Stomatologija, Baltic Dental and Maxillofacial Journal, 12: 42-50, 2010

Technical aspects of endodontic treatment procedures among Lithuanian general dental practitioners

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SUMMARY

Objective. The purpose of this study was to gather information about the various aspects, technical and biological, of endodontic treatment as performed by Lithuanian general dental practitioners and to compare their choices with established endodontic treatment standards of undergraduate education.

Materials and Methods. Questionnaires were sent to all 2850 Lithuanian dental practitioners. The structured questionnaire included inquiries about gender, duration of professional activity, working environment, details about instruments and materials.

Results. From total 1532 (53.8%) questionnaires were returned. Only responses from general dental practitioners (1431) were included. Of the respondents 66% never used a rubber dam. Most practitioners relied on conventional stainless steel instruments. The NiTi hand files were often and routinely used by 32.2% of the respondents. Sodium hypochlorite was the most popular choice as a root canal irrigant. Calcium hydroxide paste was used as an inter-appointment medicament. Cold-lateral condensation root filling method was used by 72.8% of the respondents while 15.6% used a paste for the root filling.

Conclusions. The results of this study indicate that the recently graduated dental practitioners were following the recommended standard of endodontic treatment better than those with a longer time from the graduation. It is important to improve the quality of existing courses of continuous education in endodontology in order to ensure the necessary competency in clinical practice. The low use of a rubber dam and low adoption of new technologies in Lithuania is not acceptable and needs to be changed.

Key words: questionnaire survey, general dental practitioner, root canal treatment.

INTRODUCTION

Endodontic therapy is often complicated and technically demanding. A varying degree of success of endodontic treatment has been reported; in some studies it is as high as 96% while in others it is as low as 60% [1,2,3,4]. Results of longitudinal studies where treatments were provided mainly by endodontists or highly-skilled general dentists have clearly demonstrated the possibility of controlling and eliminating periapical pathology when endodontic treatment standards, including strict asepsis, are maintained. This enhances favourable outcomes of endodontic therapy. Concomitantly, results of cross-sectional studies where endodontic therapy was mainly provided by general dental practitioners have not demonstrated high success rates. In these studies high numbers of teeth with inadequate root fillings associated with periradicular disease have been reported [1,2-4,5]. The incidence of apical periodontitis following root canal treatment procedures surveyed in many countries varies in the range of 20-60% [6]. A previous Lithuanian study found apical periodontitis in 70% of individuals, with most of the apical lesions (82%) detected in endodontically-treated teeth [5]. Such results question the quality of the endodontic treatment performed by general dental practitioners.

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The outcome of endodontic therapy has been associated with the pre-operative diagnosis of the tooth, microbial factors, maintenance of root canal treatment standards, including the quality of both root canal filling and coronal restoration, and individual factors such as the dentists' knowledge, attitudes and skills [4,7-9,10]. The environment in which the dentist works may also impact the outcome of root canal therapy.

Historically, endodontic treatment has been a part of general dental practice as the recognition of endodontics as a specialty in most parts of the world did not occur until the 1960's or later. In Lithuania, the endodontic specialty was recognized in 1992. Since the establishment of an endodontic specialty, standards of root canal treatment in Lithuania have experienced substantial changes. However, there are only 35 endodontists registered in the Lithuanian Dental Chamber. Given the small number of endodontists and the high need for endodontic treatment in Lithuania as compared to other countries, the provision of quality endodontic treatment is problematic. The number of highly-qualified specialists is low; consequently many general practitioners take responsibility for endodontic treatment which quality in Lithuania might also be influenced by their skill and knowledge in endodontics, the working environment, namely by the deficiency of both human and economical resources.

Overall, there is scarce scientific data about the general dental practitioner's approach to endodontic therapy and its impact on the success of root canal treatment is unclear [11,12,13 14]. Therefore, the purpose of the present study was to gather information about the various aspects, technical and biological, of endodontic treatment as performed by Lithuanian general dental practitioners and to compare their choices with established endodontic treatment standards of undergraduate education.

MATERIALS AND METHODS

Questionnaires were sent to all 2850 Lithuanian dental practitioners. A list was acquired from the Lithuanian Dental Chamber License registry database. The structured questionnaire was comprised of 58 questions with multiple-choice answers. The questionnaire was sent with an explanatory cover letter and a stamped, addressed return envelope. Dentists were asked to choose only answers that best fitted their clinical performance. Prior to the data collection, the questionnaire was tested in a pilot study and subsequently revised for clarity and for the length of the questionnaire.

The questionnaire (summarized in Table 1) included inquiries about gender, duration of professional activity, details about working environment, and how endodontic treatment procedures were performed including inquiries about the use of a rubber dam, choice of instruments and root canal irrigants, use of intracanal medications, choice of an obturation technique and sealer. Only responses from respondents who were licensed as general dental practitioners were assessed in the present study.

In order to make a more detailed comparison of the data, the sample was divided according to a few factors of interest: the duration of professional activity (group A (up to 9 years), group B (10-19 years), group C (20-29 years) and group D (more than 30 years)); the geographical location of the working place (rural and urban); the type of work place (full-time private dental practice, full-time public dental practice or a combination of both).

Substantial transformations in the undergraduate dental curriculum at two Lithuanian universities occurred in 1996. The first students from the new curricula graduated in 2000. In order to enable a comparison between the two Lithuanian dental schools, respondents who had graduated from their dental school since 2000 were grouped according to the university from which they received their diploma, namely into two groups OI and OF.

All returned forms were coded by a single operator and the data were checked and entered twice into a personal computer. Blank or multiple answers were treated as missing values.

Statistics

Data was analysed with the statistical software program SPSS 16 (SPSS for Windows; SPSS Inc., Chicago, IL). The Chi-square test was used to compare proportions among groups and the significance threshold for all tests was set at $P<0.05$.

RESULTS

From the 2850 questionnaires mailed out, a total of 1532 questionnaires were returned, which comprises a response rate of 53.8%. Out of the total 1532 responses, 1431 questionnaires were received from licensed general dental practitioners, of which 84.6% were females. A total of 956 dentists who practiced in urban and 576 dentists who practised in rural areas responded to the present inquiry, while a total of 802 urban and 516 rural dentists did not respond. The non-response analysis (Chi-square test) regarding the urbanization of dentists revealed no statistically significant differences ($P=0.417$) between responders and non-responders. This means that, with some degree of caution, the present sample can be considered to be representative of Lithuanian dentists.

The mean age of the respondents was 45 years old (range 23-75 years). Years in practice were distributed as follows: group A was composed of 316 dentists (22%), group B of 372 (26%), group C of 324 (23%) and group D of 419 (29%) dental practitioners. More than half of the respondents (62.1%) were from urban and 37.9% were from rural areas. The distribution of the geographical location of the work place of respondents according to the duration of professional activity is shown in Table 2. The majority of the respondents from group A practiced in urban areas while most dentists from group D practised in rural areas. In total, 59% of respondents were working full-time in private dental clinics while only 26.7% were working full-time in public dental clinics. A substantial number of dentists from group D (51.1%) were working full-time in public dental clinics (Table 2). Of the respondents who had graduated since 2000, 35.4% were from the "OI" university and 64.6% were from the "OF" university.

Use of rubber dam

The majority of Lithuanian general dental practitioners never use a rubber dam or use it irregularly during endodontic treatment procedures. Approximately 12% of the dentists reported rubber dam use either always (6%) or often (5.8%), while 66% of respondents never used it (Table 3). There was a statistically significant trend for younger clinicians from groups A and B (up to 19 years of professional activity) to use a rubber dam always or often as compared to their older counterparts who had practised for

Table 1. The operationalisation of the study variables and their scales of measurement

Study variables	Operationalisation&measurement scale
Work place	Geographical location of a dental clinic (nominal).
Gender	Male (1), Female (2). (nominal)
Age	Age in full years (interval)
Date of university graduation	Year of graduation (interval)
Duration of the professional activity	Years of dental practise (interval)
Dental Education	General dental practitioner (1), Endodontist (2), Prostodontist (3), Periodontologist (4), Orthodontist (5), Pediatric dentist (6), Oral surgeon (7), General dental practitioner and a specialist (8). (nominal).
University of graduation	Kaunas Medical University (1), Vilnius Universitety (2), Other (3). (nominal)
Type of Dental Practice	Full-time private practice (1), Full-time Community Dental Service (2), Community Dental Service and Private practice (3). (nominal)
Use of rubber dam	Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5) (ordinal).
Use of root canal disinfectants: NaOCl solution, Chlorhexidine, Hydrogen peroxide, no use of disinfectants, NaOCl and Chlorhexidine, Combinations of NaOCl and/or Chlorhexidine and/or Hydrogen peroxide.	Each measured as Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5). (ordinal)
Use of root canal irrigants: EDTA solution, RcPre Never, File-Eze Never.	Each measured as Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5). (ordinal).
Use of hand instruments for root canal preparation: Reamer, K-file, H-file, Niti-file.	Each measured as Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5). (ordinal).
Use of the intracanal medication for pulpitis: $Ca(OH)_2$, $Ca(OH)_2$ and other, no use of medication, other.	Each measured as Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5). (ordinal).
Use of intracanal medication for periodontitis: $Ca(OH)_2$, $Ca(OH)_2$ and other, no use of medication, other.	Each measured as Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5). (ordinal).
Root-canal obturation techniques: Cold lateral condensation, Single-cone gutta-percha, Use of paste type, Resorcinformaldehyde paste, Warm gutta-percha technique.	Each measured as Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5). (ordinal).
Use of intracanal sealers: AH+, Endomethasone, Zincoxide-eugenol, Resin based sealer.	Each measured as Never (1), Occasionally (2), Sometimes (3), Often (4), Always (5). (ordinal).

more than 20 years (Table 3). The numbers of dentists not using a rubber dam was highest in group D (more than 30 years of professional activity) i.e. 84.2% of respondents from this group never used a rubber dam. In private dental clinics, a rubber dam was used always or often by 17.4% of the respondents, while 91.8% of respondents working in public dental clinics never used it. The majority of respondents (76%) from OI used a rubber dam always and often during root canal treatment procedures while only 20.5% of respondents from OF used it always or often.

Instrumentation, irrigation and disinfection

When performing a root canal instrumentation, most Lithuanian practitioners relied on conventional stainless steel Flexofiles (75.9%) and K-files (62.4%). The routine use of K-files was found to be greater in groups C (67.2%) and D (69.2%) than in groups A (54.4%) and B (59.2%). Almost 6% of respondents routinely or often used endodontic instruments without knowing what kind of instrument they were using.

The NiTi hand files were often and routinely used by 32.2% of the respondents. The use of these instruments was greater among dentists from group A (42.7%) while only 21.5% of participants from group D used these instruments. The NiTi hand files were used more often by private practitioners (35.4%) than by those working in public dental clinics (18.5%). The respondents from OI group often or always used Flexofiles (80.9%) followed by NiTi hand files (52.1%) and K-files (33%). The majority of respondents from OF group used K-files (66.1%)

Table 2. Geographical location and working environment of respondents according to the duration of their professional activity

Reply options		Group of respondents				Total n=1431
		A (n=316)	B (n=372)	C (n=324)	D (n=419)	
Geographical localization						
Urban area	%	80.8	72.1	56.0	43.8	62.1
	OR*	5.4	3.3	1.6	1	
	[95% CI]	[3.8-7.6]	[2.4-4.5]	[1.2-2.2]		
Missing (n)		3	3	1	3	10
		χ_2=126.8; df=3; p<0.001				
Type of practice						
Full-time private practice	%	72.4	65.0	63.6	40.1	59.0
	OR*	3.9	2.8	2.6	1	
	[95% CI]	[2.9-5.4]	[2.1-3.7]	[1.9-3.5]		
Full-time community dental service	%	6.7	17.6	25.0	51.1	26.7
	OR*	0.1	0.2	0.3	1	
	[95% CI]	[0.0-0.1]	[0.1-03]	[0.2-0.4]		
Combination of private practice and community dental service	%	21.0	17.3	11.4	8.8 1	14.3
	OR*	2.7	2.2	1.3		
	[95% CI]	[1.8-4.2]	[1.4-3.3]	[0.8-2.2]		
Missing (n)		1	3	0	0	4
		χ_2=213.5; df=6; p<0.001				

* – odds ratio.

Table 3. Use of rubber dam according to the duration of professional activity

Reply options		Group of respondents				Total n=1431
		A (n=316)	B (n=372)	C (n=324)	D (n=419)	
Always/often	%	35.8	10.1	1.9	2.7	11.8
	OR	2.2	2.6	0.7	1	
	[95% CI]	[1.3-3.7]	[1.6-4.3]	[1.0-3.0]		
Sometimes/occasionally	%	26.6	26.0	25.2	13.1	22.2
	OR	2.2	1.7	2.3	1	
	[95% CI]	[1.3-3.6]	[1.0-2.8]	[1.4-3.8]		
Never	%	37.7	63.9	73.0	84.2	66.0
	OR	0.1	0.3	0.5	1	
	[95% CI]	[0.1-0.2]	[0.2-0.5]	[0.4-0.7]		
Missing (n)		0	6	2	7	15
		χ_2=294.2; df=6; p<0.001				

and Flexofiles (69.6%) followed by NiTi hand files (45.2%).

The results of the intracanal medicaments used during chemomechanical root canal preparation by Lithuanian practitioners are shown in Tables IV and V. Intracanal medicaments were used during chemomechanical root canal preparation by 98.8% of respondents. Sodium hypochlorite was the most popular choice as a root canal irrigant and 62.6% of the respondents used only it, while 7.5% respondents used it along with chlorhexidine (Table IV). Dentists from group A prefered to use sodium hypochlorite only. Almost 10% of respondents from group D, i.e. the ones mainly working in public dental clinics, used hyrogen peroxide for antibacterial irrigation.

EDTA in different forms was used by 92.8% of the respondents (Table IV). Of the practitioners who used EDTA, 62.3% combined it with sodium hypochlorite.

Non-setting calcium hydroxide paste $Ca(OH)_2$ was frequently used as an inter-appointment medicament by respondents for treating both vital (80.8%) and non-vital (87.8%) teeth. Approximately 11% of the respondents did not use any dressing in the treatment of vital pulp cases. In non-vital cases, 7.2% of respondents combined $Ca(OH)_2$ with other medicaments like chlorhexidine and 4.4% of respondents used other medicaments such as jodoform, phenol or camphorated products (Table V). Jodoform was used by some practitioners from groups B (3.6%), C (4.3%)

Table 4. Choice of root canal irrigants

Type of medication		Group of respondents				Total n=1431
		A (n=316)	B (n=372)	C (n=324)	D (n=419)	
Antimicrobial solution						
NaOCl	%	80.7	65.9	59.6	48.1	62.6
	OR	4.4	2.1	1.6	1	
	[CI 95%]	[3.1-6.2]	[1.5-2.8]	[1.2-2.1]		
Chlorhexidine	%	7.3	14.3	15.5	22.6	15.4
	OR	0.3	0.6	0.6	1	
	[CI 95%]	[0.2-0.4]	[0.4-0.8]	[0.4-0.9]		
NaOCl and chlorhexidine	%	6.6	8.8	9.0	5.8	7.5
	OR	1.1	1.5	1.6	1	
	[CI 95%]	[0.6-2.1]	[0.9-2.7]	[0.9-2.8]		
Hydrogen peroxide	%	2.5	5.8	7.1	9.7	6.5
	OR	0.2	0.6	0.7	1	
	[CI 95%]	[0.1-0.5]	[0.3-0.9]	[0.4-1.2]		
Combinations*	%	2.8	4.9	8.4	10.7	6.9
	OR	0.2	0.4	0.8	1	
	[CI 95%]	[0.1-0.5]	[0.2-0.8]	[0.5-1.3]		
Missing (n)		0	9	2	12	23
		χ_2=116.38; df=15; p<0.001				
EDTA						
EDTA solution	%	9.2	9.1	7.5	9.6	8.9
	OR	1	0.9	0.8	1	
	[CI 95%]	[0.6-1.6]	[0.6-1.5]	[0.5-1.3]		
Missing (n)		0	8	3	11	22
		χ_2=1.1; df=3; p=0.08				
RcPrep**	%	80.4	75.8	69.3	67.9	73.0
	OR	1.9	1.5	1.1	1	
	[CI 95%]	[1.3-2.7]	[1.1-2.0]	[0.8-1.5]		
Missing (n)		0	8	2	11	21
		χ_2=17.9; df=3; p<0,001				
File-Eze***	%	9.8	12.6	13.8	7.9	10.9
	OR	1.3	1.7	1.9	1	
	[CI 95%]	[0.8-2.1]	[1.1-2.7]	[1.2-2.0]		
Missing (n)		0	8	5	12	25
		χ_2=8.1; df=3; p=0.04				

* – combinations of NaOCl and/or Chlorhexidine and/or Hydrogen peroxide;
** – Premier Dental Products Co., King of Prussia, PA, USA;
*** – Ultradent Products Inc., South Jordan, UT, USA.

and D (4.8%) while in group A none used this medicament. Calcium hydroxide as an inter-appointment medicament in vital teeth was used by 95.8% of the respondents from OI group and by 87% of the OF group. The corresponding percentages for the non-vital cases were 100% and 91.7%, respectively.

Obturation techniques and materials

The cold lateral condensation root filling method with gutta-percha and sealer was used by 72.8% of the respondents, while 15.6% used a paste for the root filling (Table VI). The cold lateral-percha condensation method was much more common in group A than in group D (Table VI). Almost 95% of recent graduates from both universities (OI and OF) used cold lateral condensation as their main technique. The use of single-cone gutta-percha technique and pastes increased as the time from graduation increased. The "Russian red" or resorcinformaldehyde and ZnO paste was occassionally used by 11% of respondents, mainly from groups C and D.

A wide variety of root canal sealers was used, but the zinc-oxide eugenol sealer (58.7%) was most frequently chosen, followed by Endomethasone (16.4%) and AH+ (13.9%) (Table VI). The younger participants tended to use the AH+ sealer more often than older participants (Table VI). This sealer was routinely or often used by 39.6% of respondents from OI group but only 14.9% of the OF group. Endomethasone was used as a sealer by 22% of OF group respondents but only 4.2% of OI group.

DISCUSSION

The results of the present study reveal the activities and choices made by Lithuanian general dental practitioners regarding root canal treatment. In general, the majority of Lithuanian dentists were not following the modern standards of endodontic treatment. The result emphasizes the existing challenges in undergraduate and continuing education. Clearly, improvement in human as well as economic resources

Table 5. Choice of disinfectant intracanal-medication

Type of medication		Group of respondents				Total n=1431
		A (n=316)	B (n=372)	C (n=324)	D (n=419)	
Intracanal medication for pulpitis						
$Ca(OH)_2$	%	91.0	82.9	81.1	71.7	80.8
	OR	3.5	1.7	1.7	1	
	[CI 95%]	[2.3-5.3]	[1.2-2.4]	[1.2-2.4]		
$Ca(OH)_2$ and other	%	1.6	1.1	1.9	2.7	1.9
	OR	0.8	0.9	0.6	1	
	[CI 95%]	[0.4-1.8]	[0.4-1.9]	[0.3-1.5]		
Other	%	1.9	6.1	6.2	10.4	6.4
	OR	0.3	0.6	0.7	1	
	[CI 95%]	[0.2-0,6]	[0.4-0.9]	[0.4-1,1]		
No use of medication	%	5.5	9.9	10.9	15.2	10.7
	OR	0.3	0.6	0.7	1	
	[CI 95%]	[0.2-0.6]	[0.4-0.9]	[0.4-1.1]		
Missing (n)		2	4	4	11	21
		χ_2=47.0; df=9; p=0.04				
Intracanal medication for periodontitis						
$Ca(OH)_2$	%	94.9	89.0	83.2	85.0	87.8
	OR	3.2	1.3	0.9	1	
	[CI 95%]	[1.8-5.4]	[0.8-1.7]	[0.6-1.3]		
$Ca(OH)_2$ and other	%	3.8	6.9	9.0	8.7	7.2
	OR	0.4	0.8	1.0	1	
	[CI 95%]	[0.2-0.8]	[0.5-1.3]	[0.6-1.7]		
Other	%	0.6	3.6	7.5	5.6	4.4
	OR	0.1	0.6	1.4	1	
	[CI 95%]	[0.0-0.5]	[0.3-1.2]	[0.8-2.5]		
No use of medication	%	0.6	0.6	0.3	0.7	0.6
	OR	0.9	0.8	0.4	1	
	[CI 95%]	[0.1-5.3]	[0.1-4.5]	[0,0-4.1]		
Missing (n)		2	9	2	5	18
		χ_2=30.1; df=9; p<0.001				

is necessary to obtain an improvement in the technical quality of root canal therapy and thereby hopefully decrease the frequency of apical periodontitis in root filled teeth in the Lithuanian population.

The survey questionnaire is a common instrument used in evaluating healthcare systems [12,13,14,15]. The major disadvantage of surveys is that often only low response rates are obtained. The implication of low response rates is that findings can not be generalized to populations of interest with any certainty. However low response rates in survey studies are not uncommon [14,15]. In the present survey,

Table 6. Choice of root-canal obturation technique and sealer

Type of medication		Group of respondents				Total n=1431
		A (n=316)	B (n=372)	C (n=324)	D (n=419)	
Obturation technique						
Cold lateral condensation	%	94.6	81.9	67.4	52.5	72.8
	OR	17.4	4.5	2.1	1	
	[95% CI]	[10.7-28.4]	[3.5-5.9]	[1.6-2.6]		
Missing (n)		3	12	2	6	23
		χ_2=180.4; df=3; p<0.001				
Warm gutta-percha technique	%	2.6	0.6	1.6	0.7	1.3
	OR	3.6	0.8	2.2	1	
	[95% CI]	[0.9-13.6]	[0.1-4.6]	[0.5-9.1]		
Missing (n)		3	13	2	6	24
		χ_2=6.7; df=3; p=0.08				
Single-cone gutta-percha	%	4.8	4.5	8.1	17.4	9.2
	OR	0.2	0.2	0.4	1	
	[95% CI]	[0.1-0.4]	[0.1-0.4]	[0.3-0.7]		
Missing (n)		3	13	2	6	
		χ_2=51.1; df=3; p<0.001				
Paste type	%	1.9	8.6	18.0	30.3	15.6
	OR	0.0	0.2	0.5	1	
	[95% CI]	[0.0-0.1]	[0.1-0.3]	[0.4-0.7]		
Missing (n)		3	12	2	6	24
		χ_2=126.4; df=3; p<0.001				
EDTA						
AH + *	%	22.4	13.6	13.0	8.3	13.9
	OR	3.2	1.7	1.7	1	
	[95% CI]	[2.0-4.9]	[1.1-2.8]	[1.0-2.7]		
Missing (n)		3	13	2	10	28
		χ_2=29.6; df=3; p<0.001				
Endomethasone **	%	15.3	12.8	17.7	19.3	16.4
	OR	0.8	0.6	0.9	1	
	[95% CI]	[0.5-1.1]	[0.4-0.9]	[0.6-1.3]		
Missing (n)		3	13	2	10	28
		χ_2=6.6; df=3; p=0.09				
Zinc-oxide-eugenol	%	59.7	57.7	57.8	59.4	58.7
	OR	1.0	0.9	0.9	1	
	[95% CI]	[0.7-1.4]	[0.7-1.2]	[0.7-1.6]		
Missing (n)		3	13	2	10	28
		χ_2=0.5; df=3; p=0.9				
Resin based sealer	%	5.4	0.1	5.9	0.9	5.3
	OR	1.4	1.6	1.6	1	
	[95% CI]	[0.7-2.8]	[0.8-3.1]	[0.8-3.1]		
Missing (n)		3	13	4	10	30
		χ_2=2.3; df=3; p=0.5				

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the response rate was 53.8%, which is relatively high in comparison to some other studies. For example, in the Jenkins et al. [14] study, the response rate was lower (41%) and the sample was limited to graduates of one dental school. In contrast, the present sample was derived from the list of all Lithuanian dental practitioners. Moreover, the present sample comprised similar numbers of individuals with different length of professional activity.

According to the quality guidelines for endodontic treatment [16], infection control is regarded very important in root canal treatment. Use of a rubber dam is considered to be a minimum standard in infection control and is taught in the undergraduate programs of dental schools [16,17]. However, the results from numerous studies show that the use of a rubber dam in daily dental practice still differs, e.g. 59% of American general dental practitioners always use a rubber dam while the use of a rubber dam is less prevalent among European dental practitioners [12]. For example, only 30-40% of UK practitioners used a rubber dam during routine root canal treatment procedures [13,18]. Only 3.4% of Flemish respondents used a rubber dam routinely [19]. Another Belgium study, showed that the majority (64.5%) of practising dentists never or seldom used a rubber dam, while 20.5% of them used rubber dam in a limited number of cases and only 7.2% used rubber dam in all cases of endodontic treatment [20]. Similarly, a rubber dam was also irregularly used by Danish dentists as only 4% of them applied it often and it was used occasionally by another 14% of respondents [21]. These results are comparable with the results from the present study where only 6% of clinicians used a rubber dam routinely while the majority (66%) of Lithuanian general practitioners never used it.

The quality of the mechanical preparation of the root canal system is another important step which influences the outcome of endodontic treatment. Numerous studies have shown the superiority of nickel-titanium files over conventional instruments to shape the root canal [14,19,20]. However, traditional stainless steel instruments such as K-files and Flexofiles, which do not allow optimal instrumentation of curved canals, are still the most widely used instruments in many countries, including Lithuania [20]. In a study from the United Kingdom, 20% of respondents used K-Flex files and 16% used K-files [14].

Routine use of nickel-titanium files in endodontic practice may improve the quality of mechanical preparation of the root canal system. The delay in the implementation of these instruments in the daily practise of Lithuanian dentists is evident. In the present study, NiTi hand files were used by 32.2% of the respondents. NiTi hand files were used by 49.5% of Flemish practitioners, while only 18% of the dentists in Copenhagen used NiTi hand files often [20,21].

Due to the complexity of the root canal anatomy, cleanliness in roots cannot be achieved by only mechanical means [22]. Therefore, the use of an antimicrobial irrigant solution is strongly recommended. Sodium hypochlorite solution is the preferred irrigant due to the combination of antimicrobial action and a capacity to dissolve organic matter [23]. Sodium hypochlorite was used by 62.6% of the respondents. In a study of general dental practitioners, Whitten et al. [12] reported that 79% used sodium hypochlorite as an irrigant, while in surveys by Whitworth et al. [13] and Jenkins et al. [14], sodium hypochlorite was not used routinely .

Intracanal interappointment medicaments are used to kill bacteria reduce inflammation and to control pain. Biocompatible dressings such as calcium hydroxide pastes are favoured [24]. However, it has been previously reported that only a few dentists (7-10%) used non-setting calcium hydroxide as their interappointment medicament routinely [14,19]. In the present study, calcium hydroxide was commonly used as an intracanal medicament in the treatment of both vital and non-vital cases. The popular use of calcium hydroxide paste among Lithuanian dental practitioners could be due to the fact that the philosophy of endodontic treatment underwent substantial changes during the last 15 years and this knowledge was transfered to general practitioners.

The quality of the root filling is factor contributing to the overall success of endodontic treatment. The cold-lateral condensation of gutta-percha in conjunction with a root canal sealer is the most widely accepted technique for obturating root canals and is the technique taught in most dental schools as part of their undergraduate program [19,25]. Therefore, it is not surprising that this is the most popular obturating technique used by the majority of the practitioners, especially by the younger ones. It may be impossible to reliably fill the root canal space in three-dimensions with the single-cone/point gutta-percha technique. Therefore this treatment modality is not recommended as a standard endodontic treatment [14,20]. With paste-type root fillings, the risk of underfilling or overfilling of the root canal is obvious. Nevertheless, paste-type fillings were used by almost 16% of the respondents in the present study.

According to the guidelines of the European Society of Endodontists [16], sealers used during the root canal filling procedure should be biocompatible. A wide variety of root canal sealers was reported in numerous studies. The results of the present study showed the popularity of ZnOE sealer among Lithuanian endodontists. The situation is expected

to change due to the fact that ZnOE sealer has been now removed from the market.

CONCLUSIONS

It was concluded that the recently graduated dental practitioners were following the standard of endodontic treatment better than dentists with a longer time from graduation. It is important to improve the quality of existing courses of continuous education in endodontology in order to ensure the necessary competency in clinical practice. The differences in following the endodontic standards between the graduates of the two universities exists. The low use of a rubber dam and low adoption of new technologies in Lithuania is not acceptable and needs to be changed.

ACKNOWLEDGEMENTS

The authors would like to thank Mrs. Ingrid Ellis for editorial assitance during the final preparation of this manuscript.

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Received: 16 01 2010
Accepted for publishing: 21 06 2010