

The effect of pain intensity levels and clinical symptoms on the treatment preferences of patients with endodontically involved teeth: A preliminary cross-sectional study

Purpose

This study aimed to evaluate the effect of pain intensity levels and clinical symptoms on the treatment preferences of patients with endodontically involved teeth in a local Turkish population.

Subjects and Methods

A total of 30 patients with symptomatic teeth requiring non-surgical root canal treatment were included in the study. The patients' demographic (age, gender, and education level) and diagnostic data (tooth type, pain intensity, response to percussion and palpation, presence of referred pain, and diagnosis) were analyzed. Data on the patients' explicit preferences (requested treatment, whether they are willing to accept a proposed extraction, choice of treatment if an anterior tooth was involved, and choice of treatment if the pain was not severe) as well as previous root canal treatment experiences were also analyzed. Pain intensity levels were evaluated using the Visual Analog Scale.

Results

Pain intensity levels had a significant effect on the treatment requested by the patient ($p=0.001$). Among the patients who requested extraction upon referral to the clinic, the rate of those who reported that they would not accept extraction if the pain was located in an anterior tooth was significantly lower than that of patients stating that they would refuse ($p=0.039$). The presence of referred pain also had a significant effect on the requested treatment ($p=0.001$).

Conclusion

The intensity of pain and the presence of referred pain influence patients' treatment preferences.

Keywords: Decision-making, Dental pain, Ethics, Informed consent, Treatment preference

Introduction

Dental pain is one of the most prevalent pains affecting social life and is associated with a loss of productive time and treatment costs (1,2). Dental pain may result in peripheral and central sensitization due to an increase in noxious stimuli. The clinical symptoms of peripheral sensitization are a decrease in firing thresholds, which triggers discharges from non-noxious stimuli (allodynia); occurrence of after-discharges, which increases the perceived intensity of pain caused by noxious stimuli (hyperalgesia) (3,4); and spontaneous pain due to spontaneous firing (5,6). Peripheral sensitization is restricted to the injury site and persists only as long as a peripheral pathology is present. Further, it appears to play a major role in altered heat but not mechanical sensitivity, which is a distinctive feature of central sensitization (7,8).

Central sensitization, on the other hand, is the manifestation of changes in the properties of neurons in the central nervous system (CNS) that co-

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Received: 11 April, 2019

Revised: 02 April, 2020

Accepted: 06 July, 2020

DOI: 10.26650/eor.20200043

opt novel inputs for noxious stimuli for transduction purposes. By changing the interpretation of normal inputs, central sensitization causes pain hypersensitivity in non-inflamed tissue that persists long after the peripheral pathology or the initiating cause has disappeared. Central sensitization alters the CNS response to sensory inputs and, is therefore, not contingent on ongoing peripheral noxious stimuli. This makes it a distinct aspect of a major functional shift in the somatosensory system (8,9). Referred pain and mechanical allodynia are two distinctive features of central sensitization (8). Referred pain is the perception of pain in a part of the body that is not the source of the pain such as the transmission of pain from a tooth to the opposite arch or the periauricular area. Mechanical allodynia is perceived as pain triggered by non-noxious mechanical stimuli such as sensitivity to percussion and palpation (10).

One of the important aspects of patient autonomy is "consent," which is affected by the assessment capacity of a patient after they have been informed about the medical issue at hand. Therefore, the main component of consent is "to be informed," which is why it is often referred to as "informed consent." Excessive pain for which patients may be urgently seeking medical assistance coupled with panic means that a patient's participation in the decision-making process regarding treatment, and therefore their consent, may be affected, causing defective intention during the consent process. This is a potential legal issue due to the patient's reduced assessment capacity (11-13).

"Capacity" refers to the assessment of an individual's psychological ability to understand the relevant information, appreciate the situation and its likely consequences, compare the benefits and risks of various treatment options, and make rational decisions. Legal assessments of capacity are necessarily time- and decision-specific (14,15). An individual's capacity to make decisions can fluctuate or be temporarily affected by factors such as pain, fear, confusion, or the effects of medication (16).

Therefore, the aim of this study was to evaluate the effects of pain intensity levels, referred pain, sensitivity to percussion and palpation, and aesthetic concerns on the treatment preferences of individuals with endodontically involved teeth in a local Turkish population.

Subjects and Methods

Inclusion and exclusion criteria

This cross-sectional study was approved by the Ethics Committee of Istanbul Medipol University (No. 404) and registered in ClinicalTrials.gov with ID number NCT03553641. A total of 30 patients who had symptomatic teeth requiring non-surgical root canal treatment were included in the study. Patients under 18 and over 60 years of age, patients diagnosed with systemic diseases, and patients who had used an analgesic up to 12 hours prior to the appointment were excluded. All enrolled patients participated voluntarily and signed written informed consent forms.

Data collection

A datasheet including patients' demographic data, diagnostic data, and data regarding explicit preferences was filled out (Table 1). All pain scores were recorded according

to the Visual Analog Scale (VAS) as used by Turk (16). The patients' demographic data, including age, gender, and education level, were recorded. Diagnostic data regarding tooth type, pain intensity, response to percussion and palpation, presence of referred pain (transmission of pain to the opposite arch or the periauricular area), and final diagnosis were recorded after clinical and radiographic examinations (Table 1). All patients were explicitly informed that their answers to questions regarding their explicit preferences would not affect their diagnosis or treatment. Neither the diagnosis nor the indicated treatment was disclosed to the patients prior to the completion of the data sheet to avoid defective intention and false responses.

Statistical analysis

Statistical analysis of the data was performed using NCSS (Number Cruncher Statistical System) 2007 software (NCSS LLC, Kaysville, UT, USA). Descriptive statistical methods (mean and standard deviation, median, frequency, and ratio) were used to describe sample measures. The normal distribution of continuous variables was examined using the Kolmogorov-Smirnov test. The Mann-Whitney U test was used for the comparison of non-normally distributed variables with respect to VAS pain scores. The chi-square test and Fisher's exact test were used for the comparison of categorical data along one dimension. All results were reported with a 95% confidence interval, and a value of $p < 0.05$ was considered statistically significant.

Results

The demographic and clinical characteristics of the patients are displayed in Table 1.

Of the 30 participants, 43.3% were male and 57.6% were female. The patients' mean age was 36.03 ± 12.74 years, ranging between 18 and 57 years.

Among the patients, 10% were primary school graduates, 10% were secondary school graduates, 33.3% were high school graduates, 43.3% were university graduates, and 0.4% had no formal education.

Regarding the included teeth, 13.3% were anterior teeth, 23.3% were premolars, and 63.4% were molars.

With regard to diagnosis, 40% of the patients were diagnosed with acute periradicular abscess, 33% were diagnosed with acute periradicular periodontitis, and 27% were diagnosed with symptomatic irreversible pulpitis.

Twenty-six patients, or 86.7%, responded positively to percussion. The same rate was observed in terms of palpation. Referred pain was observed in 73.3% of the patients.

The mean VAS score was 8.43 ± 1.50 , ranging between 5 and 10.

Upon referral to the clinic, 63.3% of the patients requested extraction, and 36.7% requested root canal treatment (Table 2). Only one (9.1%) of the patients who had requested root canal treatment accepted the dentist's extraction proposal. The other 10 (90.9%) insisted on having a root canal treatment (Table 3). All the patients who initially requested extraction stated that they would consider root canal treatment if the pain would be less severe than they were experiencing at the time. Nineteen (63.3%) patients had previously undergone a root canal treatment.

Table 1. Distribution of subjects regarding demographic data, diagnostic data and data on explicit preferences

Demographic data				Diagnostic data							Explicit preferences				
Patient	Age	Sex	Education level	Teeth type	Diagnosis	Pain score	Percussion	Palpation	Referred pain	Required Treatment	Requested Treatment	Would you accept if the extraction is proposed?	Would you choose extraction if it were your anterior teeth?	If you were not in excessive pain would you consider other options than extraction?	Have you ever had a RCT before?
1	20	M	HSG	46	APA	9	+	+	+	RCT	Ext	Y	Y	Y	Y
2	46	F	UG	36	APA	9	+	+	+	RCT	Ext	Y	N	Y	Y
3	56	F	UG	37	APA	8	+	+	+	RCT	Ext	Y	N	Y	Y
4	42	M	MSG	17	APA	8	+	+	+	RCT	Ext	Y	N	Y	Y
5	35	F	UG	16	SIP	10	-	-	+	RCT	Ext	Y	N	Y	Y
6	46	F	HSG	31	APA	10	+	+	+	RCT	Ext	Y	Y	Y	N
7	19	M	HSG	47	APP	7	+	+	-	RCT	RCT	N	N/A	N/A	N
8	20	F	UG	46	SIP	8	+	+	+	RCT	Ext	Y	N	Y	N
9	57	M	UG	32	APP	7	+	+	-	RCT	RCT	N	N/A	N/A	Y
10	27	M	MSG	26	APP	7	+	+	-	RCT	RCT	N	N/A	N/A	Y
11	40	F	UG	26	APP	7	+	+	-	RCT	RCT	N	N/A	N/A	Y
12	49	F	PSG	21	APA	5	+	+	-	RCT	RCT	N	N/A	N/A	Y
13	24	F	HSG	46	APA	6	+	+	-	RCT	RCT	N	N/A	N/A	Y
14	25	F	UG	36	APP	8	+	+	+	RCT	Ext	Y	N	Y	N
15	38	M	UG	44	APA	10	+	+	+	RCT	Ext	Y	N	Y	Y
16	22	M	MSG	46	APA	8	+	+	+	RCT	Ext	Y	N	Y	N
17	27	M	UG	15	APA	6	+	+	-	RCT	RCT	N	N/A	N/A	Y
18	25	M	HSG	38	SIP	9	+	+	+	RCT	Ext	Y	N	Y	Y
19	25	M	HSG	26	APA	10	+	+	+	RCT	Ext	Y	N	Y	Y
20	35	F	UG	14	APP	10	+	+	+	RCT	Ext	Y	N	Y	Y
21	57	F	PSG	45	APP	10	+	+	+	RCT	RCT	N	N/A	N/A	Y
22	35	F	HSG	47	SIP	10	-	-	+	RCT	Ext	Y	N	Y	N
23	23	M	HSG	46	APP	6	+	+	-	RCT	RCT	N	N/A	N/A	N
24	53	F	UG	27	APA	10	+	+	+	RCT	Ext	Y	Y	Y	Y
25	52	F	NE	15	APP	10	+	+	+	RCT	Ext	Y	N	Y	N
26	33	F	UG	45	SIP	8	+	+	+	RCT	RCT	Y	N/A	N/A	Y
27	37	F	UG	24	SIP	9	-	-	+	RCT	RCT	N	N/A	N/A	N
28	18	F	HSG	36	SIP	10	-	-	+	RCT	Ext	Y	N	Y	N
29	51	M	HSG	47	APP	9	+	+	+	RCT	Ext	Y	Y	Y	N
30	44	M	PSG	23	SIP	9	+	+	+	RCT	Ext	Y	Y	Y	Y

M: male, F: female, PSG: Primary school graduate, MSG: Middle school graduate, HSG: High school graduate, UG: University graduate, NE: No education, APA: Acute periradicular abscess, APP: acute periradicular periodontitis, SIP: Symptomatic irreversible pulpitis, RCT: Root canal treatment, Ext: Extraction, Y: Yes, N: No, N/A: Not available

Table 2. The effect of pain intensity on requested treatment and acceptance of the proposed treatment

		VAS Scores		P	Post-hoc power
		Min-Max (Median)	Mean±Std Dev.		
Requested treatment (n=30)	Extraction (n=19)	8–10 (9.0)	9.21±0.85	^a 0.001**	0.998
	RCT (n=11)	5–10 (7.0)	7.09±1.144		
Proposed extraction by dentist (n=30)	Yes (n=20)	8–10 (9.0)	9.15±0.87	^a 0.001**	0.999
	No (n=10)	5–10 (7.0)	7.00±1.49		

^aMann–Whitney U Test (**p<0.001)**Table 3.** The comparison of requested treatment modalities with respect to the acceptance of proposed extraction and referred pain

		Requested treatment		p	Post-hoc power
		Extraction (%)	Root canal treatment (%)		
Acceptance of proposed extraction; n (%)	Yes	19 (100)	1 (9.1)	^a 0.001**	0.999
	No	0	10 (90.9)		
Referred pain; n (%)	Yes	19 (100)	3 (27.3)	^a 0.001**	0.991
	No	0	8 (72.7)		

^aFisher's Exact test (**p<0.001)

Pain intensity levels had a significant effect on the requested treatment ($p = 0.001$; Table 2). Moreover, they had a significant effect on patients accepting the treatment proposed by the dentist ($p = 0.001$; Table 2).

Sensitivity to percussion and palpation was 84.2% ($n = 16$) among the patients who requested extraction and 90.9% ($n = 10$) among the patients who requested root canal treatment. A positive response to either palpation or percussion had no significant effect on the requested treatment.

The presence of referred pain, on the other hand, had a statistically significant effect on the requested treatment ($p = 0.001$; Table 3). All the patients who requested extraction presented with referred pain. Of the 11 patients who requested root canal treatment, only 27.3% ($n = 3$) presented with referred pain.

Among the patients who requested extraction upon referral to the clinic, the rate of those who reported that they would accept extraction if the pain was located in an anterior tooth (16.7%, $n = 5$) was significantly lower than that of patients stating that they would refuse (83.3%, $n = 14$; $p = 0.039$).

In contrast, age, gender, education level, and previous root canal treatment experience had no significant effect on the requested treatment and the acceptance of the proposed extraction.

Discussion

This preliminary study evaluated the effects of pain intensity levels, referred pain, sensitivity to percussion and palpation, and aesthetic concerns on the treatment preferences of patients with endodontically involved teeth. Pain intensity levels and the presence of referred pain had significant effects on the requested treatment by patients.

Excessive levels of pain have been shown to have a debilitating effect on patients' decision-making process, which is a strong indication of defective intention (14,15). Patients undergoing medical emergency surgery had been found to have poorer recollection of the consent process and details of the consent form than patients undergoing elective surgery due to pain, analgesic medications, and fatigue (17).

The reason that pain has a devastating effect on patients' decision-making might be an ongoing major shift in the somatosensory system because of central sensitization (18), which can best be described as a complete physiological change in transmission, modulation, and regulation of pain due to pathological stimuli (8,9). In central sensitization, an expansion of the receptor field and a change in the interpretation of physiological inputs occur. Therefore, referred pain and mechanical allodynia (sensitivity to percussion and/or palpation) become the two major components of central sensitization (secondary hyperalgesia) (8,9). This makes central sensitization rather easy to diagnose with a clinical examination.

In this study, referred pain had a significant effect on the treatment requested by patients. In contrast, a positive response to palpation or percussion showed no significant effect, which suggests that mechanical allodynia does not affect patients' decision-making. In other words, although both are considered components that differentiate central from peripheral sensitization, referred pain and mechanical allodynia appear to have different effects.

Another parameter investigated in this study was the effect of pain intensity on the decision-making process. Pain levels had a significant effect on treatment preferences. Patients who requested extraction upon referral to the clinic had higher pain scores than those who did not. These patients were asked whether they would choose the same treatment if the involved tooth was an anterior tooth. This was done to determine whether the pain could affect patients' decision-making to the extent that they are willing to overlook aesthetic priorities, which are usually a major dental concern (19), in order to be relieved of the pain. The significant difference in favor of root canal treatment for anterior teeth is indicative of the importance of aesthetic priorities compared to pain in patients with central sensitization, highlighting their role in preferences (13,15,19). Many studies have demonstrated the relationship of an aesthetic smile, which is closely linked to the presence of anterior teeth, with a perception of greater intelligence and better chances of finding a job (19–21), which could also explain our patients' responses.

The patients' previous root canal treatment experiences and education levels were also analyzed for any effect on the requested treatment. Although it has been reported that there is no correlation between socioeconomic factors and the presence/absence of apical periodontitis (22), age, education level, socioeconomic status, and gender have

been found to have a significant impact on felt needs, dental awareness and, dental attendance (23). Nevertheless, in this study, neither previous root canal treatment experiences nor the education levels showed any significant effect on the requested treatment, corroborating the finding that pain intensity plays a central role in the decision-making process.

It is conceivable that the intensity of pain might affect patients' consent to a study and a patient's consent to participate might also be compromised. A previous study on patients experiencing acute pain found no correlation between pain intensity and their capacity to consent to participate in research (24). Giving consent to participate in a study that will not affect the treatment plan is not the same as giving consent to a certain treatment procedure (14,15). In this study, patients were explicitly informed both before and during the process that they were not obligated to take the poll to receive proper treatment.

To better understand the reasons behind their choice, patients who requested extraction were asked to consider treatment options other than extraction if there was not an excessive level of pain involved. All patients reported that they would change their choice if they would not be in excessive pain, disregarding other concerns, such as cost, time, or other complex human behaviors affecting the utilization of dental care (25).

Although a dentist should inform and advise patients with their best interests in mind, there is always a risk of recommending a treatment plan that is less complex and is more profitable than a root canal treatment (26), such as extraction and subsequent implant placement. A patient in excessive dental pain might agree to these options due to reduced consent capacity and disturbance of the decision-making process under the existing circumstances. This implies that ethical and legal responsibilities of a dentist, including obtaining a valid informed consent should be highly emphasized as very critical aspects of decision-making during dental education. Furthermore, pre- and post-graduate educational programs can also integrate a guideline that describes a witnessed interaction with the patient to assess his/her capacity to make treatment decisions. A useful alternative may also be the development of a two-step consent process. With such an approach, alleviation of pain prior to the final decision may improve a patient's judgement (27) and the informed consent process.

To the authors' knowledge, this is the only study to date investigating the impact of pain intensity levels and other diagnostic factors on the treatment preferences of patients with endodontically involved teeth. As this is a pioneering and preliminary study, multicenter studies with larger sample sizes are required to gain a better understanding of the factors that influence a patient's decision-making process. Further studies may confirm the necessity of modifying the informed consent procedures or incorporating guidelines when managing dental patients in severe pain.

Conclusion

Under the limitations of this study, we can conclude that pain intensity and referred pain significantly influence the treatment preferences of patients with endodontically involved teeth, whereas sensitivity to percussion and palpa-

tion does not. Careful consideration of the effects of these factors on patients' participation in the decision-making and consent processes is required.

Türkçe Özet: *Ağrı Şiddeti ve Klinik Semptomların Endodontik Tedaviye Gereksinimi Olan Hastaların Tedavi Tercihlerine Olan Etkisi: Kesitsel Bir Ön Çalışma. Amaç: Bu çalışmanın amacı, bir Türk popülasyonundaki bireylerde ağrı şiddetinin ve klinik semptomların hastanın tedavi tercihi üzerine olan etkisini değerlendirmektir. Gereç ve Yöntem: Kök kanalı tedavisi endikasyonu olan semptomatik bir diş sahip toplam 30 hasta çalışmaya dâhil edilmiştir. Hastaların demografik özellikleri (yaş, cinsiyet ve eğitim düzeyi), tanı verileri (diş tipi, ağrı şiddeti, perküsyon ve palpasyona yanıt, yansıyan ağrının varlığı, gereksinim duyulan tedavi ve tanı), tercihleri (talep edilen tedavi, hekim tarafından sunulan diş çekimi tedavi seçeneğine yaklaşım, ilgili dişin ön diş olması halinde tedavi tercihi, ağrı şiddetli olmasa idi tedavi tercihi) ve önceki kök kanalı tedavisi deneyimleri kaydedilmiştir. Ağrı şiddeti skorları, Görsel Analog Skala kullanılarak kaydedilmiştir. Bulgular: Ağrı şiddetinin hastanın talep ettiği tedavi üzerinde anlamlı bir etkiye sahip olduğu saptanmıştır ($p=0,001$). Kliniğimize başvururken diş çekimi talep eden hastalar arasında ağrı ön dişte olsa idi diş çekimini kabul eden hasta sayısının kabul etmeyenlere oranla istatistiksel olarak anlamlı derecede daha az olduğu belirlenmiştir ($p=0.039$). Yansıyan ağrı varlığının, hastaların talep ettiği tedavi üzerinde istatistiksel olarak anlamlı bir etkiye sahip olduğu saptanmıştır ($p=0.001$). Sonuç: Ağrının şiddeti ve yansıyan ağrının varlığı hastaların tedavi tercihlerini etkilemiştir. Anahtar Kelimeler: Bilgilendirilmiş onam, Diş ağrısı, Etik, Karar verme, Tedavi tercihi*

Klinik Önem: *Şiddetli diş ağrısı hastanın karar verme yeteneğini etkileyebilir ve bu nedenle bilgilendirilmiş onamın geçerliliğini tehlikeye atabilir.*

Ethics Committee Approval: The protocol of this study was approved by the Ethics Committee of Istanbul Medipol University (No.404).

Informed Consent: The informed consents were provided by the participants.

Peer-review: Externally peer-reviewed.

Author contributions: TFE and FIG designed the study. TFE participated in generating and gathering the data for the study. TFE and FIG participated in the analysis of the data. TFE wrote the majority of the original draft of the paper. TFE and FIG participated in writing the paper. All authors approved the final version of this paper.

Conflict of Interest: The authors had no conflict of interest to declare.

Financial Disclosure: The authors declared that they have received no financial support.

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