ORIGINAL ARTICLE

Turk Endod J 2017;2(2):31–37
doi: 10.14744/TEJ.2017.30502

Attitudes, materials, and methods preferred in root canal treatment in Turkey: a survey

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Objective: To obtain information about the treatment plans and the material and methods used by dentists in root canal treatments.

Methods: The survey forms were e-mailed to the participants; overall, 275 volunteer participants were enrolled in the present study. The first 4 questions were related to the demographical data, the next 6 questions were related to the root canal treatment intervals and working length determination methods used by participants during the treatments, and the last 4 questions were related to the number of treatment visit and retreatment planning. The Chi Square Test was used to analyze the data at significance level of 5%.

Results: It was determined that 10.5% of participants performed 1–2 root canal treatments per week. The rate of using rubber dam for saliva isolation was determined to be 16.7%, while remaining 83.3% of participants were found to prefer using cotton pellet. With respect to the institutions, the rate of use of rubber dam was found to be statistically significantly lower in public institutions. It was determined that the apex locator was the most preferred method in determining the working length. It was found that 53.1% of participants use only electronic apex locators, while 23.1% use the devices integrated to endodontic motor, and remaining 23.6% use and/or prefer both options.

Conclusion: To increase the number of successful root canal treatments and make referring to the endodontist possible, it is recommended to support the educational studies the training.

Keywords: Attitudes; dentists; endodontics; survey.

Root canal treatment (RCT) offers esthetical, functional, and economic benefits as well as psychological advantages to the patient by keeping the tooth within the mouth.[1] In Turkey, dentistry services are offered mainly through the private practice, government, and university hospitals. According to the data provided by Turkish Dental Association, there are 28,006 dentists actively working in Turkey as of the year of 2015, 56% of which in private institutions, 31% in institutions affiliated to the Ministry of Health, and 13% in university hospitals. Because there is no record in Turkey regarding the dentistry services provided by the private healthcare facilities, it is not possible to achieve the number of RCTs performed in those institutions. Besides that, the number of RCT performed in

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Submitted: July 13, 2017 Accepted: September 17, 2017

government hospitals was reported to be 524,207 for year 2009; 1,962,998 for 2013; and 2,309,752 for 2015. Despite the increase seen in the annual number of RCTs performed, the number of tooth extraction performed as of the beginning of year 2015 was reported to be 7,284,539, corresponding to a very high level. When compared to the number of examinations, 273 out of every 1000 examinations result in the extraction of any tooth, while only 70 out of 1000 examinations involve RCT. The quality of RCT is more important than the quantity of treatments. However, there is no consensus on which materials and methods should be used in RCT. Many studies have been conducted on the habits of physicians during the RCT.[2–7] European Society of Endodontology (ESE) has published guidelines on the acceptable standards of clinic endodontics.[8] However, it can be seen that the great majority of dentists, even those in studies carried out in Turkey,[9] do not work in harmony with these guidelines.

The purpose of present study was to obtain current and detailed information about the treatment plans and the material and methods used by dentists in RCTs and to examine their relationship with their working institutions.

Materials and methods

A survey comprising 14 items was prepared. The first 4 questions were related to the demographical data such as gender, date of graduation from postgraduate or graduate program, and the institutions at which the participants work. The next 6 questions were related to the RCT intervals and working length (WL) determination methods used by participants during the treatments, use of radiography, isolation, magnification, and irrigation solution preferences. The last 4 questions are related to the number of treatment visit and the retreatment planning. The survey forms were e-mailed to the participants, who accepted to participate into the questionnaire, and the participants, who responded to an announcement made on Internet. Overall, 275 volunteer participants were enrolled in the present study. During the questionnaire, the number of participation was regularly monitored through the distribution of participant based on the institutions where they work. The participation was ended when the institutional distribution of questionnaire to the participants showed similar pattern with the distribution of participants working in Turkey.

Statistical analysis

The data collected were transferred to the computer, and the descriptive statistics were expressed in frequency (n) and percentage (%) using SPSS 21.0 (IBM-SPSS Inc, Chicago, IL, USA) software. Using the Chi Square Test, the relationship of institutions where the participants were working with the materials and methods used by the participants and the plans implemented was statistically examined at significance level of 5%.

Results

The frequencies and percentage values of answers given by participants are presented in Tables 1–4.

Demographic data

Overall, 51.3% of participants were female, while 48.7% were male. Moreover, 51.6% of participants were working at private offices and polyclinics, 33.8% at public hospitals and oral and dental health centers affiliated to the Ministry of Health, and 14.5% at university hospitals. Given the graduation dates of participants, 3.8% of participants graduated from dentistry faculty before 1980, 8.4% between 1980 and 1999, 47.6% (the largest portion) between 2000 and 2009, and 23.3% between 2010 and 2014.

Table 1. Demographic and professional data of the respondents

	Frequency (n)	(%)
Gender		
Female	134	48.7
Male	141	51.3
Affiliation		
Private practice	142	51.6
Community service	93	33.8
University	40	14.5
Date of dentistry graduation		
<1970	3	1.1
1970–1979	11	4.0
1980–1989	23	8.4
1990–1999	43	15.6
2000–2009	131	47.6
2010–	64	23.3
Date of endodontics graduation		
<1970	0	0
1970–1979	0	0
1980–1989	0	0
1990–1999	4	1.5
2000–2009	19	6.9
2010–	35	12.7

Table 2. The number of endodontic cases per week

	Frequency (n)	(%)
None	0	0
1–2	29	10.5
3–5	63	22.9
6–10	71	25.8
10>	112	40.7

Table 3. The participants' preferences of using dental radiography and isolation methods during root canal treatment

	Frequency n (%)		Frequency n (%)
Pre-operative	241 (87.6)	Cotton Pellets	229 (83.3)
Working length	152 (55.3)	Rubber-dam	46 (16.7)
Gutta-percha confirmation	106 (38.6)		
Post-operative	188 (68.4)		
None	13 (4.7)		

Table 4. The participants' preferences of working length determination and magnification methods during root canal treatment

	Frequency n (%)		Frequency n (%)
Finger sensitivity	112 (40.7)	None	236 (85.8)
Ingle technique	6 (2.2)	Dental loupe	34 (12.4)
Apex locators	146 (53.1)	Dental operation microscope	5 (1.8%)
Apex locator integrated endodontic motors	89 (32.4%)		
Conventional radiography	63 (22.9%)		
Digital radiography	151 (54.9%)		

RCT frequency

Given the number of RCTs performed per week, it was determined that 10.5% performed 1–2 RCTs per week, while majority (40.7%) of participants performed 10 and more RCTs per week.

Radiography usage

Notably, 87.6% of participants stated that they use dental radiography in diagnosis before the RCT. While the rate of use of radiography in determining the WL was found to be 55.6%, the same rate was calculated to be significantly lower (39.8%) among the participants working at public institutions ($p<.05$). While the rate of taking master cone radiography before the root canal filling was computed to be 38.5%, this percentage was found to be statistically significantly lower (22.6%) among those working at the public institutions ($p<.05$). The ratio of using radiography for checking the root canal filling was found to be 68.4%, while this ratio was determined to be significantly higher (85%) among the participants working at university hospitals ($p<.05$). The rate of participants stating that they never use radiography in any stage of RCT was found to be 4.7%, and it was also found that there is no participant who was working at university hospital and not using radiography. Examining the relationship of stage wherein the radiography is used with the graduation dates of participants, it was determined that the highest rate of using radiography during and after the procedure was observed among the participants graduated from the faculty after the year 2010. Among the participants using radiography only for diagnosis, this rate was determined to be 82.8% for those graduated after 2010, 90.8% for those graduated between 2000 and 2009, and 93% for those graduated between 1990 and 1999. Considering the participants that do not use radiography, the highest rate belongs to those graduated between 1980 and 1989 (17.4%) followed by those graduated before 1979 (7%).

Isolation

The rate of using rubber dam for saliva isolation was determined to be 16.7%, while remaining 83.3% of participants were found to prefer using cotton pellet. From the aspect of institutions where the participants were working, the rate of use was found to be statistically significantly lower (8.6%) in public institutions ($p<.05$). Considering the relationship of using rubber dam in isolation with the graduation dates, the minimum rate of use (7%) was found among those graduated before 1979, while this rate increased to 13% (1980–1989), 14% (1990–1999), 17.6% (2000–2009), and finally peaked to 20.3% (after 2010).

WL determination

It was determined that the use of the electronic apex locator (EAL) (69%) was the most preferred technique. Examining the EAL in detail, it was found that 53.1% of participants use only the EAL device, while 23.1% use the devices integrated to endodontic motor, and remaining 23.6% use and/or prefer both options. Considering the relation-

ship between the institutions where the participants were working and their use of EAL in determining the WL, no statistically significant difference was found (p>.05). The radiography was found to be the second most frequently used method (68.7%). The type of radiography that the participants that prefer using radiography utilize was also analyzed in detail, and it was determined that 19.5% use conventional radiography, 66.1% use digital radiography, and 13.7% use both conventional and digital radiography. Considering the institutions where the participants preferring digital radiography in determining WL were working, it was found that those working at public institutions prefer its use at statistically significantly lower rate (32.3%) (p<.05). While 40.7% of participants preferred finger sensitivity, no statistically significant difference was determined in terms of the institutions (p>.05). Considering the graduation dates of participants and the use of finger sensitivity method, the highest rate (60.9%) of this method was found among those graduated between 1980 and 1989, while this rate was found to be 44.2%, 38.9%, and 37.5% (for the period after 2010) for following decades. The minimum rate (28.5%) was found for those graduated before 1980.

Magnification usage

Considering the use of magnification by the participants during the RCT, it was determined that 1.8% of participants use dental operation microscope, 12.4% use dental loop, and 85.8% (a great majority) use no magnification system. Although no significant difference was found between the institutions in terms of the use of magnification devices (p>.05), the dental operation microscope is not used or preferred in public institutions.

Irrigation

The most frequently preferred irrigation solution was found to be the sodium hypochlorite (NaOCl) with the percentage of 95.6%. This solution's rate of use in university hospitals was 100%, which is the maximum level and statistically significantly higher than that of other groups (p<.05). Chlorhexidine (CHX) was found to be the second most frequently preferred solution with the rate of 45.6%, followed by the ethylenediamine tetra acedic acid (EDTA) with 29.8%, distilled water with 25.8%, and alcohol with 6.9%. It was determined that all these solutions were used statistically significantly less in public institutions when compared to others (p<.05). The saline solution was found to be the third most widely used one with the rate of 37.8% among all participants. Although it is the second most frequently preferred option in public institutions, there is no statistically significant difference between the institutions in terms of the use of this option (p>.05). The hydrogen peroxide was determined to be preferred by 22.5% of all participants, and it was used in public institutions at statistically significantly higher levels (35.5%) (p<.05). From the aspect of relationship between the participants' graduation dates and irrigation solution preferences, CHX was found to be the most frequently preferred by those graduated after 2010 (57.8%), while the same group preferred hydrogen peroxide (14.1%) and alcohol (4.7%) at lower levels (p<.05). The highest levels in preferring NaOCl (98.4%), CHX (57.8%), and EDTA (39.1%) were observed among the participants graduated after the year 2010.

Number of visit

The vitality of teeth was used as the criterion for treatment planning, and the participants were asked whether they complete the RCT in single or multiple visits. It was determined that 73.1% of participants preferred single visit for vital teeth, while 21.1% preferred it for the devital teeth. Considering from the aspect of institutions where the participants were working, the use of single visit in vital teeth was found to peak at public institutions (82.8%), while the minimum level was observed in university hospitals (57.5%) that was at statistically significantly lower level (p<.05). No relationship was found between the institutions and the number of visit performed for devital teeth (p>.05). The minimum levels of single visit implementation for vital and devital teeth (53.1% and 14.1%, respectively) were observed among the participants graduated after the year 2010. This ratio increased as the graduation dated back further; the results observed among those graduated before 1970 were 100% for vital teeth and 66.7% for devital teeth.

Retreatment

The approach of participants to the teeth diagnosed for the retreatment indication was examined, and it was determined that the rate of those stating that the relevant teeth was extracted was found to be 16.7%, while the same ratio peaked in public institutions (21.5%) and reduced to the minimum in university hospitals (5%). The rate of those referring the patient to an endodontist for the relevant teeth was found to be 21.1%; this rate was observed to be at maximum level in public institutions (37.6%) and minimum in private institutions (13.4%). 62.2% of participants stated that they performed retreatment, and 32.1% of them emphasized that they performed retreatment only for single-root teeth but not for multiple-root ones. The

rate of those performing retreatment including the multiple-root teeth was calculated to be 42.2%; the highest level for this parameter was found to be 70% in university hospitals, while the lowest level was observed in public institutions (21.5%).

Considering the utilization of mechanical instruments used during retreatment by the institutions, it was found that Gates-Glidden drills were most widely used by the university hospitals (62.5%), while the minimum level of use was determined in public institutions (12.9%) ($p<.05$).

Discussion

The present study obtained detailed information on the perspectives of participants regarding endodontics and revealed the relationship with institutions where the participants work and their participantry experience.

The rubber dam protects the patient from canal devices, medicaments, and possible aspiration and swallow of irrigations, and it acts as a barrier against the soft tissue injuries.[10] The use of rubber dam is considered as a standard by the professional organizations such as ESE, American Association of Endodontists (AAE), and American Academy of Pediatric Dentistry.[8,11,12] In year 2010, it was declared as a standard procedure by the AAE.[13] Moreover, in year 2017, Webber[14] emphasized that no RCT should be performed without using rubber dam. In a survey study conducted in USA, it was reported that 59% of general dental practitioners "always" use rubber dam, while the same rate was found to be 92% among the endodontists.[3] In a study examining the use of rubber dam in Taiwan, where all of the healthcare facilities are gathered within a same digital platform, the rate of active use of rubber dam was reported to be 16.7% by using the radiographies taken, while the active use in public institutions other than the private clinics was reported to be 32.8%. In parallel with this, the same rate was reported to be 16.7% in the present study and the lowest rate of use of rubber dam was observed in public institutions.[15] In similar studies worldwide, the same ratio was reported to be 97% in Sweden,[16] 67.8% in England, 27.7% in Belgium,[17] 4% in Jordan,[18] and 2% in Sudan.[7] Consistent with many other studies, no relationship could be found between the age and the use of rubber dam in the present study.[19]

The NaOCl irrigation solution is considered to be the golden standard in endodontics because of its antibacterial properties and superior organic solvent features. NaOCl, which is used by 91% of the endodontists in USA,[20] was found to be the most important solution that is preferred by 95.6% of participants in the present study. From the institutional aspect, the use of NaOCl 100% in universities but 90.3% in other institutions affiliated to the government might be caused from its low cost and high availability.

CHX is widely used as root canal irrigation agent in endodontics because it has significant antimicrobial effect but not the disadvantages of NaOCl, such as undesired smell and tissue incompatibility.[21] The studies where the CHX has been used as irrigation agent and in-canal medicament in dentistry were conducted in the relatively recent past, such as year 1997.[22,23] Given the relationship with the date of graduation from faculty of dentistry, the rate of preferring CHX was found to be 34.9% among those graduated between 1990 and 1999, while the same ratio was reported to be 45.2% for those graduated between 2000 and 2009 and 57.8% for those graduated after year 2010. This may be because the use of this solution is given significant importance in undergraduate education in recent years.

It was also observed that the saline solution (37.8%), distilled water (25.5%), and hydrogen peroxide (22.5%) are widely preferred by the participants. However, it is known that they have no antimicrobial effect and it is not recommended to use them in-canal treatment.[24] In a study examining the irrigation solution preferences in USA, the rate of use was reported to be 11% for saline solution and 12% for distilled water. But, considering the usage as primary solution, the rates of use were reported to be 0.9% and 0.4%, respectively.[20] Because the rate of use of chlorhexidine is 46.5%, this solution may be frequently used as barrier between CHX and NaOCl. However, 30.9% of participants were found to use CHX in addition to at least one of saline solution, distilled water, and hydrogen peroxide. This finding indicates that it is necessary to reveal the reasons for using these solutions in RCT. CHX and EDTA were found to be used at minimum levels in public institutions, but hydrogen peroxide and saline solution were reportedly used more widely. This finding suggests that the availability of irrigation agents play important role in preferences. Despite that, the use of NaOCl, which is the cheapest and most available irrigation solution, at the minimum level in public institution indicates that the knowledge of dentists regarding the best irrigation protocols under different conditions should be brushed up. It was determined that, while the solutions such as NaOCl, CHX, and EDTA were used at higher levels, others were used at lower levels by the dentists graduated after year 2010; this indicates that the newly-graduated dentists are more open and conscious about the case-specific use of irrigation solution.

High level (69%) of use of EAL in determining the WL offers a promising opportunity for the transition from conventional methods to electronic methods. In a study

conducted in Turkey in year 2012, the same rate was reported to be 12.8%.[9] The recommended method for determining the WL for RCT is the combination of EAL and radiography.[25] In the present study, the combined use of these methods was not examined, but the high level of use of radiography (68.7%) and similar and even higher level of use of EAL indicate that it is not about the availability/unavailability of this method but it is about the preferences regarding this method. On the other hand, while the rate of use of finger sensitivity was reported to be 48.4% in public institutions in Turkey, the same rate was reported to be 6.2% for Belgium[4] and 0.4% for England.[2] It is not good that the use of finger sensitivity is that wide despite the high availability of EAL and/or radiography methods.

In general, while the studies examining the number of visits required for RCT are conducted in relation with the number of roots, the advancing experiences indicate that the vitality and apical health of teeth should be considered in determining the number of visit.[26] If there is no exact decision that has been made, the multiple visit seem to be more successful for the devital teeth.[27] In the present study, a relationship was found between the vitality of teeth and the number of visit, and it was determined that dentists generally completed the canal treatment with multiple visit for the devital teeth. The fact that single visit RCT protocol is preferred by those graduated before is believed to be related not only with the approach to indication but also with the adequacy of practical skills and the sufficiency of session duration. Higher level of single- visit implementation for both vital and devital teeth in public institutions, which are known with the higher number of examinations per day, may be related to the shortness of time allocated for each of patients.

In a study conducted in Finland to examine the retreatment indication, it was observed that the endodontists and general dental practitioners made similar decisions in interpreting the cases.[28] In the present study, the treatment approaches of participants to the cases diagnosed for retreatment indication were examined. Many (21.5%) participants working at public institutions preferred direct extraction rather than referring the patient to an endodontist, and this may be interpreted as the unavailability of option to refer to an endodontist, the low sociocultural level or the profile of patient who preferred those institutions because of the financial deficiencies.

In a study conducted on the instruments used during retreatment procedure, it was reported that the NiTi rotary devices specific to retreatment are effective and time-consuming.[29] Besides that, it was shown in another study that the best treatment was achieved from the use of manual and mechanical hand instruments in combination.[30] In addition, it is very attention-grabbing that there are significant differences between the device preferences of institutions. Although the H-type files are the most frequently used instruments in public institutions (82.8%), the least frequently used one is NiTi retreatment canal devices (12.9%); this finding also suggests that it is not about the "preference" but the "deficiencies/unavailability."

It is known that, in developing countries, the economic factors play important role in patients' requests and physicians' indication and treatment plans.[5] Moreover, it should be kept in mind that keeping the teeth within the mouth using endodontic treatment is more advantageous from the economic aspect than tooth extraction, bridgeworks, and implants.[1]

Conclusion

Even though the increase in proliferation of technological advancements (EAL and digital radiography) is considered promising, the low rate of use of rubber dam and magnification systems and the rates of determining the WL and completing the RCT without radiography, even for diagnostic purposes, suggest that there are deficiencies in terms of both of training and opportunities. Better relationships of newly-graduated dentists with the actual methods indicate that the endodontic trainings after the graduation should be supported. To increase the number of successful RCT s and to make referring to the endodontist possible, it is recommended to increase the number of endodontists working particularly at public institutions and to support the educational studies the training studies.

Conflict of interest: None declared.

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