.8 years, data very similar to that we report in the current study. One investigation (CHOI et al., 1995), reported a mean duration of TTH of about 6.3 years which is again similar to duration in patients reporting frequent and chronic pain in our study.

Because in this study we report a frequency of 45.9% of patients with chronic TTH, such data are not in accordance with the prevalence of 63% chronic TTH reported by one investigation (LANGEMARK et al., 1988). It may be that such investigators examined more chronic cases in a neurological setting whereas we assessed general cases in an environment suitable to examine cases with facial and CMDs. One study (CHOI et al., 1995), reported a higher frequency of chronic cases of TTH (63.2%) as compared to frequent or infrequent cases, thus reinforcing data reported in our study.

4. Pain was reported as never pulsating, occasionally pulsating and always pulsating:

Because we found a frequency of 32.4%, 57.6% and 9.9% of “never pulsating”, “occasionally pulsating” and “always pulsating” TTH pain, respectively, the results of this investigation are not in line with those from another research (BIGAL-LIPTON, 2008), reporting that TTH is a bilateral pain of non throbbing quality, but BIGAL AND LIPTON’S information is not based on experimental or epidemiological studies. Additionally, one investigation (AYATOLLAHI et al., 2009), reported a frequency of 34.7% throbbing or pulsating pain, but did not report if pain was always or occasionally throbbing. Additionally, CHOI et al, 1995, reported a frequency of 28.4% of pulsating quality in TTH patients as compared to 9.9% in the current investigation. However, the prevalence of severe pain which could be related to pulsating pain in their sample was about 42.8% as compared to 25.2% in the current investigation, difference which could explain the lower prevalence of pulsating pain in the current study. We believe that our lower prevalence of always pulsating pain is not so different from the frequency of 17.5% pulsating pain reported in one investigation (RASMUSSEN, JENSEN, OLESEN, 1991) in TTH individuals. An association between always pulsating and more severe pain is reinforced by patients’ reports that pain is pulsating particularly when is very severe or unbearable.

5. The relationship between the throbbing quality of pain and frequency, throbbing quality and severity and between throbbing quality and duration of pain reports were assessed using Pearson correlations coefficients and a multiple regression model.

Pearson coefficient for throbbing and frequency ($r=0.1325$, $p=0.16$) indicates a non significant correlation. Pearson coefficient between severity and pulsating ($r=0.327$ and $p=0.0005$) indicates an extremely significant relationship between these variables. Pearson coefficient between duration and pulsating ($r=0.378$ and $p=0.0001$), indicates a statistically significant relationship between these variables. Thus, severity and duration were more determinant for the description of throbbing pain, than frequency of pain episodes. A multiple regression model was used to assess the influence of frequency, severity and duration of pain on the throbbing quality of such complaint. Considering that Y (pulsating, the dependent variable) and frequency, severity and duration of pain, (X, the independent variables) and observing that $p=0.0004$, we may say that all the independent variables influenced the pulsating behavior of pain. Frequency made no contribution to the pulsating quality of pain ($p=0.84$). However, severity ($p=0.005$) and duration ($p=0.009$), made important contributions to the pulsating quality of pain.

6 CONCLUSIONS

Based on the results of this study and backed by the current literature on the subject, the following conclusions can be drawn:

1. Infrequent, frequent and chronic forms of TTH can be found in CMDs patients with TTH;
2. Most TTH patients report moderate and mild pain, but some also report severe and excruciating pain;
3. CMDs patients seeking active treatment do present acute, chronic and very chronic TTH;
4. Never pulsating, occasionally pulsating and always pulsating pain can be reported by CMDs and TTH patients;
5. A pulsating quality of pain can be influenced by the frequency, severity and duration of episodes of pain in TTH individuals;
6. Contrary to many reports, pain in TTH can be described as severe and pulsating, in many cases.

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