

# Perception of Undergraduate Students at the Faculty of Medicine in Hradec Králové Regarding Their Endodontic Education and Suggested Improvements

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## ABSTRACT

**Aim:** The aim of this study was to assess the perception of undergraduate dentistry students at Charles University, Faculty of Medicine in Hradec Králové, the Czech Republic regarding their endodontic education within the context of the Undergraduate Curriculum Guidelines for Endodontology by the European Society of Endodontology (ESE). The secondary aim was to compare this perception among students in the Czech and English groups.

**Methodology:** A questionnaire survey was conducted among fifth year students at the very end of their studies.

**Results:** The students returned 60 filled questionnaires, making the response rate of 75.9%. More than two thirds of the respondents declared that they were competent at or had knowledge of most of the major competencies defined by the ESE. Eighty seven percent of respondents felt competent to perform a root canal treatment on anterior teeth; 86.7% on premolars; and 48.3% on molars. Nearly all respondents (98.3%) recommended more opportunities to practice on patients.

**Conclusions:** The overall perception of the students was that their endodontic education was sufficient and largely conformed to the guidelines. Insufficient exposure to endodontic practice on patients was identified as a deficiency. There were no significant differences in perceptions between the two study groups.

## KEYWORDS

dental education; dentistry students; endodontic curriculum; endodontic education; questionnaire survey

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## INTRODUCTION

Root canal treatment (RCT) is the treatment of teeth with irreversibly damaged or necrotic dental pulps with the goal of preserving the non-vital but functional tooth in the mouth (1). As there is no official state-guaranteed specialization in endodontics in the Czech Republic, RCT falls into the basic spectrum of treatment modalities provided by general dental practitioners. Thus, during undergraduate dentistry studies, students need to be familiarized with endodontology and achieve sufficient skills to be able to perform RCT independently.

The European Society of Endodontology (ESE) published recommendations about undergraduate endodontic curriculum in 2013 (2). There are 3 domains of endodontic competencies defined: scientific foundations of endodontic practice, nonsurgical endodontic treatment and surgical endodontic treatment. Each domain has several corresponding major competencies with specified required level of skills. The different levels of skills are defined and approved by the Association of Dental Education in Europe (3) (Table 1).

Within the curriculum of the dentistry programme at Charles University, Faculty of Medicine in Hradec Králové, endodontic education is divided into three subjects (Table 2). Apart from these dedicated endodontic subjects, students learn other topics related to endodontics in other subjects, such as tooth morphology including the root system in the Preclinical Dentistry I in the winter term of the first year and X-ray imaging in Dental Radiology in the winter term of the third year.

There are two parallel study groups – one in the Czech language and the other one in English. Both groups have the same curriculum, the same lectures, the same teachers and the same assessments. The only difference between the 2 groups is the language used. For practical lessons the students of these two groups are mixed, meaning each working pair consists of one student from each group.

In the literature there are only few studies dealing with the evaluation of endodontic education by students. There are no published studies on this topic from the Czech Republic or the Central European region.

**Tab. 1** Definitions of the levels of applied to competences (3).

To be competent at	A dentist should on graduation demonstrate a sound theoretical knowledge and understanding of the subject together with an adequate clinical experience to be able to resolve clinical problems encountered independently or without assistance.
To have knowledge of	A dentist should on graduation demonstrate a sound theoretical knowledge and understanding of the subject but may have only limited clinical/practical experience.
To be familiar with	A dentist should on graduation demonstrate a basic understanding of the subject but need not have clinical experience or be expected to carry out procedures independently.

The primary aims of this study were (i) to assess the perception of the undergraduate students at Charles University, Faculty of Medicine in Hradec Králové, the Czech Republic regarding the endodontic curriculum within the context of the Undergraduate Curriculum Guidelines for Endodontology published by ESE in 2013; (ii) to evaluate endodontic education from the point of view of the students at the time of graduation in terms of other factors, i.e. quality and range of the lectures, extent of practical training, and suitability of the included topics; (iii) to document students' perceptions about their own endodontic experience, e.g. number of treated canals/teeth in patients and in vitro, the confidence in root canal treatment of different teeth; and (iv) to gather suggestions for improving endodontic education. The secondary aim was to compare these perceptions among the students in the Czech and English language groups.

**Tab. 2** Description of dedicated endodontic subjects.

Subject		Endodontics I	Endodontics II	Endodontics III
Timing	Year	3rd	4th	5th
	Semester	summer	summer	winter
Teaching hours	Theory	25	6	15
	Preclin. practice	12	9*	0*
Description	Theory	Basic endodontic topics, e.g. diseases of dental pulp, vital pulp treatment, procedure of RCT including the instruments and materials used, complications, postendodontic treatment.	Machine shaping of the root canals, usage of ultrasound and operation microscope in endodontics.	Advanced endodontics procedures such as root canal retreatment, retrograde endodontic treatment, internal bleaching etc.
	Practice	Training of root canal treatment using hand instruments and lateral compaction.	Training of rotary shaping of the root canals. RCT in patients.	RCT in patients including postendo.
Requirements		Hand RCT of 2 canals in plastic blocks and 3 canals in extracted teeth	Rotary RCT of 2 canals in plastic blocks and 3 canals in extracted teeth.	RCT of 1 tooth in patient.

\* Clinical practical lessons are incorporated in the practical lessons of the subject Clinical dentistry.

**Tab. 3** A comparison of Czech and English groups and the years of graduation in terms of age and gender.

		Total	Gender		Age [years] - quantitative	Age [years] - qualitative			
			Men	Women	Median	23	24	25	26-38
		% (n)	% (n)	% (n)	(Q1; Q3)	% (n)	% (n)	% (n)	% (n)
Language	Czech	71.7 (43)	30.2 (13) *	69.8 (30) *	24 (24; 25)	2.3 (1) **	51.2 (22) **	32.6 (14) **	14.0 (6) **
	English	28.3 (17)	64.7 (11) *	35.3 (6) *	24 (23; 24)	35.3 (6) **	41.2 (7) **	0.0 (0) **	23.5 (4) **
Year	2017	55.0 (33)	30.3 (10)	69.7 (23)	24 (24; 25)	6.1 (2)	45.5 (15)	33.3 (11)	15.2 (5)
	2018	45.0 (27)	51.9 (14)	48.1 (13)	24 (24; 25)	18.5 (5)	51.9 (14)	11.1 (3)	18.5 (5)

\* p < 0.05; Pearson's Chi-Square test

\*\* p < 0.001; Pearson's Chi-Square test or Fisher's exact test

### MATERIAL AND METHODS

The study was approved by the Ethics committee of the University Hospital Hradec Králové (ref. no. 201708 S12P) and by the dean of Charles University, Faculty of Medicine in Hradec Králové.

A questionnaire survey was conducted. The authors created the questionnaire based on the ESE recommendations about the undergraduate endodontic curriculum (2) and on questionnaires used in other published studies on similar topics (4, 5). In the first part of the survey, respondents were asked about their gender and age. The second part included the major endodontic competencies according to the ESE recommendations. Each competency was asked two different ways: subjective self-evaluation of the student, if he or she is competent at or has knowledge of the specific area; and the student's assessment of the education, whether it was sufficient in this particular field. The third part contained of questions about the students' endodontic experience, their evaluation of the education and suggestions.

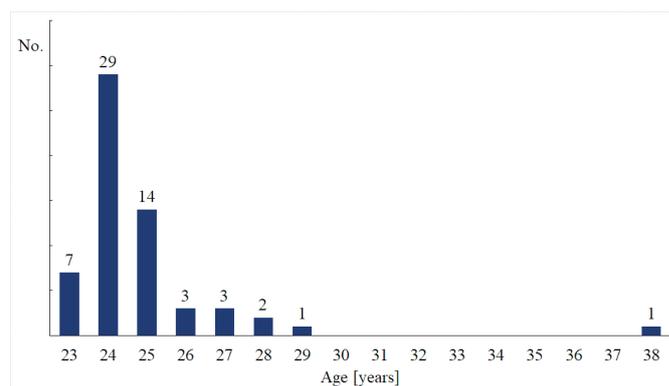
After piloting the survey with 10 students, no changes were made and the questionnaires were distributed to all students of the fifth year at the very end of their studies, studying in both Czech and English language, in two subsequent academic years (2016/2017 and 2017/2018). The inclusion criterion was graduation in one of the involved academic years. No exclusion criteria were applied. A total of 79 questionnaires were distributed. Participation in the study was voluntary, each participant signed an informed consent. Data from the questionnaires were analyzed anonymously in the NCSS 10 using methods of descriptive statistics, nonparametric Mann-Whitney test and Pearson's  $\chi^2$  test of independence in contingency tables or Fisher's exact test. The level of statistical significance was set to  $\alpha = 0.05$ .

### RESULTS

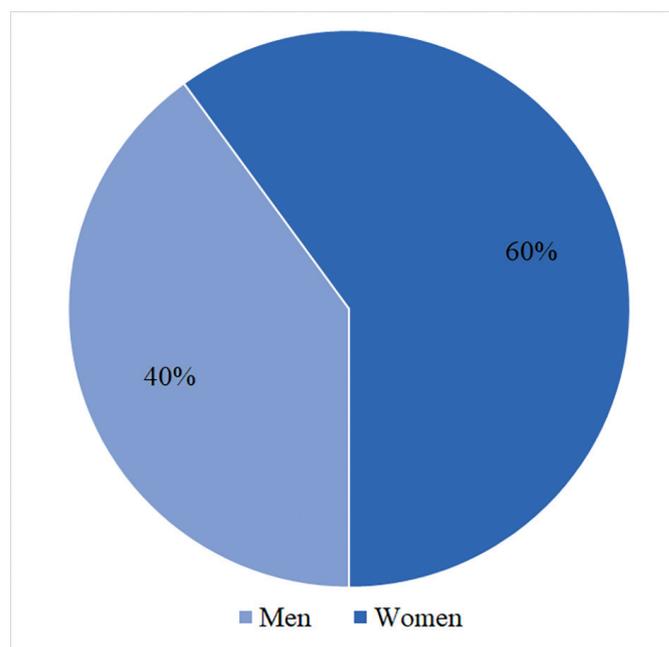
A total of 60 students filled and returned the questionnaires, making the response rate 75.9%.

Figures 1 and 2 show the information about the age and gender distribution of the participating students. The me-

dian age was 24 years (Q1 = 24; Q3 = 25). The comparison of age and gender distribution between the study groups (Czech/English) and between the years of graduation (2017/2018) are presented in Table 3. For the statistical analysis of the differences between the groups the students in the age of 26 to 38 years were joined.



**Fig. 1** Age distribution of the respondents.

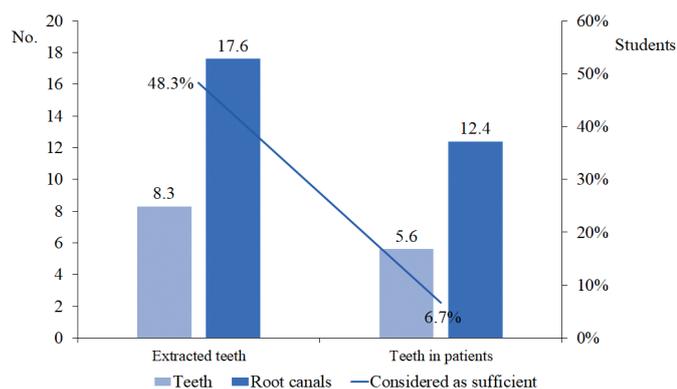


**Fig. 2** Gender distribution of the respondents.

Tab. 4 Respondents' answers to the questions dealing with the major endodontic competencies.

	Yes % (n)	No % (n)		Yes % (n)	No % (n)
<b>Domain 1: Scientific foundations of endodontic practice.</b>					
I have knowledge of development, structure, function and ageing of oral and dental tissues.	100.0 (60)	0.0 (0)	I am competent at performing procedures to retain all or part of the dental pulp in health.	93.3 (56)	6.7 (4)
– Was the education in this field sufficient?	100.0 (60)	0.0 (0)	– Was the education in this field sufficient?	91.7 (55)	8.3 (5)
I have knowledge of anatomy of the head and neck region.	95.0 (57)	5.0 (3)	I am competent at performing good quality root canal treatment.	70.0 (42)	30.0 (18)
– Was the education in this field sufficient?	96.7 (58)	3.3 (2)	– Was the education in this field sufficient?	68.3 (41)	31.7 (19)
I have knowledge of dental anatomy.	100.0 (60)	0.0 (0)	I am competent at restoring root canal-treated teeth.	70.0 (42)	30.0 (18)
– Was the education in this field sufficient?	100.0 (60)	0.0 (0)	– Was the education in this field sufficient?	66.7 (40)	33.3 (20)
I have knowledge of pathology of oral and dental diseases.	100.0 (59)	0.0 (0)	I am competent at monitoring and evaluating the outcome of endodontic treatment.	93.3 (56)	6.7 (4)
– Was the education in this field sufficient?	93.2 (55)	6.8 (4)	– Was the education in this field sufficient?	91.7 (55)	8.3 (5)
I have knowledge of microbiology and immunology.	73.3 (44)	26.7 (16)	I am competent at communicating verbally and in writing with dental and medical colleagues.	83.3 (50)	16.7 (10)
– Was the education in this field sufficient?	71.7 (43)	28.3 (17)	– Was the education in this field sufficient?	56.7 (34)	<b>43.3 (26)</b>
I have knowledge of general medicine and surgery as applied to the management of dental (including endodontic) patients.	81.7 (49)	18.3 (11)	I have knowledge of the management of dentoalveolar trauma.	88.3 (53)	11.7 (7)
– Was the education in this field sufficient?	76.7 (46)	23.3 (14)	– Was the education in this field sufficient?	81.7 (49)	18.3 (11)
I have knowledge of pharmacology and therapeutics as applied to the management of dental (including endodontic) patients.	76.7 (46)	23.3 (14)	<b>Domain 3: Surgical endodontic treatment.</b>		
– Was the education in this field sufficient?	66.7 (40)	33.3 (20)	I am competent at conducting a detailed general and dental history for a patient with post-treatment endodontic disease.	100.0 (60)	0.0 (0)
I have knowledge of biomaterials science as applied to endodontics.	65.0 (39)	<b>35.0 (21)</b>	– Was the education in this field sufficient?	90.0 (54)	10.0 (6)
– Was the education in this field sufficient?	56.7 (34)	<b>43.3 (26)</b>	I am competent at conducting a comprehensive clinical examination of a patient with post-treatment endodontic disease.	95.0 (57)	5.0 (3)
I have knowledge of diagnostic imaging.	91.7 (55)	8.3 (5)	– Was the education in this field sufficient?	91.7 (55)	8.3 (5)
– Was the education in this field sufficient?	85.0 (51)	15.0 (9)	I am competent at reaching a diagnosis and possible differential diagnosis, and presenting treatment options for the management of post-treatment endodontic disease.	91.7 (55)	8.3 (5)
I have knowledge of epidemiology, public health measures and biostatistics.	43.3 (26)	<b>56.7 (34)</b>	– Was the education in this field sufficient?	88.3 (53)	11.7 (7)
– Was the education in this field sufficient?	46.7 (28)	<b>53.3 (32)</b>	I have knowledge of recognizing conditions that may best be managed by surgical endodontic treatment.	63.3 (38)	<b>36.7 (22)</b>
<b>Domain 2: Nonsurgical endodontic treatment.</b>			– Was the education in this field sufficient?	65.0 (39)	<b>35.0 (21)</b>
I am competent at conducting a detailed general and dental history.	100.0 (60)	0.0 (0)	I have knowledge of assessing the benefits, risks and likely outcome of endodontic surgery.	65.0 (39)	<b>35.0 (21)</b>
– Was the education in this field sufficient?	95.0 (57)	5.0 (3)	– Was the education in this field sufficient?	65.0 (39)	<b>35.0 (21)</b>
I am competent at conducting a comprehensive clinical examination of a patient with an endodontic-related problem.	98.3 (59)	1.7 (1)	I have knowledge of postoperative monitoring of surgical endodontic patients.	46.7 (28)	<b>53.3 (32)</b>
– Was the education in this field sufficient?	98.3 (59)	1.7 (1)	– Was the education in this field sufficient?	45.0 (27)	<b>55.0 (33)</b>
I am competent at reaching a diagnosis and possible differential diagnosis.	98.3 (59)	1.7 (1)			
– Was the education in this field sufficient?	98.3 (59)	1.7 (1)			
I am competent at establishing a treatment plan and communicating this to the patient.	86.7 (52)	13.3 (8)			
– Was the education in this field sufficient?	80.0 (48)	20.0 (12)			

The five highest numbers of answers "No" are in bold.



**Fig. 3** Summary of endodontic experience of the respondents. Bars show the numbers of treated root canals/teeth on extracted teeth and in patients; axis on the left side. Line shows the percentage of the respondents considering these numbers as sufficient; axis on the right side.

Table 4 presents the answers of the respondents to the questions dealing with the major endodontic competencies according to the ESE recommendations.

Figure 3 shows the numbers of root canal treatments on extracted teeth/root canals and on real patients, along with the students' assessment of whether the experience was sufficient for independent practice. Four of the students declared they had not performed any root canal treatment on real patients. The teeth which were endodontically treated as the first RCT by the student on a patient were most often teeth 15 and 16 (maxillary right second premolar and maxillary right permanent first molar respectively; 7 cases each). Next in order were tooth 25 (maxillary left second premolar), tooth 36 (mandibular left permanent first molar) and tooth 46 (mandibular right permanent first molar); 4 cases each.

Forty-nine respondents (87.1%) felt that they were competent to perform RCT on anterior teeth, 52 (86.7%) on premolars, and 29 (48.3%) on molars.

The number of teaching hours, the range of education and the quality of education were considered sufficient by 81.7%, 86.7%, and 83.3% of respondents respectively.

As a proposed improvement, 98.3% of the respondents (n = 59) stated more practice on patients; 51.7% (n = 31) stated more practice on extracted teeth; 13.3% (n = 8) stated higher quality of lectures; and 8.3% (n = 5) stated more lectures.

Table 5 shows the frequently mentioned topics suggested for modification.

No statistically significant differences were found in the responses of students from the Czech and English study groups.

## DISCUSSION

A questionnaire survey was chosen as a study design to reach the goals of the study. It is an inexpensive and fast method to gather required information. Although it has a limitation in the subjectivity of the answers, the questionnaire survey is often used in similar kinds of studies (4, 5).

**Tab. 5** Most frequent respondents' suggestions.

Topics suggested to be added or addressed more	n
More practice on the patients	13
Postendodontic treatment	7
Endodontic radiology	6
Complications during and after treatment	6
Root canal retreatment	6
Improve preclinical training	5
More rotary endodontics	5
Topics suggested to be removed or shortened	n
Too much rotary endodontics	5

The study groups differed in terms of gender distribution and age. There were more women than men in the Czech group, which corresponds with the traditional gender distribution among dentists in the Czech Republic, where 61.9% are female dentists and 38.1% are male dentists (6). In the English study group, where there are students from many other countries, the gender distribution was opposite. The median age was the same in both groups; however, there were different distributions of students according to their age.

The second part of the questionnaire was based on the major competencies listed in the ESE recommendations on the undergraduate endodontic curriculum (2). The first parts of the questions presented a self-evaluation related to the students, whereas in the second parts the students evaluated the education itself. Overall, the evaluation in both parts of the questions was rather positive in the majority of the competencies. More than 80% of the respondents answered "yes" in the first parts of 17 questions and in the second parts of 15 questions out of 26. More than one half of the students declared they didn't have knowledge of "epidemiology, public health measures and biostatistics" and of "postoperative monitoring of surgical endodontic patients"; correspondingly, more than one half of the respondents considered the education in these two fields as insufficient. Between one third and one half of the students declared they didn't have knowledge of "biomaterials science as applied to endodontics", of "recognizing conditions that may best be managed by surgical endodontic treatment" and of "assessing the benefits, risks and likely outcome of endodontic surgery"; more than one third of the students also considered education insufficient in these three fields and additionally in "communicating verbally and in writing with dental and medical colleagues". These subjects need to be addressed.

The average number of root canal treatments performed on both extracted and real teeth in this study was higher than in the study from the Cardiff University (4), where the average number of root fillings among the fifth year students was 7.4 on extracted teeth and 2.81 on real teeth. One third of involved students completed zero or one root filling. The number of root fillings performed on extracted and real teeth had an influence on the perception of competence. Such a correlation was not seen in our

study, i.e. no number of root canals was found as a minimum to be considered sufficient, neither for extracted nor real teeth. An alarming finding was that four students had never done root canal treatment on a patient during their undergraduate studies. Thus, it is essential to implement performing a root canal treatment on a real patient as a strict credit condition. In the current syllabus the formulation of this requirement is vague. The mean number of root canals treated by the fifth-year students at the University of Otago, New Zealand, was 10.4 canals (5).

There are different demands on students during their undergraduate endodontic education at schools in the European Union (7, 8), in the USA and in Canada (9). Out of the dental schools in the United Kingdom 87% had minimum requirements for the number of RCTs during the preclinical training, and 67% for the clinical training (7). A total of 81% of European schools required a minimum number of RCTs performed by their students. This minimum varied between 3 and 80 canals with an average of 17 canals (8). Among the schools in the USA and Canada the students were required to do RCT of at least 3–9 teeth (average 4.9 teeth) or of 4–18 root canals (average 8.8 canals) (9). At Cardiff University students are expected to treat 6 extracted teeth, two of them being molars (4). Our respondents would roughly meet these requirements.

Around 80% of the third, fourth and fifth year students ranked education in endodontics at the Cardiff University as  $\leq 5$  on the Likert scale (1 = inadequate to 10 = good), stating a lack of clinical experience. Out of the fifth year's students 90.5% felt competent when performing uncomplicated non-surgical RCT on a single-rooted tooth, but only 42.9% on a multirouted tooth (4). Our results showed similar findings. Most of our students felt competent to perform RCT on anterior teeth and premolars, however, less than half of them felt competent to perform RCT on molars. The students mostly expressed a satisfaction with the amount, range and quality of endodontic lectures, but they recommended increasing experience with both extracted teeth and on the patients. Correspondingly, the most frequent suggestion in the open-ended questions was to provide more practice on real patients. In recent years the number of the patients demanding primary RCT has decreased. The reasons are improvements of dental health status in the general population and the introduction of more reliable treatments for preserving the vital dental pulp.

The student's suggestions in other fields summarized in Table 5 should be addressed. Targeted actions must be taken to make the students feel more confident in these particular areas. There was a controversy in the opinions of the respondents about the rotary shaping of root canals. Five students suggested extending the rotary preparation training, whereas five opined there was too much time spent on it. They stated that it was not worth learning about a particular system because later in practice each will use something different. The authors consider rotary shaping of root canals as a routine method of preparation and that it should be implemented in the undergraduate endodontic education both theoretically and practically.

The limitation of this study was quite small number of the participating students (around 40 graduates every year). To increase the number of respondents the study

was performed in two subsequent academic years in two study groups with different language of the lessons. No exclusion criteria were applied for the same reason.

## CONCLUSIONS

The students mostly considered that endodontic education was sufficient at the Charles University, Faculty of Medicine in Hradec Králové and that it largely conformed to the recommendations published by the ESE.

Several topics need to be emphasized and taught in more depth, notably surgical endodontic treatment.

The dominant problem of the endodontic education found by this study was lack of practice on patients. To be considered sufficient it must be extended.

The perception of the endodontic education in the different language groups was similar.

The results of this study will be used as a valuable feedback to enhance endodontic education. The respondents recommended several improvements.

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The authors declare no conflict of interest.

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