

## Trends in Endodontic Malpractice Claims and their Indemnity in Finland in the 2000s

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Received Date: February 05 2017; Accepted Date: February 20 2017; Published Date: February 22 2017

Citation: Miira M Vehkalahti, et al. (2017) Trends in Endodontic Malpractice Claims and their Indemnity in Finland in the 2000s. J Dent Oral Health 4: 1-7.

### Abstract

**Objectives:** We hypothesized that malpractice panorama in endodontics has changed alongside of adoption of new devices. To assess such changes, we compared endodontic malpractice claims and their indemnity in Finland in 2002-2006 and 2011-2013.

**Methods:** Our two cross-sectional data sets comprised the health care claims related to endodontic malpractice, handled by The Patient Insurance Centre (PIC) in Finland. Based on the law, PIC awards patients with financial compensation in cases where injury could have been avoided by following good clinical practice. In 2002-2006 and 2011-2013, a total of 1322 claims were handled and 1271 cases were eligible for analyses. Two dental advisors at the PIC scrutinized the original documents of the cases. Data included patients' and operators' gender and age, service sector, type of tooth, and methods of instrumentation and as types of injury, perforations and broken instruments. Indemnity was defined as dichotomy. Chi-square tests and odds ratios (OR) served for statistical evaluation.

**Results:** From 2002-2006 to 2011-2013, mean number of cases per year increased from 134 to 201 ( $p=0.026$ ). From the former to the latter period, proportion of the cases with the use of engine-driven instrumentation increased from 17% to 45% ( $p<0.001$ ) and of cases with root canal perforations from 8% to 13% while cases with pulp chamber perforations decreased from 13% to 10% ( $p=0.016$ ). Endodontic claims entitled to financial compensation remained nearly the same, 48% and 44%. Perforations (OR 4.4-6.6) were the most likely to receive compensation.

**Conclusion:** Number of endodontic malpractice claims was rising rapidly and so was the adoption of new technique, engine-driven instrumentation. Our findings thus call for more attention on expanding dentists' knowledge of tooth anatomy and training in the use of new endodontic devices

**Keywords:** Patient insurance; Dental malpractice; Endodontics; Indemnity of malpractice claims; Compensation of failures; Adverse Events

### Introduction

Endodontic treatment is a challenge for dentists who demand versatile technical competency in addition to the control of biological factors affecting treatment. Although detailed updated guidelines are available [1-5], failures in clinical work continue to occur; in fact endodontic injuries form an important part of malpractice claims in dentistry [6-11].

Depending on a country's dental care service system, either private or public insurance handles patient claims if they are not resolved at the clinic in question or as litigation cases in court. As in other Nordic countries, the Finnish system follows the 'No Blame' rule, where the goal is not to blame the operator, but to award financial compensation to patients for injuries incurred during health care events in either the private or public sector.

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The Patient Injury Act of 1987, which regulates health care claims in Finland, recommends indemnity in cases where the operator could have avoided patient injury by following good clinical practice; this leaves normal risks of failures without compensation.

Research reports as well as statistics about the types and frequencies of injuries in endodontics are scarce. One recent paper analyzed technical reports on professional malpractice in endodontics in Italy and presented perforation (13%) and a broken instrument (6%) as technical “errors” in the 117 cases studied [11]. In Denmark, a nationwide study analyzed 482 endodontic claims registered between 1995 and 2002 [9]. Available data indicate that 137 (of 374 claims) were categorized as “Technical complications or incorrect treatment”, and in 40% of those cases, regional Dental Complaint Boards decided a “Verdict of malpractice”. Root perforations accounted for 10% of “Technical complications”. In Finland, broken instrument (24%) and perforation (22%) were found as the most common injuries among the 1271 endodontic malpractice claims scrutinized [12]. In the 2000s, new endodontic equipment and devices have increasingly become involved in everyday practice. The adoption of these new devices may not only have improved the technical procedures for root canal treatment, but also changed the panorama of malpractice in endodontics. To assess such possible changes over the years, we compared endodontic malpractice claims and their indemnity in Finland across two periods: 2002-2006 and 2011-2013.

## Methods

### Background

In Finland, oral health services for adults are available in both the private and public sectors; the dentist-population ratio is around 1:1100. The majority of adults visits private dentists and is entitled to reimbursements for treatments from the National Health Insurance system, which covers all residents in Finland. Patients visiting public dentists pay out-of-pocket, but the fees they pay are highly subsidized. In both the private and public sectors, around 6% of all treatments for adults are endodontics.

### Study setting

The Patient Insurance Centre (PIC) handles patient health care claims. The amount of possible compensation is based on the patient’s extra medical expenses and immaterial harms such as pain and temporary or permanent incapacity or permanent cosmetic defect, as well as functional incapacity or inability to work. Patients can make a claim easily and free of charge using forms available at service points and online. After a claim is registered in the PIC electronic database, the PIC requests patient documents from the care provider, who also has an opportunity to present his or her own views about the treatment in question. The PIC advisors then examine the case based on the documentation obtained, and propose a decision whether to compensate the claim or to reject it as an unavoidable injury or for other reasons. The PIC also informs the claimant of its decision in writing. Accepted claims will include a form for compensation that the claimant then completes and returns to the PIC to receive the compensation.

Claimants dissatisfied with the PIC’s decision can appeal the matter to the Patient Injuries Board, which processes the requests free of charge, or sue in court. Insurance fees paid by health care practitioners cover the costs of indemnity and maintenance of the PIC; such insurance is mandatory for all health care providers and workers.

Advisors at the PIC examine some 7000-8000 claims annually, about 30% of which are awarded indemnity [13]. According to official PIC statistics, one in ten claims involves dental malpractice, and of these, one in three represents endodontics.

### Data collection

Our two cross-sectional data sets comprised all endodontic malpractice claims handled by the PIC in Finland in two periods: 2002-2006 and 2011-2013 [12]. Two dental advisors at the PIC, both specialists in endodontics, scrutinized the official documents of the endodontic malpractice claims. Immediately at inspection, the advisors recorded the raw data on a computerized platform created for this purpose. We then tested the data for logicity and possible keystroke errors and corrected any mistakes on the basis of original patient documents, re-scrutinized by one of the authors (OS). The test process found cases where the identification of the tooth was missing (n=37), and double claims for the same treatment (n=3), and withdrawn cases (n=11). After excluding these incomplete cases (n=51), a total of 1271 cases remained for analyses: 668 handled in 2002-2006 and 603 in 2011-2013.

The data included patients’ gender and age, defined as years from birth to the time of the injury, and the service sector where the treatment took place. The tooth in question was numbered according to the ISO 3950 system and later categorized as anteriors (incisors and canines), premolars or molars. Information on the technical process included the presence of preoperative, working-length and postoperative radiographs, method of instrumentation (manual or engine-driven) and use of an electronic apex locator. Technical injuries included perforation of the root canal or pulp chamber and type of broken instrument (manual or engine-driven), if any. We used the PIC decisions on indemnity as a dichotomy of entitled to compensation or not. Since information in the documents about the operator included only his/her name and working sector, we harvested the additional background data from various available public sources, such as the yearbooks of the Finnish dentists and the inquiry-system of the National Supervisory Authority for Welfare and Health (Valvira). The latter reveals the name, year of birth and professional details of all health care workers. This service is intended for the public so that patients can verify the details of their health care provider. Therefore, the Valvira website allows inquiries about one professional at a time. Unfortunately, the website does not provide the caregiver’s gender. For Finnish dentists, their given name usually indicated their gender clearly enough, but not so for dentists with a foreign background.

## Ethical consideration

The PIC, together with the Ministry of Social Affairs and Health, approved the protocol for the baseline 2002-2006 study and the PIC for the follow-on 2011-2013 study. To further ensure the fulfillment of the ethics criteria, running numbers were the only identifiers of the cases in the database.

## Statistical methods

To evaluate differences between the groups, we used chi squared tests for the frequencies and t tests for the mean values. Further, we determined odds ratios (OR) as cross-products and calculated their 95% confidence intervals (95% CI).

## Results

Over the years, the number of endodontic malpractice claims handled per year increased by 50%: in 2002-2006, their average number was 133.6 (SD=33.6), and in 2011-2013, 201.0 (SD=26.6) ( $p=0.026$ ). Table 1 describes the characteristics of the cases. Patients' mean age and gender distribution were similar in both periods; in the service sector, we found a slight tendency towards an increase in claims from the public sector. In the latter period, the dentists' mean age was higher than in the former period ( $p<0.001$ ). Female patients (71%) and molar teeth (65%) predominated in both periods.

Table 2 compares the technical aspects of the treatment and the injuries found in the cases. The patient documents revealed a notable increase in engine-driven instrumentation and in the use of electronic device for apex location, as well as a decrease in preoperative radiographs; all differences were statistically highly significant. Perforations occurred in 21% of cases in 2002-2006 and in 23% in 2011-2013. From the former to the latter period, canal perforations increased by five percentage units while pulp chamber perforations decreased by three percentage units ( $p=0.016$ ). One in four claims involved broken instruments, with no difference between the periods.

In 2002-2006, 48% of endodontic malpractice claims were awarded financial compensation; in 2011-2013, the percentage was 44% ( $p=0.130$ ). Figure 1 shows the numbers of compensated and uncompensated cases by year. From the former to the latter period, the mean number of uncompensated claims increased by 62% (69.0 vs. 112.3;  $p=0.014$ ), while the number of compensated claims showed no statistically significant increase (64.6 vs. 88.7;  $p=0.12$ ).

Table 3 shows the rates of compensation according to the type and occurrence of the injury. In both periods, the vast majority (76%-78%;  $p<0.001$ ) of cases involving perforation, but fewer than half (47%-32%) of the cases involving a broken instrument received compensation. Differences in indemnity decisions between the periods were obvious as regards those cases involving no perforation and those involving a broken instrument.

Table 4 shows the impacts of selected factors related to the compensated claims. In 2002-2006, endodontic malpractice was more likely to receive compensation in cases where the operator was a private dentist or a male dentist than in other cases. This difference faded in 2011-2013. In both periods, cases with perforations were the most likely to receive compensation (OR 4.4-6.6). A broken instrument inversely affected compensation and only in the latter period.

## Discussion

As expected, changes in technical procedures of endodontics from 2002-2006 to 2011-2013 were obvious, as evidenced by the increased use of engine-driven instrumentation and electronic apex locators. This change corresponds well with the growth in the commercial supply of endodontic devices [14]. Another difference was in injury type, as the location of perforations shifted from the pulp chamber to the root canal. However, the occurrence of perforations remained nearly the same. This could indicate the operators' better insight when opening the pulp chamber, but an over-scaled or over-powered instrumentation in root canals, which might partly result from the growing use of engine-driven equipment. In both periods, decisions on indemnity were strongly related to the occurrence of perforation, which well reflects the law's intended purpose of compensating patients for such injuries when the treatment fails to follow good clinical practice.

As reported in many countries, root fillings occur most frequently in molars and premolars, but the quality or outcome of root canal treatments is more often inadequate in posterior than in anterior teeth [15-20]. Accordingly, the vast majority of the present malpractice claims concerned molar teeth, thus confirming the diverse challenges involved in treating posterior multi-rooted teeth. Their anatomical complexity poses abundant challenges to endodontic treatments which, as recently reported, may result in untreated canals in half of maxillary molars and in one in five mandibular molars [21]. Further, the numbers of endodontic treatments may be rising as a consequence of patients' demands to keep their teeth until old age. Estimates indicate that "more than 20 million root canal treatments are carried out annually in the United States alone" [22], which highlights the growing role of endodontics and its quality in conservative dental care. Moreover, informing patients of the benefits and risks of a treatment has been statutory in Finland since 1992 [23]; parallel principles have been proposed for dentists e.g. in the USA [24].

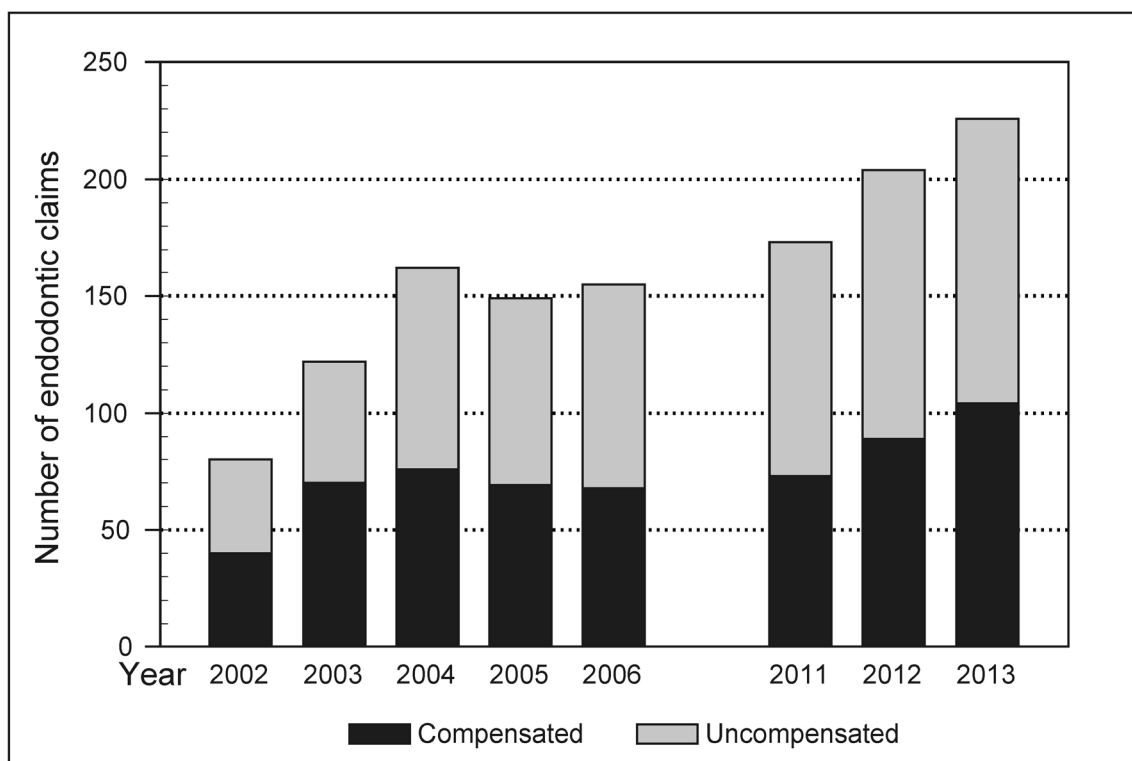
Root perforations occurred in 21%-23% of the endodontic malpractice cases studied, which indicates that the primary topics in endodontic treatment, named by West [25] as "finding canals, following canals, and finishing canals", had not been properly followed. For the operators, this calls for more thorough understanding of the variation in anatomical details of the teeth and roots, as well as more effective training in the use of new equipment for root canal preparation before introducing them into actual service. Since the present findings are based on patient documentation, no information is available about the skills of the operators or about their training history, which can be taken as limitations of our study.

The material studied comprised all endodontic malpractice claims in the years studied. These claims certainly represent only a very small part of all endodontic treatments and probably only a few of the failures occurring in everyday endodontic practice.

**Table 1:** Characteristics of endodontic malpractice claims in Finland in 2002-2006 and 2011-2013; p values refer to differences between the time periods.

Characteristics of cases	In 2002-2006 (n=668)	In 2011-2013 (n=603)	p value
<b>Patients</b>			
Age (years): Mean (SD)	44.5 (13.6)	45.0 (15.1)	0.57
Range; Median	14-85; 43.5	8-85; 45.9	
Women (%)	71	71	0.86
Men (%)	29	29	
<b>Service sector</b>			
Private (%)	56	51	0.06
Public (%)	44	49	
<b>Dentists</b>			
Age (years): Mean (SD)	44.2 (9.5)	46.9 (10.8)	
Range; Median	44.2 (9.5)	24-75; 47.6	
Data missing	n=7	n=44	
Women (%)	62	61	0.80
Men (%)	38	39	
General practitioner (%)	93	94	0.76
Specialist (%)	7	6	
<b>Type of tooth</b>			
Anterior (%)	11	12	0.78
Premolar (%)	24	23	
Molar (%)	65	65	

**Figure 1:** Compensated and uncompensated endodontic malpractice claims (n=1271) by year.



**Table 2:** Process-related technical aspects and injuries in endodontic malpractice cases in Finland in 2002-2006 and in 2011-2013; p values refer to differences between the time periods.

Aspects of process and Type of injury	In 2002-2006 (n=668) %	In 2011-2013 (n=603) %	p value
<b>Instrumentation</b>			
Manual	76	45	<0.001
Engine-driven	17	45	
Undocumented	7	10	
<b>Preoperative radiograph</b>			
Taken	44	25	<0.001
Not taken	56	75	
<b>Apex location by</b>			
Working length radiograph	51	34	<0.001
Electronic device	7	35	
Undocumented	42	31	
<b>Perforation</b>			
None	79	77	0.016
In root canal	8	13	
In pulp chamber	13	10	
<b>Broken instrument</b>			
None	77	74	0.36
Manual	14	16	
Engine-driven	9	10	

**Table 3:** Decisions of indemnity for claims related to endodontic malpractice by type of injury in Finland in 2002-2006 and in 2011-2013; C = Compensation, NC = No compensation; 1p values refer to differences within each time period, and 2p values, between the time periods.

Type and occurrence of injury	In 2002-2006 (n=668)			In 2011-2013 (n=603)			Difference by period
	C (%)	NC (%)	<sup>1</sup> p value	C (%)	NC (%)	<sup>1</sup> p value	
<b>Perforation</b>							
Occurred	76	24	<0.001	78	22	<0.001	<0.001
None	41	59		34	66		
<b>Broken instrument</b>							
Occurred	47	53	0.78	32	68	<0.001	<0.001
None	49	51		49	51		



Table 4: Strength of selected factors related to decisions of indemnity for endodontic malpractice claims in Finland in 2002-2006 and in 2011-2013, by means of odds ratios (OR) and their 95% confidence intervals (95% CI); for bolded OR values,  $p < 0.05$ ; ref. = reference category.

Factors and the categories compared	In 2002-2006 (n=668)		In 2011-2013 (n=603)	
	OR	95% CI	OR	95% CI
<b>Service sector</b> Private vs. Public (ref.)	<b>1.7</b>	1.2, 2.3	1.2	0.9, 1.7
<b>Dentist's gender</b> Male vs. Female (ref.)	<b>1.4</b>	1.0, 1.9	1.0	0.7, 1.4
<b>Perforation</b> Occurred vs. Not (ref.)	<b>4.4</b>	2.9, 6.8	<b>6.6</b>	4.3, 10.3
<b>Broken instrument</b> Occurred vs. Not (ref.)	1.0	0.7, 1.4	<b>0.5</b>	0.3, 0.7

Despite the ease of making a claim, many cases may still remain unreported. The patients may feel that occasional failures are unavoidable and that nothing can be done except perhaps to consider finding a new dentist. However, patients' complaints seem to be relatively reliable safety risk indicators [26] and should therefore be introduced to and discussed within the dental profession in order to improve the quality of dental care. Accordingly, debriefing of adverse events has been suggested as a priority for hospitals and medical schools [27]. Now and then, patients' complaints may lead to direct compensation for an injury at the dental office, which was the reason reported for 11 claims withdrawn from our study. In the years studied, endodontic malpractice claims accounted for about 30% of all dental care claims in Finland [13]. This confirms the extreme challenges and likelihood of failures in endodontics, since it accounts for only about 6% of all dental treatments.

The majority of malpractice claimants were women, in line with women's generally more frequent use of dental services than men's [28-30]. In addition, women may be more active in filing a claim for discomfort experienced, as recently reported on the basis of PCI claims related to hospital care [31]. In the 2000s, PCI statistics show a clear tendency towards an increase in all injury claims as well as in claims related to dental care [13], which may indicate patients' growing awareness of their rights to apply for compensation from their health care provider free of charge without filing a lawsuit in court. An increase in the number of claims can also be considered as a positive point in the health care system to identify the occurrence of and possibly also the reasons for erroneous practices. All information of patients' experiences of adverse events in health care should be used to minimize them in order to improve care processes and the quality of health care services [32].

Depending on a country's dental care service system, either private or public insurance handles patient claims if they are not resolved at the clinic in question or as litigation cases in court. As in other Nordic countries, the Finnish system follows the 'No Blame' rule, where the goal is not to blame the operator, but to award financial compensation to patients for injuries incurred during health care events in either the private or public sector.

## Conclusion

The number of endodontic malpractice claims seems to be rising rapidly, alongside with the adoption of new technique, engine-driven instrumentation. This calls for more attention to updating dentists' knowledge of tooth anatomy and to more training in the use of new equipment available for endodontic treatment. In addition, open discussion about failures and near-failures is recommended as part of regular meetings in dental service units.

## Acknowledgments

The authors thank Sirpa Pöyry, DDS, who assisted with the inspection of the 2002-2006 cases, as well as Ville Lilja, MSc, and Mika Sirviö, MSc, who assisted with the data collection.

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