國立臺灣大學醫學院臨床牙醫學研究所

博士論文

Graduate Institute of Clinical Dentistry

College of Medicine

National Taiwan University

Doctoral Dissertation

根管治療醫療糾紛判決之實證研究

An Empirical Study of Endodontic Malpractice Litigation

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中華民國 一百一十一年六月

June, 2022

doi:10.6342/NTU202201485

國立臺灣大學博士學位論文
口試委員會審定書

根管治療醫療糾紛判決之實證研究

An Empirical Study of Endodontic Malpractice Litigation

本論文係吳金俊君(學號 D02422004)在國立臺灣大學臨床牙醫學研究所完成之博士學位論文，於民國 111 年 5 月 19 日承下列考試委員審查通過及口試及格，特此證明

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doi:10.6342/NTU202201485

謝辭

「醫療糾紛」的探討，並非當前醫學研究的顯學，可投稿的 SCI 期刊也相對較少；然而，這個主題與大多數臨床醫師皆有切身關係，值得深入研究。

本論文得以完成，特別感謝台大臨床牙醫學研究所和法律學研究所提供優質的學習環境與豐沛的研究資源；指導老師郭彥彬教授於研究設計和結果討論費盡心思、辛勤指導；法學研究所吳志正教授特許我旁聽了三年「醫療民事責任專題討論」並參與「人工植牙醫療糾紛專題」課程的教學；論文口試召委呂炫塗教授、委員林思洸教授、謝松志教授、張瑞青教授對研究內容提出許多剴切的修正意見；尤以謝松志、林思洸兩位根管治療學界大師鞭辟入裡的指正，讓臨床專攻牙周植牙專科的我得以一窺牙髓病學堂奧、重新體悟深奧的根管治療學。

大學部畢業後，先後唸了北醫、東吳、台大的研究所，取得了牙醫學碩士、法律學碩士、臨床牙醫學博士學位。三校學風迥異，各擁特色。何其有幸，得於漫漫長路中結識了生命歷程裡具有重大意義的師友！台大這一站，蒙受師長們厚愛，逐步成長茁壯。江俊斌院長、陳漪紋教授在論文的發表和投稿上予我許多指導；郭敏光教授、醫學院陳敏慧副院長、新竹台大洪冠予院長、高醫鄭景暉院長、台大牙周病科侯連圖教授、劉謙美醫師、張博鈞所長、王振穎醫師；台大傑出校友邱宏正醫師、葉忠武醫師、連新傑醫師及新竹台大牙科部同仁們的關懷與鼓勵；新竹台大醫研部蘇芳瑩小姐於生物統計分析的協助，于此一併致謝。

春暉寸草、親恩浩瀚，謹以本論文獻給天上的 父母親！

吳金俊　2022 仲夏

doi:10.6342/NTU202201485

中文摘要

背景

關於牙科根管治療醫療糾紛訴訟的結果和特性，目前所知有限。本研究依據法院裁判的結果，探討原告、被告之背景特性及發生訴訟的可能原因，以期減少根管治療醫療訴訟的發生。

材料及方法

本研究以法學實證研究方式進行，以根管治療醫療訴訟的法院判決書為研究標的。第一部分自台灣司法院法學資料檢索系統 (https://law.judicial.gov.tw)，以關鍵字 (根管治療–交通事故–車輛–碰撞–給付保險金–違反醫師法–詐欺–妨害自由) 搜尋地方法院 2001/01/01 – 2021/12/31 一審判決、簡易判決案件。第二部分自美國 LexisNexis 法學資料檢索系統 (https://plus.lexis.com) 以關鍵字「medical malpractice」AND (I)「endodontist」, (II)「endodontics」, (III)「root canal」, (IV)「dental pulp」，搜尋 2000/01/01 – 2020/12/31 根管治療醫療糾紛訴訟的判決案件。除資料庫檢索方式外，另以人工方式搜尋可能的疏漏案件。逐筆檢視原告背景資訊、被告服務院所、專科資歷、訴訟的理由、判決的結果，以卡方檢定統計分析。

結果

22 個台灣地方法院搜尋得案件數共計 188 件，扣除非牙科、無照執業、非根管治療等案件，共得到 36 件根管治療醫療糾紛判決，平均每年 1.71 ± 1.20 件，案發地以台中發生 10 件最多。 36 件中有 3 件和解, 告訴撤回，法院諭知公訴不受理之判決 , 餘 33 件案件判決進行分析。 33 件案件之被告， 2 件為根管專科醫師

doi:10.6342/NTU202201485

(6.1%)，26 件非專科醫師 (78.8%)，5 件無法識別 (15.1%)。訴訟理由包括術前欠缺告知後同意、術中操作不當、術後感染、術後齒裂等。法院裁判的結果，三個案件 (9.1%) 原告勝訴、30 個案件 (90.9%) 被告勝訴, 牙醫師有罪率 9.1% 。三件牙醫師敗訴案件，新北、新竹、台中各一件, 病患勝訴的原因為術前未告知次氯酸鈉灼傷的風險、根管銼斷裂於根管內未適當處理、根管充填不足引發感染等。

美國資料庫搜尋得案件數共計 581 件，有 87 件根管治療醫療訴訟判決，平均每年 4.14 ± 2.23 件。扣除一件和解、二件部分勝敗案件，取得 84 件判決進行分析，其中 73 個案件 (86.9%) 被告非專科醫師， 36 個案件 (42.9%) 原告病患勝訴、48 個案件 (57.1%) 被告勝訴。 病患勝訴的原因為術後麻木、牙根穿孔、未使用橡皮障、治療錯牙、術後感染等。病患基於「術後」理由提告的勝訴率顯著高過「術前」、「術中」 理由 ($P < 0.05$)。本研究台灣牙醫師的有罪率為 9.1%, 美國牙醫師的有罪率為 42.9%，亦具顯著差異。

結論

根管治療發生的法律訴訟，雖然時有所聞，但台灣、美國發生的案件平均每年皆不超過五件，且絕大多數被告非根管專科醫師。台灣牙醫師勝訴率達 90.9%、美國牙醫師則僅 57.1%。本研究建議牙醫師務必於術前正確診斷，詳細告知說明、取得患者同意後，再使用橡皮障小心以器械清創、擴大、完整充填神經管。至於困難病例，則建議轉診根管專科醫師治療; 根管治療術後若出現非預期性結果，應即刻告知、設法補救、減輕後續傷害，方能減少訴訟的發生。

關鍵字

根管治療、醫療糾紛、法律訴訟、告知後同意、專科醫師

doi:10.6342/NTU202201485

Abstract

Background and Purpose

Little is known regarding the outcomes and distinguishing characteristics of lawsuits related to endodontic procedures. This study aimed to analyze the factors associated with endodontic malpractice lawsuits and mitigate the risk of litigation.

Materials and Methods

This study presents a unique comprehensive analysis of endodontic malpractice lawsuits in Taiwan and the United States (US). The analysis interprets decisions from jurisdiction court collected between 2001 and 2021 in Taiwan and between 2000 and 2020 in the US. In Taiwan, the Judicial Law and Regulations Retrieving System (https://law.judicial.gov.tw) was used to collect endodontic malpractice litigation cases. "Endodontic therapy" – "traffic accident" – "car" – "collision" – "insurance pay" – "against physician law" – "fraud" – "offenses against personal liberty" were used as keywords for searching the "First-instance Court" and "Summery Court" endodontic malpractice judgments from January 1, 2001 to December 31, 2021. In the US, the LexisNexis legal database

doi:10.6342/NTU202201485

(https://plus.lexis.com) was used to search for endodontic malpractice cases from January 1, 2000 to December 31, 2020, using the terms “medical malpractice” and (I) “endodontist” (II) “endodontics” (III) “root canal” (IV) “dental pulp.” Each case was reviewed for medical characteristics and litigation outcomes. Data were analyzed using chi-squared test for categorical variables based on the plaintiff’s demographics, defendant’s qualifications, allegations, and outcomes. The significance of all tests was set at a two-tailed *P* value < 0.05.

Results

In Taiwan, a total of 188 cases were collected using the Boolean search, of which 36 cases met the inclusion criteria. Annually, the mean number of cases was 1.71 ± 1.20 (mean ± SD). Thirty-three cases were enrolled in the final analysis after exclusion of 3 settled cases. Most of the defendants were non-endodontist (78.8%). Taichung had the most cases (n = 10), and 3 guilty verdicts were identified in New Taipei, Hsinchu, and Taichung. The major causes of action included insufficient information or lack of informed consent before therapy (n = 12), improper instrumentation (n = 14), post-treatment pain (n = 8), infections (n = 8), and cracks (n = 5). Only three dentists were

doi:10.6342/NTU202201485

found guilty (9.1%). The primary reasons for the guilty verdicts include sodium hypochlorite (NaOCl) irritation and lack of informed consent, broken instrument, and incomplete root canal obturation. In the US, a total of 581 cases were initially identified, 87 cases were included, and 84 cases were enrolled in the final analysis after exclusion of the settled and two-partial win/loss cases. Of the 84 defendants, 73 (86.9%) was non-endodontists; 36 (42.9%) cases favored the plaintiff, whereas 48 (57.1%) favored the defendants. The annual case mean was 4.14 ± 2.23 (mean ± SD). The major allegations favored for the plaintiffs involved paresthesia, root perforation, rubber dam use, wrong tooth therapy, and infections. Plaintiffs who claimed with postprocedural reasons had a significantly higher winning rate than those claiming non-post-procedural reasons ($P < 0.05$). In the present study, the conviction rate of endodontic litigation in Taiwan was 9.1%, whereas it was 42.9% in the US, and the difference was significant as well.

Conclusions

Endodontic therapy is still associated with malpractice disputes, despite the annual case mean being ≤ 5 in both Taiwan and the US. In this study, 90.9% of the verdicts in Taiwan and 57.1% in the US favored the dentists. Clinicians should always diagnose

doi:10.6342/NTU202201485

correctly, share decision-making, obtain informed consent before an invasive therapy, use rubber dam routinely, use proper instrumentation, and employ timely management to prevent malpractice claims. Therefore, it is recommended that general dentists refer complicated cases to endodontists and treat patients carefully to avoid paresthesia, root perforation, wrong tooth therapy, and infections.

Key Words

Endodontics, malpractice, litigation, informed consent, endodontist

doi:10.6342/NTU202201485

目錄

doi:10.6342/NTU202201485

doi:10.6342/NTU202201485

doi:10.6342/NTU202201485

doi:10.6342/NTU202201485

Chapter I. Introduction

1.1 Medical malpractice crisis

Medical dispute seems to become an epidemic issue (Mello *et al.*, 2004). Legal and disciplinary actions against physicians have gradually become widespread in recent years (Shi *et al.*, 2019). Malpractice denunciations are pervasive around the world over the past few decades (Ferrara, 2013). An anecdotal perception of an overall increase in the medical malpractice phenomenon in terms of the number of cases and specialties involved has also been confirmed (Buzzacchi *et al.*, 2016). In the United States, 7.4% of physicians were involved in a malpractice claim annually, and 75%-99% of physicians in different specialties faced a claim before the age of 65 (Jena *et al.*, 2011). In Taiwan, 36.4% of physicians have experienced a medical dispute (Chen *et al.*, 2017). The most frequent causes of disputes in malpractice claims are related to surgery, followed by diagnosis errors (Hwang *et al.*, 2018). Compensation payments for disputes involving errors were significantly higher than non-errors (Studdert *et al.*, 2006). And as usual, the lengthy judicial process is stressful for clinicians. Consequently, 93% of physician practiced defensive medicine (Studdert *et al.*, 2005). In Germany, disciplines most frequently confronted

doi:10.6342/NTU202201485

with malpractice charges were orthopedics and accident surgery (30.2%), dentistry (16.4%), general surgery (12.1%), and gynecology and obstetrics (7.8%) (Knaak *et al.*, 2014). Dentistry was the second most frequent discipline confronted with claims of medical malpractice so that the dentist should pay attention to the malpractice lawsuit.

Medical malpractice is as an act or omission by a medical practitioner during treatment procedure that deviates from the standard of medical care and causes an injury or damage to the patient (Bal, 2009). Physicians occasionally provide an incorrect diagnosis or improper treatment that reduces the quality of medical service, breaches the standard of care and causes injury or damage to the patients (Arlen *et al.*, 2005). Nowadays, higher patients' expectations and significant advances in medical technologies have driven physicians to take risks in caring for critical patients. However, positive outcomes cannot always be achieved. Sometimes, patients suffered serious injuries from the medical procedures. Therefore, malpractice actions against physicians for negligence in the delivery of medical services have become more widespread than ever before, resulting in a medical malpractice crisis (McQuade, 1991).

doi:10.6342/NTU202201485

1.2. Legal elements of medical malpractice

Generally, a successful claim of medical malpractice is characterized by four elements, which include: (1) the existence of doctor–patient relationship, out of which grows the "duty of care," (2) the medical behavior breaches the professional duty of care, (3) proximate cause, (4) the existence of damages stemming from the medical injury (Gittler *et al.*,1996).

A physician should have owed a legal duty to the patient. Whenever a professional relationship is established between a patient and health care provider, "duty of care" comes into play. The general idea of this legal duty is based on the custom that in a civilized society, mutual help and cooperation benefit the people. The custom law bound the people to benefit and do no harm to others. Extending this concept to the medical profession, whenever a health practitioner provides medical services to a patient, the provider is compelled to provide reasonable professional care to the patient. No duty exists where no doctor–patient relationship is established. In some situations, the law may limit the liability of the treating physician, such as when medical bystanders are encouraged to provide interventions during an accident.

doi:10.6342/NTU202201485

Civil liability or criminal sanctions have been the major forms of assigning responsibility for a medical injury. Traditionally, redress for a patient's injury during the course of medical therapy is made through civil actions. The main purposes of a civil litigation are to indemnify the injured patients and oversee the quality of medical care. However, plaintiffs are only monetarily compensated for physical and mental injuries, with the defendant having no risk of imprisonment. Currently, in most Western countries, medical malpractice cases are resolved via civil procedures. One study showed that the criminal prosecution of a physician for negligence is unconventional (Monico *et al.*, 2007) and that only in extreme cases may criminal proceedings be conducted (Blau *et al.*, 2017). On the other hand, Taiwan has a statutory law system similar to that in Germany and Japan. Unlike case law countries, a proportion of medical disputes are handled *via* criminal proceedings (Hsieh *et al.*, 2021). The criminal prosecution of a doctor for professional negligence is a unique and complicated cause of action that initially requires a breach in the standards of care and a causal relationship (Filkins *et al.*, 2001). Aside from the historical background, the lack of fees in criminal proceedings, inefficient civil action, and the perception that doctors have "deep pockets" have promoted the litigation of medical lawsuits in criminal courts (Ger, 2009). An analysis of the criminal medical malpractice decisions

doi:10.6342/NTU202201485

of the Taiwan Supreme Court reveals that prison sentences range from 1 to 12 months (Wu *et al.*, 2016). Analyzing court decisions is valuable for not only patient safety but also quality improvement and medical training, which may help doctors to prevent medical malpractice (Knaak *et al.*, 2014).

1.3 Dental malpractice

Essentially, elements of dental malpractice are almost the same as medical malpractice, wherein a dental professional fail to follow the standards of care, thereby harming the patient (Manca *et al.*, 2018). Dentists are bound to exercise reasonable and ordinary care, skill, and diligence of dental profession (Graves, 1900). Despite recent trends showing medical malpractice lawsuits to be on the decline, the percentage of dental malpractice payments is growing among the health profession (Nalliah, 2017). In the dental and oral-maxillofacial operative field, unexpected adverse effects or complications often occur. Common poor dental outcomes such as endodontic failure, damage to the inferior alveolar nerve, invasion of implant into the maxillary sinus, and damage to adjacent teeth have led to various instances of dental malpractice disputes (Pinchi *et al.*, 2014). However, most research on malpractice claims in Taiwan has focused on medicine (Lin, 2009; Ger, 2009;

doi:10.6342/NTU202201485

Wu *et al.*, 2009; Wu *et al.*, 2016), with almost none being conducted on dentistry specifically.

1.4 Endodontic malpractice

Endodontics is a branch of dentistry that deals with the nerves and vessels in the pulp and root canal. The Department of Health and Welfare in Taiwan recognizes endodontics as a specialty in dentistry. Root canal therapy (RCT) may rescue the teeth with necrotic pulp caused by caries, trauma, or periodontal disease. The treatment of pulp disease includes access opening, infected pulp tissue extirpation, shaping, enlargement and obturation of the root canals, and occasionally surgery for abscess drainage or apicoectomy (Adams *et al.*, 2014). The standards of endodontic practice can be defined as the appropriate degree of prospects for professional interventions expressed by a professional organization, which are based on evidence and sketched using the currently available scientific knowledge and expertise (Alrahabi *et al.*, 2019; AAE, 2014).

Clinical endodontic therapy involved variety of instruments, medicaments, and nonsurgical or surgical treatment procedures (Del Fabbro M *et al.*, 2007). The lengthy and complicated treatment characteristics inevitably promote disputes in the care of pulpal

doi:10.6342/NTU202201485

disease. According to the current medical law, pulp disease could be treated by any qualified dentist and is not limited to endodontists. For the best interests of the patients, general dental practitioners (GPs) may refer patients to endodontists for better quality of care. Although these dentists do not actually treat pulpal disease, they should still be capable of establishing a correct diagnosis of the disease based on patients' clinical symptoms, informing the patients in detail after a diagnosis, and referring them to an appropriate endodontist for treatment.

Among the various divisions in dentistry, cases related to endodontics are commonly filed for malpractice claims (Selbst, 1990). Endodontic litigation has been addressed in the past 50 years. The first article on endodontic litigation, published in 1973, mentioned that the cases were increasing (Serene, 1973). Givol *et al.* analyzed the endodontics-related complaints reported to the Medical Consultants Company during 1992–2008 and found that 520 out of 720 complaints were justified. Additionally, operator errors typically occurred during the intra-procedural phase, specifically during instrumentation (49%; Givol *et al.*, 2010). This may be because the canal system is extremely variable and can exhibit unusual curvatures. Moreover, RCT is a technique-sensitive process involving extensive use of breakable instruments.

doi:10.6342/NTU202201485

Endodontic malpractice litigations can be divided into “pre-, intra-, and post-procedural claims.”

1.4.1 Pre-procedural Claims

Preoperative claims were primarily caused by reckless in diagnosis, failure to inform the patient of potential risks or complications and feasible alternatives during the treatment process, and failure to obtain informed consent.

1.4.1.1 Reckless in diagnosis

Dentists should form an impression based on an overview of the patient’s medical history, course of disease, clinical examination, radiological examination, probing depth and electric pulp test (Cohen *et al.*, 1998). They should also develop a treatment plan accordingly and document it in the patient’s medical records. If a dentist was, reckless in the diagnosis process, against reasonable clinical judgment and leading to great misfortune, the dentist should be held liable for the damage caused by misdiagnosis (Venkatraman *et al.*, 2013).

doi:10.6342/NTU202201485

1.4.1.2 Failure to obtain informed consent

The doctrine of informed consent has been recognized and accepted by health professionals as a requirement of medical ethics and law. Informed consent refers to the pre-treatment process in which a physician informs patients of recommended treatment and expected outcomes, major risks, potential complications, and alternatives (Levine, 1983). Insufficient or absence of information was the most important problem together with failure in the informed consent process (Lopez-Nicolas M, 2007). Patients have free right to decide whether to accept treatment or not.

Regarding the provision of the aforementioned information, given a patient's right to make their own health decisions and by using acceptable medical conduct as the judgment criteria, the patient should decide whether to undergo treatment after receiving sufficient information to make a knowledgeable choice.

"Diagnosis," "the act of informing," and "treatment" are closely related. Physicians and patients should communicate with each other to decide on a course of treatment. Exceptions to the rules of informed consent include emergency or in which a patient is neurotic or prone to injuries, or when fully informing patients of medical information can cause specific risks (Tan, 2012). One of the major causes of endodontic malpractice

doi:10.6342/NTU202201485

claims in recent years was associated with doctrine of informed consent. Whether information has been sufficiently provided is no longer based only on the opinion of health professionals but upon a reasonable person in the similar situation will wish to know (Grady, 2015; Scott *et al.*, 2003; Bal *et al.*, 2012).

In a claim with the issue of consent, the patient must prove 1) that the dentist failed to inform the patient of reasonably foreseeable risks and failed to disclose alternatives that another medical practitioner would have reasonably disclosed in the similar circumstances; 2) that a reasonably prudent patient in the similar situation would not have undergone the treatment if he or she had been fully informed; and 3) that the lack of informed consent was the proximate cause of injury (Heywood *et al.*, 2010; Wagner *et al.*,1995).

However, the lack of informed consent itself will not cause injury. In fact, the missing operation itself (RCT procedure or anesthesia) is the true cause of injury.

1.4.2 Intra-procedural Claims

Intraoperative claims were mostly caused by treatment malpractice. These claims occur more frequently than any other type of claim. Because endodontic procedures are complex, they can result in numerous medical errors.

doi:10.6342/NTU202201485

Common claims of negligence include adverse reactions to anesthesia, failure to use a rubber dam, incomplete cleaning of canals, swallowing or inhaling of foreign matter, instrument fragments being left in the tooth, root perforation, extrusion of root canal filling material or under-filling, failure to inform the patient of foreseeable complications or accidents in the treatment process, and the use of improper filling material causing nerve damage.

1.4.2.1 Adverse reaction to anesthetics

Anesthesia is a necessary intraoperative procedure as usual. Before administering anesthetics, dentists should first assess a patient's general condition; choose a suitable anesthetic agent, dose and injection method. The dentist should have got informed consent for anesthesia from the patient. Common adverse reactions to anesthesia include dizziness, tachycardia, agitation, blurred vision, and nerve injury (Daubla¨nder *et al.*, 1997). Severe cases may include miscarriage or stroke (Suresh *et al.*, 2004). The use of anesthesia for surgery carries an inherent risk. If adverse reactions occur, the patient's general condition should be considered when assessing the dentist's liability (Savage, 1998).

doi:10.6342/NTU202201485

1.4.2.2 Failure to use a rubber dam

Rubber dams have numerous functions. In a root canal procedure, a rubber dam acts as a barrier that partitions the bacteria and prevents it from penetrating the root canal system during the cleaning and shaping process. Rubber dams can isolate a tooth from oral contaminants, prevent infection of the root canal and offer an isolated and contamination-free area. They help dentists to maintain a clear view of the treatment area and to keep the area dry (Leinonen *et al.*, 2021). Rubber dams can isolate the oral cavity and pharynx to prevent the risk of dental instruments being swallowed or inhaled, and to reduce the possibility of NaOCl burn of the soft tissues in the oral cavity (Grossman, 1971). However, rubber dams are not used routinely by some dentists, despite their numerous advantages (Going, 1967). Ahmad indicated the reasons for not using rubber dams, including concerns over patient acceptance, time required for application, cost of equipment and materials, insufficient training, difficulty in using, and low treatment fees (Ahmad, 2009). The failure to use rubber dam departs from the standard of care and is one of the major causes of malpractice claims (Bjørndal *et al.*, 2014).

doi:10.6342/NTU202201485

1.4.2.3 Incomplete cleaning of canals

Complete removal of a source of infection from the root canal system is the foundation of success for an endodontic procedure and relies on the careful cleaning and shaping of canals with endodontic instruments. Incomplete cleaning and shaping leaves residual sources of infection, resulting in persistent symptoms and treatment failure (Siqueira, 2014).

The cleaning and shaping of the pulpal root canal system depends on the skill of the dentist. A dentist performing an endodontic procedure is liable for any violation of the standards of care unless the dentist can prove that the endodontic procedure was difficult because of a calcified root canal (Ramugade *et al.*, 2018).

Normally, a dentist should fill the root canal after completing the cleaning and shaping procedure. The proper procedure in case of coronal micro-leakage after the canal instrumentation is to start the entire root canal procedure again (Achiar *et al.*, 2008).

1.4.2.4 Broken instruments

Broken instruments are a common intraoperative misfortune usually occurred in calcified or curved root canals, which prevent straight access into the canal system and may

doi:10.6342/NTU202201485

cause the instrument to break (McGuigan *et al.,* 2013). At this point, complete cleaning and shaping of the canal is more difficult, leading to poor prognosis of the tooth. Factors that may relate to the breakage of rotary instruments are the frequency with which they are used, the speed of rotation, and the curvature of the canals in which they are used (Zelada *et al.,* 2002).

Occasionally, instrument fracture occurs because of metal cyclic fatigue, torsional resistance or excessive instrumentation pressure (Sattapan *et al.,* 2000). If instrument fracture occurs in the early stage of endodontic treatment when the canal has not yet been properly cleaned and shaped, the procedure is likely to fail unless the broken instrument is removed and the canal is thoroughly treated. If instrument fracture occurs in the final stage of treatment when the canal has been properly cleaned and shaped, the procedure can still be completed by filling and sealing the canal with gutta-percha and sealer to prevent bacterial leakage (Plotino *et al.,* 2007).

The breaking of endodontic instruments in the canal is an inherent risk of root canal treatment and is not necessarily negligent, but patients must be informed of broken instruments and the potential problems or complications. Malpractice is established if a patient is injured as a result of failure to keep the patient informed and failure to take

doi:10.6342/NTU202201485

proper remedial action (Nehammer *et al.,* 2004). However, not all broken instruments can be removed, in which case patients are advised to seek a specialist, and this referral must be documented in the patient's medical record (Kakkar *et al.,* 2015).

1.4.2.5 Swallowing or inhaling of foreign matter

In the United States, around 1500 people die following ingestion of foreign objects into the upper gastrointestinal tract annually (Webb, 1988). The most often ingested foreign bodies are coins, meat impaction, button batteries, and dental objects (Schwartz 1976). It was reported that files, reamers, burs, impression materials, inlays, onlays, crowns, posts and cores, rubber dam clamps, removable prosthesis, orthodontic retainers, band and wires, implant components, and even parts of intra-oral tracing apparatus are the dental objects most likely ingested or inhaled (Nelson 1992).

The swallowing or inhaling of foreign matter will be prevented if a rubber dam is used in root canal treatment. A court occasionally applies the doctrine of *res ipsa loquitur* when ruling on cases involving swallowing or inhaling of foreign matter (Kim v. Anderson, 1980). *Res ipsa loquitur* is a legal doctrine that presumes a defendant is negligent in a case of medical injury (Long, 1962). The defendant must present evidence to rebut this presumption.

doi:10.6342/NTU202201485

The swallowing or inhaling of foreign matter during a dental treatment procedure constitutes *res ipsa loquitur* if it simultaneously exhibits the following characteristics: (1) Given the environment at the time, the swallowing or inhaling of foreign matter would not have occurred in the absence of negligence according to the experience and common knowledge of lay persons. (2) The use of endodontic instruments was completely controlled by the dentist. (3) The injury sustained by the plaintiff was caused by the swallowing or inhaling of foreign matter (Simpson v. Davis, 1976).

Most of these objects pass spontaneously (75.6%, Velitchkov, 1996), but about 10−20% need to be removed endoscopically, and about 1% require surgery (Webb, 1988). Occasionally, an endodontic instrument dropped into the respiratory tract or digestive track have to be removed surgically, exposing patients to surgical risks and adverse effects. In these cases, the dentist can be found guilty of negligence without expert testimony.

1.4.2.6 Perforation of a tooth

Endodontic treatment involves using dental drills to open the pulp chamber and using endodontic instruments to access root canals. Perforation of a tooth or penetration of a canal can occur when the anatomical structure of the tooth variates or the canal calcifies.

doi:10.6342/NTU202201485

(Vertucci, 2005). Perforation of a tooth is an inherent risk in root canal treatment and is not necessarily negligent. Whether a dentist is negligent in perforating a tooth must be substantiated by factual evidence.

When perforation of a tooth occurs, a dentist remains responsible in the following situations (Cavanaugh v. Sherberg, 2012):

1) Infection is caused by perforation: A perforated canal is prone to bacterial infection and suppuration. A dentist should be liable for injuries caused by the perforation of a tooth if he/she cannot proof the reason of perforation.

2) No remedial actions: A dentist breaches the standards of care when he/she fails to take any remedial actions despite being aware that he/she has perforated the patient's tooth.

3) Without informing the patient that he/she has accidentally perforated the canal during a root canal procedure, the dentist proceeds to fill a canal: Filling material leaks from a perforated hole, and the tooth must be extracted because periodontal

doi:10.6342/NTU202201485

tissues are damaged and abscess begins to form. The dentist is negligent because he/she continued with the canal filling procedure even after perforating the tooth.

1.4.2.7 Sodium hypochlorite (NaOCl) irrigation accident

NaOCl is an antimicrobial irrigating solution that dissolves tissues and removes the smear layer (Haapasalo, 2014; Mohammadi *et al*., 2019). This solution is the choice for root canal irrigation. However, NaOCl is also a strong irritant that must be used with caution because of its cytotoxic and corrosive nature (Pashley *et al*.1985).

The agent is restricted to root canals and can achieve complete disinfection. NaOCl seepage from a canal opening or the root apex causes severe tissue reaction, pain, swelling, and even bleeding. A case report indicated that seepage of NaOCl into the frontal sinus and inferior alveolar nerve can lead to postoperative complications such as swelling, bruising, and nerve injury (Bosch-Aranda *et al*., 2012). Although the burning of the mucosa by NaOCl and the extrusion of NaOCl beyond the root apex are not deliberately caused by dentists, patients can still claim compensation for severe injuries resulting from negligence.

doi:10.6342/NTU202201485

1.4.2.8 Improper material used to fill canals

After infection sources were eradicated, the canals must be filled with filling materials to prevent the growth of pathogenic microorganisms and reinfection of the complex root canal system.

Currently, gutta-percha and paste is the filler of choice for root canal treatments (Panzarini *et al*., 2012). Mineral trioxide aggregate (MTA) has also been used as a filling material in root canal treatment (Torabinejad *et al*., 1995). The failure to fill a canal or the use of an improper material to fill a canal is a breach of the standards of care. A dentist is deemed liable for damages if a causal relationship between a patient's injury and the dentist's negligence is proven. Previously, agents containing paraformaldehyde (e.g. Sargenti paste or N2) were used as a filling material; however, the extrusion of paraformaldehyde beyond the root canal causes tissue necrosis in the apex and alveolar bone. In serious cases, the trigeminal or facial nerves were injured. (Kleier *et al*.,1988; Grossman *et al*., 1978; Allard, 1986) Accordingly, using paraformaldehyde preparations to fill the canals were no more allowed (AAE, 1991).

doi:10.6342/NTU202201485

1.4.2.9 Over-filling, over-extension, and under-filling

Over-filling implies that the root canal space is completely obturated, but the filling material extend beyond the apical foramen. Over-extension implies that the root canal space is not completely obturated. The filling materials extend beyond the apical foramen because of failure to create an apical stop during instrumentation (AAE, 2020). Over-filling or over-extension may cause irritation to the surrounding tissues in the root apex, which damages the anatomical structure of the oral cavity, resulting in inflammation or infection or even paralysis.

Under-filling a canal causes secondary infection and recurrence of symptoms. According to medical standards, root canal filling materials should be kept 0.5–1 mm from the major foramen (Kuttler, 1958).

1.4.3 Post-procedural claims

After a root canal procedure, sources of infection were removed and symptoms should gradually disappear. If sources of infection are not completely eliminated or inadvertently inoculate the peri-apical tissues with bacteria, postoperative flare-up and even cellulitis or oral-antral fistula can occur (Patel, 2015). The continued presence of these

doi:10.6342/NTU202201485

symptoms and the physician's failure to administer proper treatment are the main causes of postoperative claims.

Because the nerves and blood vessels in a root canal were removed completely, the tooth structure became brittle because of the physical changes in the dentine of the pulp-less teeth (Tikku *et al.*, 2010). Dentists should inform patients of the possibility of tooth fracture during or after a root canal procedure and advise them to have a crown fabrication to protect the treated tooth.

1.4.3.1 Presence of infections and dentist failure to administer proper treatment

The continued presence of symptoms even after RCT does not indicate negligence on the part of the dentist. The causes must be explored or patients should be referred to experts for further evaluation.

If a patient continues to experience symptoms after a root canal procedure, the dentist should carefully examine the soft tissues surrounding the apex, take X-rays to identify the cause of discomfort, and then treat the patient accordingly.

doi:10.6342/NTU202201485

Antibiotics might be prescribed once infectious signs occur. The continued presence of pain after RCT was indicative of an infection (Haapasalo *et al.*, 2003). The use of an antibiotic after a root canal procedure can prevent severe infections. In the event that a patient continues to experience symptoms and a physician fails to administer proper treatment, the physician is liable for compensation if a causal relationship is found between the patient's injury and the physician's negligence.

1.4.3.2 Postoperative tooth fracture

A root-canal-treated tooth becomes brittle and is inclined to crack if the patient bites something too hard. A vertical root fracture often propagates from the apex to the coronal part and is a common cause of liability claims (Galagali *et al.*, 2011; Alsani *et al.*, 2017). Rosen's study showed that vertical root fractures most frequently occur in the premolars and mandibular molars. Poor quality root fillings complicate the diagnosis of vertical root fracture, which in turn extends the time for achieving an accurate diagnosis and increasing the medico-legal risk (Rosen, 2012).

doi:10.6342/NTU202201485

1.4.3.3 Paresthesia

Overfilling of root canals is one frequent complication of RCT (Tilotta-Yasukawa *et al.*, 2006). When the overfilled material in connection with adjacent nerves, may cause chemical irritation and lead to paresthesia (Koslowski v. Sanchez, 1990).

The degree of numbness is related to the type of filling material (especially sealer), the amount of the extrusion, and the condition of the periapical tissues. If the sealer is extruded into the space of mandibular canal, it can cause problems that vary from mild inflammatory reactions to severe neurotoxic damage (Brkić *et al.*, 2009). Symptoms are disabling sensory disturbances, such as paresthesia or anesthesia (Ektefaie *et al.*, 2005).

1.5 Hypothesis and specific aims

Endodontic intervention of damaged teeth constitutes a main part of services provided by dentists worldwide. RCT may significantly affect the health and function of the tooth. However, failures in management may lead to malpractice claims. Endodontic litigations pose heavy economic and emotional burdens both on dentist and patient. Identification of the factors affecting litigated malpractice cases has practical implications. Cur-

doi:10.6342/NTU202201485

rently, most materials used to analyze endodontic disputes were obtained from professional liability insurance databases (Bjørndal *et al.*, 2008; Givol *et al.*, 2011; Rosen *et al.*, 2012). However, verdict-based surveys (Knaak *et al.* 2014; Murphy *et al.*, 2018) regarding endodontic malpractice lawsuits are lacking.

Owing to the increasing incidences of medical malpractice, a number of doctors feel nervous and uneasy with the thought of facing lawsuits. Moreover, medical malpractice lawsuits can last for several years or even over a decade in extreme cases. After such a long lawsuit, doctors come out physically and mentally exhausted even when vindicated by the courts. To minimize the harsh challenges posed by medical malpractice lawsuits, one should have a basic understanding of endodontic disputes and acquire optimal risk control skills in addition to the advanced techniques required for performing a therapeutic procedure.

The hypothesis of the present study was that endodontic malpractice lawsuits are pervasive and have increased in recent years. The research questions were “What are the proximate causes of endodontic disputes?” and “What are the key factors of conviction for endodontic malpractice litigation?” Therefore, this study collected endodontic litigation verdicts as a database and conducted an empirical study to investigate the factors

doi:10.6342/NTU202201485

associated with endodontic malpractice lawsuits. The specific purposes were to explore court decisions and distinguish the characteristics of claims related to endodontic lawsuits through experiences in Taiwan and the United States. The findings may contribute toward preventing endodontic malpractice litigations and improving the quality of medical and public welfare.

doi:10.6342/NTU202201485

Chapter II. Materials and Methods

This study presents a uniquely comprehensive analysis of endodontic malpractice lawsuits in Taiwan and US. This analysis interprets decisions from jurisdiction court collected between 2001-2021 in Taiwan and 2000-2020 in US. The present study was exempt from requiring the approval of an institutional review board (IRB) because all data were publicly available.

2.1 Endodontic malpractice litigation in Taiwan

2.1.1 Study samples and cases collection

Endodontic malpractice litigation cases were collected from the Judicial Law and Regulations Retrieving System (https://law.judicial.gov.tw), with "First-instance Court judgments" and "Summery Court judgments" being the main subjects.

2.1.2 First-instance Court judgments

A total of 22 district courts in Taiwan were enrolled in this study. "Endodontic therapy" – "traffic accident" – "car" – "collision" – "insurance pay" – "against physician law" – "fraud" – "offenses against personal liberty" were used as the keywords for searching

doi:10.6342/NTU202201485

the “First-instance Court” endodontic malpractice judgments from January 1, 2001 to December 31, 2021. Manual searches were also performed for missed cases. The content of each verdict was examined, and cases not associated with endodontic malpractice were excluded. After screening, the verdicts were reviewed and summarized for statistical analysis. The main dependent variable for inferential statistics was the judgment, whereas the independent variables included the following: (1) claim period and jurisdictional court; (2) defendant’s specialty and institutional level; (3) causes of action; (4) availability of expert testimony and correlation between judgment and expert testimony; (5) court decision and sentence of liability: monetary redress or length of custodial sentence. The allegations were categorized as pre-procedural, intra-procedural, and post-procedural stages as described by Murphy *et al.* (2018).

2.1.3 Summary court judgments

The setting of this research condition is similar to that described above, except that target subject “First-instance Court” was replaced by “Summery Court.”

2.1.4 Statistical analysis

Microsoft Excel was employed to file the variables, and the statistical software SPSS version 22.5 was used for statistical analysis. Correlations between judgments and the

doi:10.6342/NTU202201485

aforementioned independent variables were determined. Categorical variables were expressed as numbers with percentages [N (%)], whereas continuous variables were expressed as mean values with standard deviations (mean ± SD). All cases were divided into the following two groups: plaintiff-prevailed and defendant-prevailed. Differences in the frequencies were tested using the chi-squared test. The statistical significance of all tests was set at a two-tailed P value < 0.05.

2.2 Endodontic malpractice litigation in the US

2.2.1 Study samples and cases collection

The LexisNexis (Dayton, OH, USA) online legal academic database (https://plus.lexis.com) contains case law from US Court decisions. These data were used to search for endodontic treatment-related litigations in the United States, from January 1, 2000, to December 31, 2020. A Boolean search was conducted using four strategies with the terms “root canal treatment” & (I) “endodontist” (II) “endodontics” (III) “root canal” (IV) “dental pulp.” The investigator then evaluated the results for relevance to endodontic lawsuits. For the case that has more than one judgment, only the eventual

doi:10.6342/NTU202201485

verdict was included. All information regarding the decision year, plaintiff's gender, defendant's specialty, malpractice allegations, and final decisions were summarized and reviewed by the investigator. The allegations were also categorized as pre-, intra-, and post-procedural (Murphy *et al.*, 2018).

2.2.2 Statistical analysis

Data were analyzed using chi-squared or Fisher's exact test for categorical variables based on plaintiff's demographics, defendant's qualifications, allegations and outcomes. Statistical significance was indicated by a two-tailed $P < 0.05$.

doi:10.6342/NTU202201485

Chapter III. Results

3.1 Endodontic malpractice litigation in Taiwan

A total of 188 cases were collected via the Boolean search, including 119 and 69 cases from strategies (I) and (II), respectively, with 4 additional cases identified through manual research. Information contained in the 192 initially identified cases were reviewed for relevance. Among the 159 excluded cases, 97 were not associated with dental medicine, and 7 comprised complaints raised by unlicensed practitioners. The remaining 52 were not associated with endodontics. Additionally, three settled cases were also excluded given the lack of judicial judgments. Thus, 33 cases met the inclusion criteria (Fig. 1). Summaries of these cases were listed in Appendix I.

3.1.1 Claim period and jurisdictional court

Among the 33 cases, the judgment years were between 2001 and 2021. Annually, the mean number of cases was 1.71 ± 1.20. No significant trend was observed in the number of verdicts based on the year of decision, with the most judgments (n = 4) being made in 2020 (Fig. 2). The claim period from case filing to judgment lasted between 2 and 186 months, with an average of 40.60 ± 34.76 months (mean ± SD).

doi:10.6342/NTU202201485

Cases of endodontic malpractice were distributed among the district courts of Taipei (n = 5), New Taipei (n = 8), Taoyuan (n = 1), Hsinchu (n = 2), Taichung (n = 10), Changhua (n = 3), Yunlin (n = 1), Kaohsiung (n = 2), and Pingtung (n = 1) (Table 2). Taichung had the most cases (n = 10), and three guilty verdicts were identified in New Taipei, Hsinchu, and Taichung. Using Taichung as the boundary, Northern Taiwan (including Taichung) accounted for 78.8% of all cases, whereas Southern Taiwan accounted for only 21.2%, indicating that dental malpractice was more common in Northern Taiwan.

3.1.2 Institutional level of the defendant

The defendant's institutions included medical centers (n = 4), regional hospitals (n = 2), and dental clinics (n = 27). Most of the defendants were from local clinics (27/33 = 81.8%), and all of the defendants who failed in the lawsuits (n = 3) were local dentists (Table 1).

doi:10.6342/NTU202201485

3.1.3 Causes of action and judgment

The major reasons for initiating legal proceedings included harm caused by professional negligence. The injured patients experienced infection, tooth loss, cracks, or pain and suffering, suggesting that the damage caused by endodontic negligence can be severe. The major causes of action included improper instrumentation or obturation (n = 14), insufficient information or lack of informed consent prior to surgery (n = 12), post-treatment pain (n = 8) or infections (n = 8), and cracks (n = 5). Details regarding the causes are listed in Table 3.

Among the 33 cases, only 3 dentists were found guilty (9.1%). The primary reasons for the guilty verdicts included NaOCl irritation and lack of informed consent (n = 1), broken instrument leading to infection/cellulitis (n = 1), and incomplete root canal obturation with subsequently long-term abscess (n = 1) (Table 3). In Taiwan, most of the dentists have been found not guilty of endodontic claims (90.9%).

3.1.4 Liabilities

In the present study, there were more civil actions (n = 27) than criminal actions (n = 6). Plaintiffs prevailed in 3 out of 27 civil proceedings but failed in all 6 criminal charges.

doi:10.6342/NTU202201485

Three plaintiffs prevailed in civil actions, with the judicial tribunal issuing monetary compensations of NT$ 50000, 68606, and 130300, respectively (Appendix 1).

3.1.5 Availability of expert testimony and correlation between judgment and expert testimony

Among the 33 cases, 11 had no expert testimony, whereas 22 were appraised by the Medical Review Committee (MRC) or teaching hospital, resulting in an appraisal rate of 66.7%. This indicated that the judiciary was somewhat reliant on expert testimony. Among the 22 appraised cases, the reviewers found one dentist to be negligent and liable for the patient (n = 1). The rest 21 dentists were not negligent, 20 of these defendants prevailed during litigation (n = 20), except one case (n = 1) (Figure 3).

Generally, most of the judgments were correlated with the appraisals of the expert witness. The positive correlation between judgment and expert testimony was pretty high (21 out of 22 appraised cases are identical).

doi:10.6342/NTU202201485

3.2 Endodontic malpractice litigation in the US

A total of 579 cases were collected via the Boolean search, including 63, 57, 395, and 64 from strategies (I) to (IV), respectively, and 2 additional yielded through manual research. Information contained in the 581 initially identified cases were reviewed for relevance. Of the 494 excluded cases, 101 were duplicates in the four search strategies, 232 comprised complaints raised by inmates regarding deliberate indifference, in violation of the *Eighth Amendment* (Buranelli, 1991). The remaining 161 were not associated with endodontics. In addition, 2 partial win/loss and 1 settled cases were also excluded**.** Thus, 84 cases were enrolled in the final analysis (Fig. 4). Summaries of these cases were listed in Appendix II.

3.2.1 Characteristics of endodontic malpractice cases

Annually, the mean case number was 4.14 ± 2.23 (mean ± SD). No significant trend was observed in the number of verdicts based on the year of decision (Fig.5). Characteristics of cases are presented in Table 5. The plaintiffs were 31 males (36.9%), 51 females (60.7%), and 2 were couples (2.4%). The defendant won in 48 cases (57.1%) and the plaintiff in 36 (42.9%). Non-endodontists (probably General practitioners) were most commonly involved with the lawsuits (86.9%).

doi:10.6342/NTU202201485

Further analysis of the 84 representing cases, there were no significant difference in winning rate either between male/female or non-endodontists/endodontists in defendant-prevailed/plaintiff-prevailed groups. Furthermore, 36, 66, and 30 had pre-, intra-, and post-procedural allegations, respectively. Plaintiffs who claimed for post-procedural reasons had a significantly higher winning rate than those who claimed for non-post-procedural reasons ($P < 0.05$; Table 6).

3.2.2 Rationales for lawsuits and court decisions

There were 163 allegations among the 84 cases. Lawsuits were mainly filed due to improper instrumentation or obturation (n = 31), and 11 plaintiffs prevailed among these cases. Improper diagnosis (n = 14), insufficient information or failure to obtain informed consent (IC; n = 20), injury to anatomy (n = 11), broken instrument (n = 17), and infections (n = 19) were the other major allegations, and 6, 6, 7, 8, and 14 plaintiffs prevailed, respectively. The dentists were liable in all allegations involved with failure to use rubber dam (RD; n = 2) and paresthesia (n = 6); in 5 of the 6 allegations that involved root perforation (n = 6) or wrong tooth treatment (n = 6). In contrast, the plaintiffs failed in 5 of the 6 allegations of improper anesthesia (n = 6). (Table 7).

doi:10.6342/NTU202201485

Chapter IV. Discussions

Modern society is characterized by a culture of high expectations, and patients file legal actions when they are dissatisfied with a service or outcome. The prevalence of pain following root canal obturation reportedly ranges from 9.6% to 12% (Sjogren *et al.,* 2019; Polycarpou *et al.,* 2005). Thus, perhaps about 10% of patients who undergo RCT are potential plaintiffs.

The current study tries to present the actual situation of endodontic malpractice litigation in Taiwan and the United States (US). However, the withdrawn cases were not available and might cause underestimation of the real claims. Here, we could just screen 33 endodontic malpractice cases in Taiwan and 84 in the US for analysis. In general, endodontic claims were settled and resolved *via* liability insurance (Pinchi *et al.,* 2013), just a small part proceeded to litigation. Therefore, cases enrolled in the present study is lesser than studies utilized insurance data (Bjørndal *et al.,* 2008; Givol *et al.,* 2011; Rosen *et al.,* 2012; Schwarz, 1988; Pinchi *et al.*, 2014; Bordonaba-Leiva *et al.*, 2019). Moreover, original information regarding tooth position, reason for RCT, instrumentation or obturation method used, recording chart and radiographs could not be accessed. The above are the limitations.

doi:10.6342/NTU202201485

4.1 Elements of endodontic malpractice lawsuits

An endodontic medical malpractice lawsuit is mainly based on torts, where dentists violate their obligation for due diligence and thereby infringe upon the health and autonomous rights of patients. For some cases, however, the “Medical Contract” theory had been utilized to seek redress from health care facilities for their failure to uphold their end of the contract, such as incomplete medical treatment or therapy, infringement upon patients’ life, health, or medical autonomy.

For a medical malpractice lawsuit to succeed, the plaintiff must prove the following four elements.

4.1.1 Doctor–patient relationship

A doctor–patient relationship is usually established when patients seek care from a doctor or other health care providers at a health care facility. A medical contract becomes effective only after the health care facility accepts a patient’s registration. After the medical contract is signed, the health care facility is bound by the contract. A doctor–patient relationship usually does not exist between the person asking questions and the responder in a medical consultation situation often seen in the media. Discussions among doctors regarding a patient’s condition or exchanges in medical opinions among doctors do not

doi:10.6342/NTU202201485

indicate that the doctor being consulted is in a doctor–patient relationship with the patient being discussed.

The existence of a doctor–patient relationship is a prerequisite for clarifying liabilities. Once duty is established, its content will depend on certain circumstances. In general, a doctor must act in accordance with the standard of a reasonable, competent physician within his/her specialty. Accordingly, an endodontist must act reasonably, which entails a responsibility to be conversant with current procedures and treatment options, communicate these to the patient, and execute treatment with expertise.

4.1.2 Breach the duty of care

When a medical malpractice suit is brought, the burden of proof regarding the elements of the breach of duty, causation, and damages, usually lies with the plaintiff who must prove that the dentist violated the standard of endodontic care. Generally, patients should attempt to prove that the endodontist had insufficient knowledge, used that knowledge inappropriately, performed a procedure badly, or failed to provide the patient with the information required to make an informed decision regarding whether to undergo the procedure. Examples of negligent conduct might include diverse problems such as failure to sterilize the equipment or doing so imprecisely (resulting in infection), operating

doi:10.6342/NTU202201485

on the wrong tooth, allowing the patient to accidentally swallow or inhale an instrument, or leaving an object in the canal space.

An objective standard is required when evaluating whether a doctor breached their duty of care. In other words, whether the defendant breached their duty of care is assessed comprehensively according to similar general cases, instead of what is involved in the specific case only. An objective standard is that "the defendant breaches the duty of care for the lack of knowledge or skills if a reasonably skilled doctor can meet the standard criteria under similar circumstances."

4.1.3 Medical procedure resulting in damages

One of the prerequisites for a lawsuit is that the medical behavior had resulted in damages for the patient.

The determination of whether damages existed is performed professionally by an expert. If damages do exist, the expert must carefully analyze the clinical condition of the patient and determine whether the damages had been caused by the doctor violating his/her due diligence obligation or by the complications of the procedure itself. If the damages occurred due to the doctor failing to pay attention, the doctor shall be liable for the compensation.

doi:10.6342/NTU202201485

The value of the compensation depends on the nature, severity, and duration of the physical and mental damages suffered by the patient, as well as whether permanent and irreversible damages had occurred. According to the compensation standards established in the theory of liabilities over inappropriate medical care, punitive compensation may also be requested under certain circumstances (e.g., extremely egregious errors, or intentional concealment of the plaintiff's condition).

4.1.4 Proximate cause

A proximate cause indicates that an event (act) will lead to the occurrence of damages (outcome) should the event proceed naturally without intervention from other factors and that without the act, the damages (outcome) would not have occurred. The damages incurred by the patient resulting from the breach of the duty of care by the doctor should have a proximate cause. If the damages suffered by the patient are the result of his/her negligence or other factors, the doctor does not necessarily have medical liabilities.

Causation in cases of alleged failure to provide informed consent is more complicated. If the doctor informed the patient of the possible risks, he/she is not liable for the damages caused by the complications (assuming that the procedure itself was performed competently). If a material risk is not disclosed, however, the dentist/endodontist may be

doi:10.6342/NTU202201485

liable should that risk materialize and cause injury. Most courts require that the undisclosed risk be serious enough that a reasonable person would not have consented to the procedure had they known of it before undergoing the procedure.

If causation is proved, the compensation usually includes costs required for treating the underlying endodontic problem or any complications incurred resulting from the doctor's negligence. This also includes loss of income due to the malpractice and the compensation for mental loss.

4.2 Comparisons of endodontic malpractice litigation between Taiwan and the US

4.2.1 Endodontic malpractice litigation in Taiwan

The current study describes litigations on endodontic malpractice using a jurisdiction database from 2001 to 2021. Apart from three settlement cases, we found only 33 actual endodontic decisions involving dentists in Taiwan during the 21-year period. The average number of annual lawsuits was less than two.

doi:10.6342/NTU202201485

4.2.1.1 Conviction rate and characteristics

Based on the results, 3 of the 33 dentists accused of endodontic malpractice lost their lawsuits, resulting in a conviction rate of 9.1% (Table 1), which was lower than that of in the US (42.9%, Table 5). Regarding the sex of the plaintiff, women filed more lawsuits than men (Table 1). Moreover, Taichung (n = 10), New Taipei (n = 8), and Taipei (n = 5) had the most claims (n = 23; 69.7%) and culpable verdicts (n = 2), which may have been related to the higher socio-economic status of people who have better knowledge regarding medical autonomy and the standard of care in these three municipalities. The average claim period (40.60 ± 34.76 months) observed herein is comparable to that reported in Maeda's study, which revealed that the average time taken for medical malpractice litigation was 3.0 years in Japan (Maeda *et al.*, 2001).

4.2.1.2 Dental clinics encounter most of the litigations

Regarding the institutional level of the defendant, dentists practicing at local clinics accounted for 81.8% of claims (n = 27). This result is somewhat similar to that of Perea-Pérez's study, in which 85.7% of disputes originated from dental clinics (Perea-Pérez *et al.*, 2011). Furthermore, all dentists who lost their lawsuits were from local clinics (n = 3). In Taiwan, almost 80% of the dentists' practice are in local clinics where equipment

doi:10.6342/NTU202201485

is probably relatively insufficient and might not be as advanced as that in hospitals. Clinics provide majority of dental services and, based on the volume effect, have more chances to encounter and lose malpractice lawsuits. Regarding the six cases at the hospital level, although all dentists were found not liable, we cannot make any inferences as to whether the judge's judicial discretion was related to the level of the defendant's institution.

4.2.1.3 Causes of action and the critical factors

Endodontic therapy focuses on manipulating procedures and is a type of operative dentistry. Naturally, the treatment course is similar to that of surgery, with an emphasis on diagnosis, therapeutic process, and post-treatment care (Balan *et al.*, 2014). In particular, the lack of informed consent, improper surgical procedure, and post-treatment infections have been the major reasons for legal action with surgery. In the present study, 3 dentists failed in the lawsuits. With the three cases, one patient suffered from mucosal irritation due to NaOCl leakage and post-treatment infections. The patient was not informed the risks and complications before RCT. Another patient experienced separation of an instrument, which caused inappropriate debridement of the canals and consequent facial cellulitis. The defendant dentist concealed the event and the patient didn't find the

doi:10.6342/NTU202201485

broken instrument until he visited another dentist. The last one suffered from an incomplete root canal obturation and painful flare-up. The defendant dentist failed to comply with the standard of endodontic care and breached the medical contract. In these three cases, the dentists were liable for the patients' suffering. The major causes were associated with the lack of informed consent, improper treatment procedure (broken file and incomplete canal filling), and infection after therapy. Clinicians should always address issues regarding informed consent and exercise caution with canal instrumentation and obturation.

4.2.1.4 Civil or criminal proceedings

Although most medical disputes are subject to criminal proceedings in Taiwan (Lin, 2009), our results revealed that only a minor proportion of endodontic disputes (18.2%) were subject to criminal lawsuits. Civil proceedings may resolve the disciplines with monetary compensation for the victim. In medical malpractice litigation, patients would receive substantial monetary compensation for physical and mental damages.

In contrast to civil claims (n = 27) with three guilty verdicts, all criminal lawsuits had non-guilty verdicts (n = 6), perhaps because reamer/file fracture or mucosa ulcers could be caused by several factors. Therefore, convictions were unlikely given the lack

doi:10.6342/NTU202201485

of proximate causation. Whether instrument fracture or mucosal ulcers would be considered negligence should be evaluated by judicial court. The burden of proof and requirement of evidence for conviction are not the same in civil and criminal litigations. Therefore, in spite of similar or the same cases, decisions in civil and criminal prosecution were not always identical.

4.2.1.5 Expert testimony and judgment

Generally, negligence in dental practice was appraised by experts, whereas the crime of negligence was determined by the judicial court. Among the 22 cases were appraised by the experts in the current study, only one dentist had been found negligent and lost the lawsuit. The other 21 dentists were determined to have no negligence by the experts, among whom 20 prevailed in their litigation. This result reveals that the judicial decision was quite consistent with the testimony of the experts (Wu *et al*., 2022). For the exception one, the judicial judgment was not in accordance with expert's testimony. The expert testified that NaOCl leakage may be happened even with no fault and is an unavoidable complication during RCT. On the contrary, the judge determined that the risk of mucosa irritation should have been disclosed and the lack of informed consent constituted the breach of the duty of care.

doi:10.6342/NTU202201485

4.2.2 Endodontic malpractice litigation in the US

Dentists were found liable in 36 of the 84 cases (42.9%) (Table 5). This result is approximate to that reported by Bjørndal *et al.* (2008), wherein in 179 of the 482 (37.1%) endodontic claims, the dentist was liable, as determined by the Danish Dental Complaints Board. Furthermore, women file more lawsuits than men (60.7% vs. 36.9%), probably because women undergo dental treatment more often than men (Givol *et al.*, 2010; Manski *et al.*, 2002). This finding is consistent with the report by Rosen *et al.* (women, 59.7%; Rosen *et al.*, 2012). In general, women are more concerned about oral health, demand more dental treatment, and are more willing to file a lawsuit (Loreto *et al.*, 2019).

4.2.2.1 Pre-procedural allegations

Of the 84 representing cases, 36 (42.9%) consisted of pre-procedural allegations. Incorrect or delayed diagnosis and failure to obtain informed consent (IC) prior to the procedure were the major causes.

A correct diagnosis and an appropriate treatment plan form the basis for a successful therapy. If a physician acts recklessly in diagnosis, the physician would be held liable for the causation of damages.

doi:10.6342/NTU202201485

Furthermore, in this study, 23.8% of dentists were sued for insufficient information disclosure or failure to obtain IC. A successful healthcare treatment is usually accompanied by effective pre-procedural communication (Shigli *et al.*, 2010). Mellor *et al.* reported that lack of communication was significantly more among dentists with official malpractice complaints (Mellor *et al.*, 1995). Failure to obtain IC should be considered as an adverse event (Fonseca *et al.*, 2020). Roter indicated that physician dominance is related to the likelihood of being involved in a malpractice claim. They also found that sued doctors were less likely to solicit the patient's opinions or understanding of the provided information (Roter *et al.*, 2006). Despite variations among states (Sfikas *et al.*, 2003), common points of IC include capacity, information, understanding, voluntariness, and choice (Mukherjee *et al.*, 2017). Even though patients believe that they have understood well, they do not always exhibit adequate comprehension from their IC processes (Moreira *et al.*, 2016). Improvements in the communication with increased patient-centered decision-making might decrease the risk of liability claim.

4.2.2.2 Intra-procedural allegations

Of the 84 cases, 66 (78.6%) consisted of intra-procedural allegations, indicating that intra-procedural errors, same as Givol's report (2010), continue to be the most common

doi:10.6342/NTU202201485

reason for litigation in endodontic therapy. Non-adherence to strict operating protocols causing substandard treatments was a common cause of malpractice claims. Improper performance (n = 31), broken instrument (n = 17), and anatomical injury (n = 11) were the three major allegations.

Improper performance indicates that the dentist fails to properly perform RCT and promptly treat an infection or adhere to the accepted standard of canal obturation. Instrument separation sometimes happens during RCT, especially in calcified or curved root canals. The consequences of separated rotary instrument may be related to manufacturing process, number and dynamics of instrument use, canal configuration and preparation technique, cleaning and sterilization procedures (Parashos *et al.*, 2006). The file might fatigue during instrumentation, and there is an inherent risk of its breakage. Broken instrument can't be avoided by the exercise of reasonable care and won't be substantially a breach of the standard of care of endodontic therapy. If a piece of file is lodged and cannot be removed, the dentist should inform and refer the patient to an endodontist immediately. Unfortunately, most of the dentists are still hesitant from informing the patient about the incident occurrence (Mathew, 2015). The dentist would be liable if this matter is fraudulently concealed, or if an infection is developed due to lack of timely referral. General

doi:10.6342/NTU202201485

dentists should review the Endodontic Case Difficulty Assessment Form and Guidelines to determine case complexity. A referral to an endodontist should be considered if the canals are not visible or the curvature (>30°) exceeds clinician's experience and ability (AAE., 2019). Infringements upon anatomical structures, such as the lip, mucosa, sinus, nerve, and artery during the enlargement or obturation procedure, can lead to serious complications. The inferior alveolar nerve (IAN) injury or mucosa burn due to NaOCl leakage was the common damage.

In 1980s, Cohen & Schwartz had indicated two intra-procedural errors considered as obvious departures from the standard of endodontic care: 1) failure to use a rubber dam (RD); 2) attempt to fill a canal with paste containing paraformaldehyde and steroids (Cohen *et al.*, 1987). Findings from the Dental Practice-Based Research Network revealed that not all general dentists used a RD (Anabtawi *et al.*, 2013). A previous study reported that < 19% of dentists used a RD routinely, and 44.5% of practitioners indicated that they had never used a RD (Jenkins *et al.*, 2001). The RD can reduce the occurrence of anatomical injuries, such as chemical burns or instrument ingestion/inhalation, thereby minimizing the chances of an endodontic litigation.

doi:10.6342/NTU202201485

Root perforation is another major allegation for intra-procedural errors. Accidental perforations comprise 29% of serious injuries during RCT (Vehkalahti *et al.*, 2020). Perforations complicate canal treatment, and the perforated root needs to be repaired. Failure to halt treatment prior to perforation and refer the patient to an endodontist is a breach of the standard of care. Supplementary radiographs or cone-beam CT for assessing the canal system might decrease the risk of pulp floor or canal perforation. (Vithanage, 2018)

In the current study, we also found few dentists performed RCT on the wrong tooth (n = 6). Treating recklessly is considered negligence without a doubt. Careful identification of the offending tooth followed by patient's confirmation might aid in avoiding such mistakes. In contrast, the plaintiffs failed in 5 of the 6 allegations of improper anesthesia. Actually, it is difficult for patients to obtain expert testimony to prove the causation of anesthetic damage. In the present study, among the various intra-procedural allegations, a significant difference in court decisions was observed ($P < 0.05$; Table 7).

doi:10.6342/NTU202201485

4.2.2.3 Post-procedural allegations

Causes of post-procedural allegations involve bleeding, cracks, improper referral or medication, infections, and paresthesia. Of the 84 cases, 30 included post-procedural allegations. It is noteworthy that a high proportion of dentists failed to counter these allegations (70.0%, $P < 0.05$; Table 6).

Previous studies demonstrate that flare-ups might appear in 1.5%–20% of cases following RCT, and they should be regarded as side effects and not as complications (Tsesis *et al.*, 2015). In rare cases, patients might develop cellulitis after endodontic treatment. Grönholm *et al.* evaluated the clinical and radiological findings of patients who presented with locally invading maxillofacial infections from odontogenic sources and required hospital care. Reportedly, unfinished RCT was the most common finding in patients hospitalized due to the local infections (Grönholm *et al.*, 2013). Patients with unfinished RCT have been associated with a higher risk of cardiovascular hospitalization (Lin *et al.*, 2015). In the present study, plaintiffs won in 14 of the 19 cases (73.7%) attributed to post-procedural infections. Thorough debridement of the canal system is essential to minimize the spread of infection. Timely referral to an oral-maxillofacial surgeon with early incision and drainage can minimize morbidity and legal actions.

doi:10.6342/NTU202201485

In the cases with post-procedural allegations, the dentists were found to be lost in all claims (n = 6) pertaining to paresthesia. In a recent systematic review, Alves *et al.* identified 40 cases of endodontic-related paresthesia over a 10-year period (Alves *et al.*, 2014). Although these incidents are relatively rare, their consequences are serious and may lead to life-long sufferings. Paresthesia following RCT is often caused by extruding filling materials or irrigants from the normal confines of the root causing nerve damages in the jaws. Givol *et al.* analyzed 16 claims of persistent numbness following RCT and found that most cases (n = 11, 69%) occurred in the second mandibular molars (Givol *et al.*, 2011). This might be due to the distance between the root apex and roof of the inferior alveolar canal, which is less than 1 mm in the case of the second molar and varies between 1 and 4 mm of the first molar (Tilotta-Yasukawa *et al.*, 2006). RCT of the mandibular second molar poses a significant potential risk of IAN injury (Chong *et al.*, 2015). Sometimes, filling material was found to penetrate the apex of the mandibular second molar and damage the IAN. Other high-risk areas were located in the mandibular premolars and associated with the mental nerve. Care must be taken to maintain an appropriate working length and avoid over-instrumentation and excessive enlargement of the apical foramen,

doi:10.6342/NTU202201485

which favors extravasation of the filling material beyond the apex that could cause chemical or mechanical injury to the nerve.

Most outcomes that favored the plaintiffs involved paresthesia and infection, a primary reason for a significantly higher number of patients who prevailed in cases pertaining to post-procedural than non-post-procedural allegations (Table 6 & 7; $P < 0.05$). These results may alert dentists about the focus of RCT and mitigate endodontic litigation.

4.2.3 Comparisons between Taiwan and the US

4.2.3.1 The similarities

In this study, in both Taiwan and the US, female patients file more lawsuits than male patients. In addition to performing surgery carefully, dentists should always spend more time communicating with female patients.

Most of the defendants were from local clinics in Taiwan and US and were supposed to be non-endodontists. Aside from the volume effects, general dentists should always focus on the procedure when treating difficult cases.

The major reasons for lawsuits in Taiwan and the US were also similar. The major pre-procedural allegations were insufficient information or informed consent. The major intra-procedural allegations were improper instrumentation or obturation. The major post-

doi:10.6342/NTU202201485

procedural allegations were infections. These results indicated that the rationales for endodontic lawsuits were almost the same for Taiwan and the US. As such, clinicians should be familiar with the causes of actions to avoid legal affairs.

4.2.3.2 The differences

Naturally, the judicial system in Taiwan and the US is different in substance. Unsurprisingly, in the present study, all endodontic lawsuits in the US were resolved *via* civil proceedings (100%), whereas 6 of the 33 lawsuits in Taiwan were *via* criminal actions (18.2%).

In the present study, the conviction rate of endodontic litigation in Taiwan was 9.1%, whereas it was 42.9% in the US, and the difference is significant ($P < 0.05$). The judgment was determined by members of the jury in the US, but by professional judge in Taiwan. It is supposed that the jury usually offers sympathy to vulnerable patients. Therefore, dentists probably have more chances to lose lawsuits in the US. On the contrary, the professional judge will consider the elements of negligence and determine the trial with reasonable presumption. A physician's guilt is established only when the factors are beyond a reasonable doubt. Therefore, the conviction rate of dentists in Taiwan is lower than that in the US.

doi:10.6342/NTU202201485

Although the major causes of actions were similar in Taiwan and the US, they were quite different in some allegations. In the US, patients might allege that the dentist failed to use rubber dam, failed to refer, or abandoned the patients. However, no such allegations were raised in Taiwan. In Taiwan, patients might allege that there was mucosal irritation by NaOCl seepage or postoperative pain and suffering. However, no such allegations were raised against the dentists in the US.

doi:10.6342/NTU202201485

Chapter V. Conclusions

1. The average annual endodontic malpractice lawsuits occurred in Taiwan was less than two and less than five in the US. The results indicate that the incidence of endodontic malpractice litigation was not high in Taiwan and the US.

2. Most of the defendants were non-endodontist in Taiwan and the US, so we recommend that non-endodontists might refer difficult cases to endodontic specialists.

3. The major causes of action being lack of informed consent, improper instrumentation, and post-procedural infection.

4. The overall conviction rate for endodontic malpractice litigation was 42.9% in the US but just 9.1% in Taiwan.

5. The judicial judgment was highly consistent with the expert testimony in Taiwan.

6. Dentists should always practice with caution when establishing diagnoses and treatment planning.

7. It is mandatory for the dentists to perform RCT with the employ of rubber dam to prevent infection and foreign matter inhalation or swallowing.

doi:10.6342/NTU202201485

8. Root perforation and paresthesia without proper remedy constitute the highest conviction rate.

9. The dentists should always manage the post-procedural infection attentively.

10. Shared decision-making and informed consent before an invasive therapy would minimize endodontic malpractice litigations.

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Figures

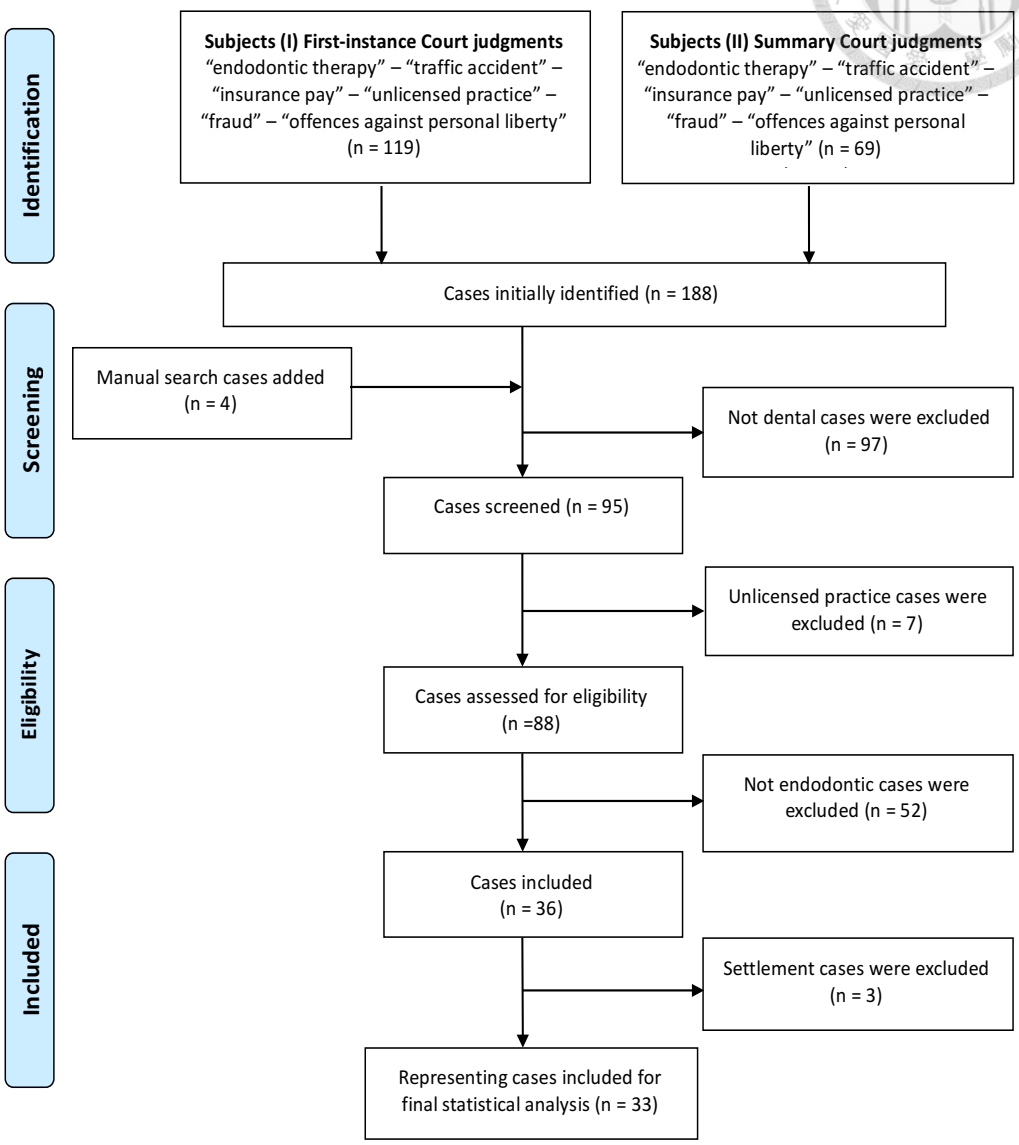

Figure 1. Cases collection for endodontic malpractice litigation in Taiwan

doi:10.6342/NTU202201485

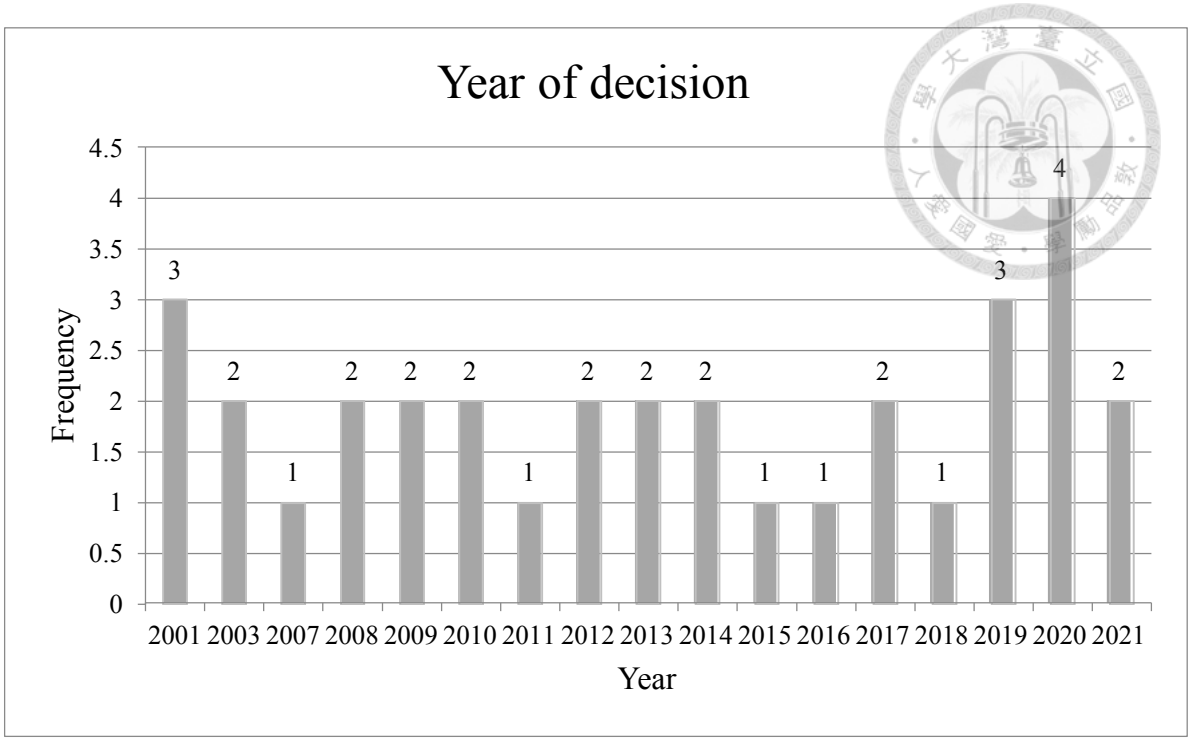

Figure 2. Year of decision for endodontic malpractice litigation in Taiwan.

Figure 3. Lawsuits appraised by the expert witness. One of the 22 dentists appraised with negligence was liable. On the other hand, one of the 21 dentists appraised with no negligence was sentenced guilty.

doi:10.6342/NTU202201485

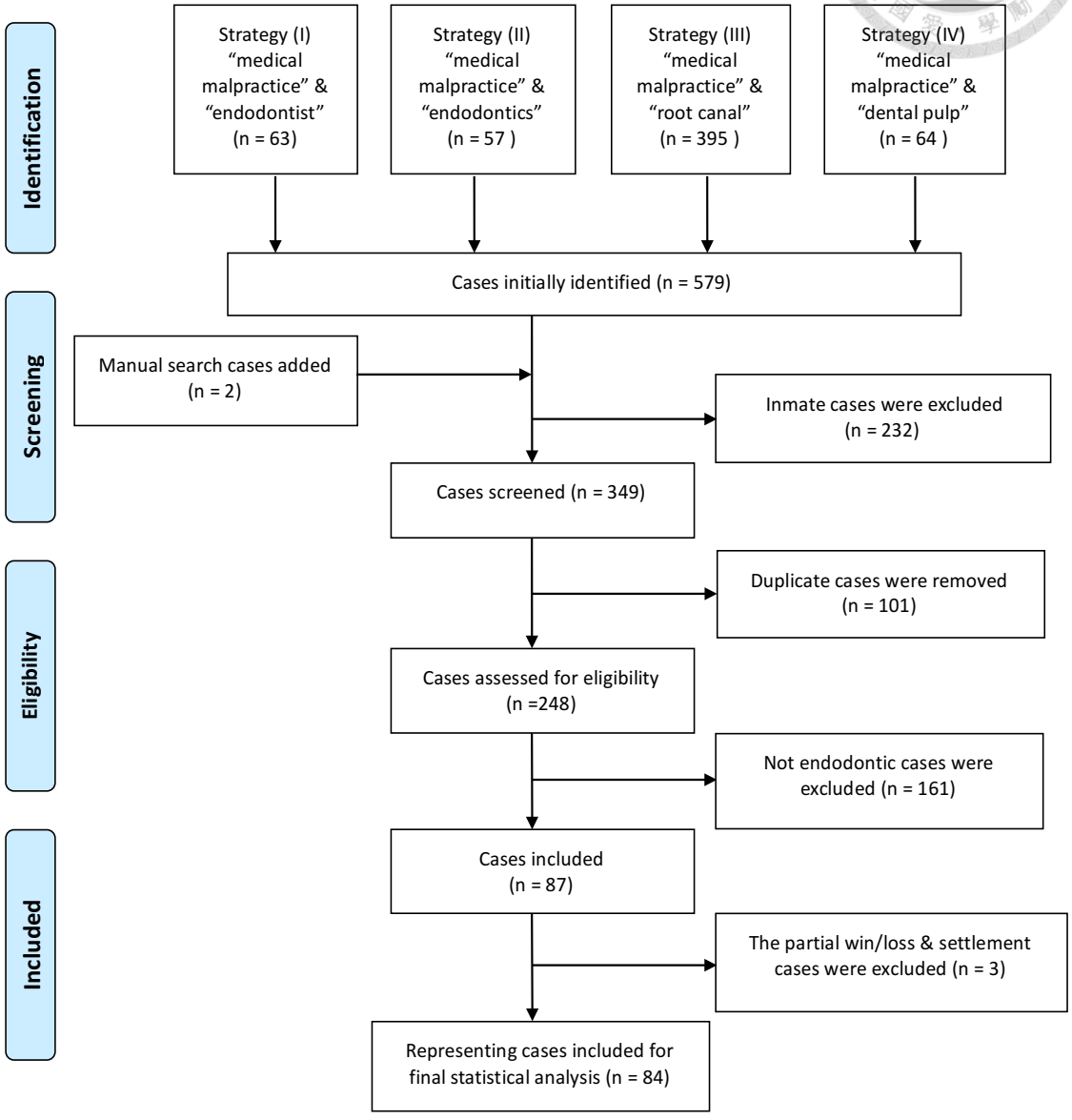

Figure 4. Cases collection for endodontic malpractice litigation in US.

doi:10.6342/NTU202201485

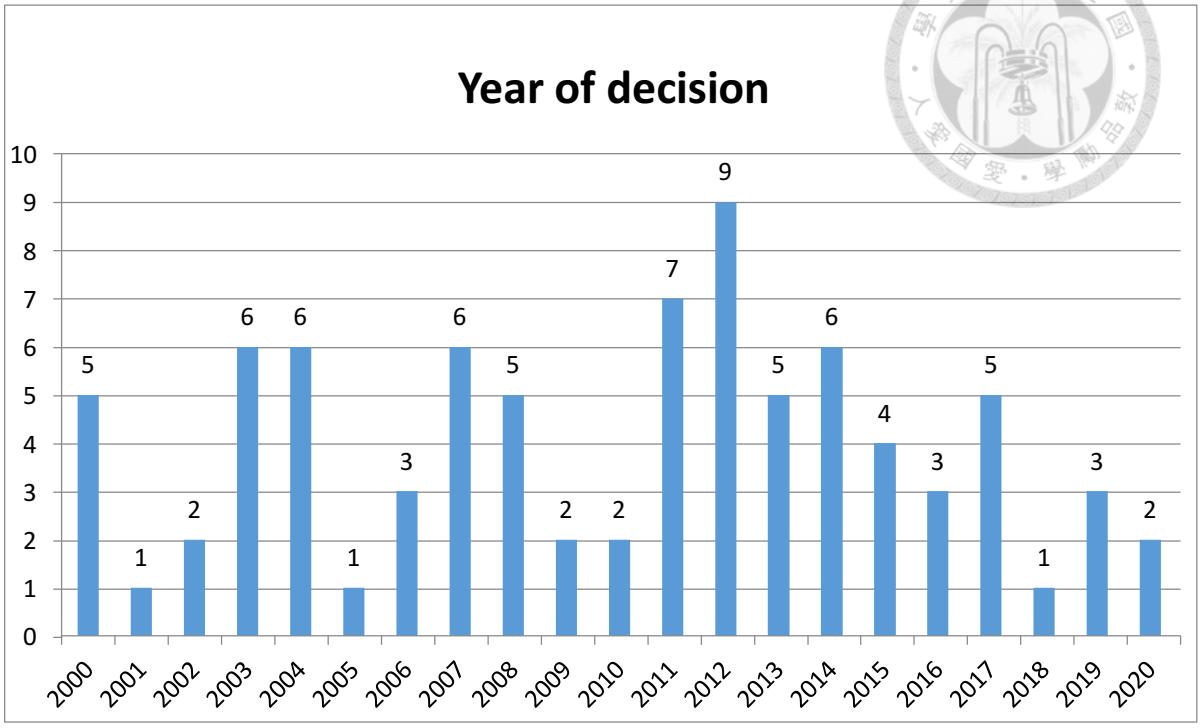

Figure 5. Year of decision for endodontic malpractice litigation in US.

doi:10.6342/NTU202201485

Tables

Table 1. Characteristics of cases with endodontic malpractice litigation in Taiwan from 2000 to 2021 (N=33).

Gender of plaintiff	**Case No (%)**
Male	13 (39.4%)
Female	16 (48.5%)
Unknown	4 (12.1.9%)
Defendant professional level	
Non-Endodontist	26 (78.8%)
Endodontist	2 (6.0%)
Unknown	5 (15.2%)
Lawsuit outcomes	
Plaintiff-prevailed	3 (9.1%)
Defendant-prevailed	30 (90.9%)
Total	33 (100%)

Table 2. Geographical distribution of endodontic malpractice litigation in Taiwan. Taichung (N=10) and New Taipei (N=8) had the most cases and guilty verdicts.

Jurisdictional court	**Number of Malpractice cases**	**Number of guilty verdicts**
Taipei	5	0
New Taipei	**8**	**1**
Taoyuan	1	0
Taichung	**10**	**1**
Changhua	3	0
Hsinchu	2	1
Yunlin	1	0
Kaohsiung	2	0
Pingtung	1	0
Overall	33	3

doi:10.6342/NTU202201485

Table 3. Rationales for lawsuits and court decisions in Taiwan. Because most cases had more than one allegation, there are 75 allegations in the 33 representing cases (N=33).

	Claims Count	Plaintiff-Prevailed Verdict	Defendant-Prevailed Verdict	Fisher's Exact Test P-value
Pre-Procedural Allegation	n=17	n=1	n=16	>.05
Fail to perform endodontic treatment	2	0 (0.0%)	2 (100.0%)	
Incorrect or delay in diagnosis	3	0 (0.0%)	3 (100.0%)	
Insufficient information or consent	**12**	**1 (8.3%)**	**11 (91.7%)**	
Intra-Procedural Allegation	n=29	n=3	n=26	>.05
Broken instrument	3	1 (33.3%)	2 (66.7%)	
Improper anesthesia	1	0 (0.0%)	1 (100.0%)	
Improper instrumentation or obturation	**14**	**1 (7.1%)**	**13 (92.0%)**	
Improper apicoectomy	1	0 (0.0%)	1 (100.0%)	
Improper infection control	1	0 (0.0%)	1 (100.0%)	
Improper occlusal reduction	1	0 (0.0%)	1 (100.0%)	
Injury to anatomy	2	0 (0.0%)	2 (100.0%)	
Root perforation	2	0 (0.0%)	2 (100.0%)	
NaOCl irritation	4	1 (25.0%)	3 (75.0%)	
Post-Procedural Allegation	n=29	n=3	n=26	>.05
Crack	5	0 (0.0%)	5 (100.0%)	
Gingiva discoloration	1	0 (0.0%)	1 (100.0%)	
Infections	**8**	**2 (25.0%)**	**6 (75.0%)**	
Improper medication	1	0 (0.0%)	1 (100.0%)	
Pain	**8**	**1 (12.5%)**	**7 (87.5%)**	
Radicular cyst	1	0 (0.0%)	1 (100.0%)	
TMJ disorder	1	0 (0.0%)	1 (100.0%)	
Tooth extraction	2	0 (0.0%)	2 (100.0%)	
Ulcer	2	0 (0.0%)	1 (100.0%)	
Total	75	7	68	

doi:10.6342/NTU202201485

Table 4. Institution level of the defendant in Taiwan (N=33). Dentists in local clinics faced the highest number of malpractice lawsuits.

Defendant institute level	Total Case Number N (%)	Plaintiff-Prevailed Group	Defendant-Prevailed Group	chi-squared Test
	N=33	N=3	N=30	P-value
				0.693
Medical center	4 (100.0%)	0 (0.0%)	4 (100.0%)	
Regional hospital	2 (100.0%)	0 (0.0%)	2 (100.0%)	
Local clinics	**27 (100.0%)**	**3 (11.1%)**	**24 (88.9%)**	
Total	33 (100%)	3 (9.1%)	30 (90.9%)	

Table 5. Characteristics of cases with endodontic malpractice litigation in US from 2000 to 2020 (N=84).

Gender of plaintiff	**Case No (%)**
Male	31 (36.9%)
Female	51 (60.7%)
Male and Female (couple)	2 (2.4%)
Defendant professional level	
Resident in Endo Department	2 (2.4%)
Non-Endodontist	73 (86.9%)
Endodontist	7 (8.3%)
Endodontist & Non- Endodontist	2 (2.4%)
Lawsuit outcomes	
Plaintiff-prevailed	36 (42.9%)
Defendant-prevailed	48 (57.1%)
Total	84 (100%)

doi:10.6342/NTU202201485

Table 6. Characteristics of representing cases with court decisions in US (N=84). Plaintiffs claimed with Post-Procedural reasons had significantly higher winning rate compared to Non Post-Procedural reasons. (*$P < 0.05$)

	Plaintiff-Prevailed Verdict	**Defendant-Prevailed Verdict**	
	N=36	N=48	P-value
Gender of plaintiff			0.1795
Male	11 (34.4%)	21 (65.6%)	
Female	25 (50.0%)	25 (50.0%)	
Male/Female	0 (0.0%)	2 (100.0%)	
Defendant professional level			0.4771
Resident in Endo Department	0 (0.0%)	2 (100.0%)	
Non-Endodontist	32 (43.8%)	41 (56.2%)	
Endodontist	4 (57.1%)	3 (42.9%)	
Endodontist &Non-Endodontist	0 (0.0%)	2 (100.0%)	
Pre-Procedural Allegation			0.2793
Non Pre-Procedural	23 (47.9%)	25 (52.1%)	
Pre-Procedural	13 (36.1%)	23 (63.9%)	
Intra-Procedural Allegation			0.8780
Non Intra-Procedural	8 (44.4%)	10 (55.6%)	
Intra-Procedural	28 (42.4%)	38 (57.6%)	
Post-Procedural Allegation			* 0.0002
Non Post-Procedural	15 (27.8%)	39 (72.2%)	
Post-Procedural	21 (70.0%)	9 (30.0%)	

doi:10.6342/NTU202201485

Table 7. Rationales for lawsuits and court decisions in US. Most cases had more than one allegation, there were 163 allegations in the 84 representing cases. A significant difference in court decisions was observed among the intra-procedural allegations (*$P < 0.05$). The plaintiffs won all of the allegations regarding post-procedural paresthesia (n = 6).

	Claims Count	Plaintiff-Prevailed Verdict	Defendant-Prevailed Verdict	Fisher's Exact Test P-value
Pre-Procedural Allegation	**n=49**	**n=20**	**n=29**	**0.5986**
Abandonment	3	2 (66.7%)	1 (33.3%)	
Failing to refer	3	1 (33.3%)	2 (66.7%)	
Improper treatment plan	9	5 (55.6%)	4 (44.4%)	
Incorrect or delay in diagnosis	14	6 (42.9%)	8 (57.1%)	
Insufficient information or consent	20	6 (30.0%)	14 (70.0%)	
Intra-Procedural Allegation	**n=78**	**n=38**	**n=40**	***0.0497**
Broken instrument	17	8 (47.1%)	9 (52.9%)	
Failure to use rubber dam	2	2 (100.0%)	0 (0.0%)	
Improper anesthesia	6	1 (16.7%)	5 (83.3%)	
Improper instrumentation or obturation	31	11 (35.5%)	20 (64.5%)	
Injury to anatomy	11	7 (63.6%)	4 (36.4%)	
Root perforation	5	4 (80.0%)	1 (20.0%)	
Wrong tooth	6	5 (83.3%)	1 (16.7%)	
Post-Procedural Allegation	**n=36**	**n=26**	**n=10**	**0.1253**
Bleeding	1	0 (0.0%)	1 (100.0%)	
Crack	5	2 (40.0%)	3 (60.0%)	
Improper medication	3	2 (66.7%)	1 (33.3%)	
Improper referral	2	2 (100.0%)	0 (0.0%)	
Infections	19	14 (73.7%)	5 (26.3%)	
Paresthesia	6	6 (100%)	0 (0.0%)	
Total	**163**	**84**	**79**	

doi:10.6342/NTU202201485

Appendix I. Endodontic malpractice litigation in Taiwan- Summary of included cases

案件名稱	判決年月	案發至判決耗費時間 (Month)	告訴人性別 (M=1, F=2, Unknown =3)	層級 (medical center=1; regional hospital=2, clinics=3)	術前 (Pre-Procedural Allegation)	術中 (Intra-Procedural Allegation)	術後 (Post-Procedural Allegation)	有無鑑定 (無=0; 有=1)	判決有無罪 (無=0; 有=1) (賠償金)
1.屏東地院 90 年訴字第 891 號民事判決	9206	52	2	2	Insufficient information or informed consent related	1.Insufficient information or informed consent related. 2.Improper root canal obturation	1. Pain 2. TMJ disorder	0	0
2.臺北地院 94 年醫字第 2 號民事判決	9704	102	2	3	-	Root perforation	-	1	0
3.臺中地方法院 98 年醫字第 16 號民事判決	9810	8	2	1	-	NaOCl leakage and irritation	Infections	0	0
4.新北地方法院 99 年醫簡上字第 2 號民事判決	9909	86	3	3	-	Improper access opening	Pain	0	0
5.臺中地方法院 100 年醫字第 26 號民事判決	10112	39	1	3	-	1. NaOCl leakage and mucosa irritation 2. Injury to anatomy	Ulcer	1	0
6.臺北地院 99 年醫字第 51 號民事判決	10305	73	2	3	Incorrect or delay in diagnosis	Improper root canal obturation	Pain	1	0

doi:10.6342/NTU202201485

7.新竹地院 104 年醫簡上字第 1 號民事判決	10405	23	2	3	-	Improper root canal obturation	Gingiva discoloration	1	0
8.臺北地院 106 年醫簡上字第 1 號民事判決	10702	38	2	2	Insufficient information or informed consent related	-	Crack	1	0
9.彰化地院民事 107 年度醫字第 1 號民事判決	10809	39	2	3	-	1. Improper instrumentation 2. Improper root canal obturation	Pain	1	0
10.臺中地院 109 年度醫簡上字第 3 號民事判決	10907	33	1	3	Insufficient information or informed consent related	Improper instrumentation	Crack	1	0
11.臺中地院民事 108 年度醫字第 9 號民事判決	10912	47	1	1	Insufficient information or informed consent related	Root perforation	Infections	1	0
12.雲林地院民事 109 年度醫字第 2 號民事判決	11001	38	1	3	1. Incorrect or delay in diagnosis 2. Insufficient information or informed consent related	Improper apicoectomy	Infections	1	0
13.臺中地院民事 110 年度醫字第 10 號民事判決	11010	47	1	3	-	Improper instrumentation	Radicular cyst	1	0

doi:10.6342/NTU202201485

14.新北地院 98 年度醫字第 3 號民事判決	9812	21	2	3	Insufficient information or informed consent related	improper infection control	Infections	0	0
15.臺中地院 88 年訴字第 3566 號民事判決	9007	20	2	3	-	Improper root canal obturation	Pain	1	1 (68,606 NT$)
16.三重簡易庭 109 年度 重醫簡 字第 2 號民事判決	10911	26	2	3	I Insufficient information or informed consent related	NaOCl leakage and irritation	Infections	1	1 (50,000 NT$)
17.彰化簡易庭 108 年度 彰小字第 974 號民事判決	10901	6	1	3	Failed to perform endodontic ther-apy	-	Pain	0	0
18.臺中簡易庭 108 年度 中醫簡 字第 1 號民事判決	10807	186	2	1	Incorrect or delay in diagnosis	-	-	0	0
19. 105 年度 雄醫小 字第 1 號民事判決	10601	2	2	3	Insufficient information or informed consent related	-	-	0	0
20.店醫簡字 104 年度第 2 號民事判決	10512	25	1	1	Insufficient information or informed consent related	-	Crack	1	0

doi:10.6342/NTU202201485

21.竹北簡易庭 103 年度 竹東簡 字第 107 號民事判決	10309	18	2	3	-	Broken instrument	Infections	0	1 (130,300 NT$)
22.桃園簡易庭 102 年度 桃簡字第 67 號民事判決	10211	24	1	3	Failed to perform endodontic ther-apy	-	-	1	0
23.鳳山簡易庭 100 年度 鳳簡字第 719 號民事判決	10103	6	1	3	Insufficient information or informed consent related	-	Crack	1	0
24.新店簡易庭 99 年度 店醫簡字第 2 號民事宣示筆錄	10001	10	1	3	-	Improper root canal obturation	Tooth extraction	0	0
25.三重簡易庭 98 年度 重簡字第 2192 號民事判決	9905	82	3	3	-	1. Improper access opening. 2. improper local an-esthesia	Pain	0	0
26.三重簡易庭 96 年度 重簡字第 2524 號民事判決	9603	45	1	3	-	Improper root canal obturation	Tooth extraction	1	0

doi:10.6342/NTU202201485

27.板橋簡易庭 89 年度 板簡字第 1334 號民事宣示筆錄	9003	20	3	3	-	Improper occlusal reduction	-	1	0
28.臺中地院 89 年自字第 816 號刑事判決	9006	12	1	3	Insufficient information or informed consent related	-	-	1	0
29.彰化地院 91 年易字 757 號刑事判決	9201	31	3	3	-	Broken instrument	Pain	0	0
30.新北地院 96 年易字第 2235 號刑事判決	9706	38	2	3	-	Broken instrument	Infections	1	0
31.臺中地院 100 年醫易字第 2 號刑事判決	10201	40	1	3	-	1. NaOCl leakage and irritation 2. Injury to anatomy	Ulcer	1	0
32.臺中地院 107 年醫易字第 1 號刑事判決	10812	54	2	3	-	-	1. Improper medication 2. Infections	1	0
33.臺北地方法院 105 年度聲判字第 179 號刑事裁定	10606	49	2	3	Insufficient information or informed consent related	1. Improper access opening 2. Improper instrumentation	Crack	1	0

doi:10.6342/NTU202201485

Settlement (Excluded Cases)									
高雄地方法院 99 年自字第 8 號刑事判決	10001	96	2	3	-	Root perforation	Pain	0	Settlement (excluded)
宜蘭地方法院 103 年度易字第 249 號刑事	10308	5	1	3	-	Swallowing of file	-	0	Settlement (excluded)
臺北地方法院 109年度醫易字第 4 號	10908	24	2	3	-	Broken instrument	Pain	0	Settlement (excluded)

doi:10.6342/NTU202201485

Appendix II. Endodontic malpractice litigation in US- Summary of included cases

Cases	Year	Patient (Age, Sex)	Dr. (GP or S or R)	Issue Reasoning	Verdict favored (P-patient; D-dentist; S-settled)	Reasons of decision or Others (settlement or not an Endo case)
1. Schuffert v. Morgan	2000	F	G	Improper work had caused cellulitis, infection, periodontal disease, and generalized bone loss. She further claimed that Dr. Morgan had breached the applicable standard of care by failing to diagnose and treat the periodontal disease.	P	Schuffert produced substantial evidence tending to prove that Dr. Morgan breached the applicable standard of care and that the breach proximately caused the injury for which Schuffert seeks damages.
2. Ketchup v. Howard	2000	M	G	Nerve damage during a root canal procedure, that defendant failed to inform him of the risk of permanent damage.	D	Informed consent was not recognized in Georgia at the time of the trial court's decision.
3. Robinson v. Astra Pharm.	2000	F	G	Three days after RCT, she had a miscarriage. Appellants sued appellees, claiming the local anesthetic caused the miscarriage.	D	Miscarriages are not uncommon and the cause of most of them remains unknown; that appellants failed to show that anesthetic given during ***root canal*** caused appellant woman's miscarriage. (1/7 weight, cause of the miscarriage was poor placentation)
4. Foote v. Rajadhyax	2000	F	G	Plaintiff experienced numbness in her jaw after RCT, later diagnosed as an injured mandibular nerve.	P	The court found that plaintiff did not need to establish negligence in the performance of the procedure to recover pursuant to a lack of informed cause of action.
5. Dupont v. Preston	2000	F	S	Improper anesthesia.	P	Paresthesia after root canal treatment.
6. Decker v. Flood	2001	M	G	Failing to properly drill, clean, fill, or pack the root canal.	D	Patient's expert witness regarding the dentist's standard of practice was an endodontist, would not be qualified to offer expert testimony on the standard of practice of a general practitioner.
7. Clark v. Martin	2002	F	G	Defendants wrongfully left a foreign object in her body and fraudulently concealed the cause of action.	D	There was no evidence that Dr. Martin knew her problems were the result of the overfilled root.

doi:10.6342/NTU202201485

						Misdiagnosis may be negligence. Leaving a foreign object in a patient's body is necessarily different than negligence in performing the procedure.
8. Mazor v. Isaacman	2002	F	G	A piece of a drill bit had been left inside patient's tooth during the previous ***root canal***.	P	The patient had one year from the time she discovered or should have discovered the foreign object in which to file her lawsuit.
9. Newman v. Sonnenberg	2003	F	S	Abandonment.	D	A plaintiff patient must show that the abandonment occurred during a critical stage of the patient's treatment. Expert evidence would be required to establish that the plaintiff was at a critical stage.
10. LaSorsa v. Oelbaum	2003	F	G	A cleaning file broke off, and part of it lodged in the patient's gum and jaw. Using the broken file as post-core to fabricate crown caused the tooth 7 fracture 3 years later.	D	The patient had learned that a foreign object had been left in her mouth over four years before she filed suit, her claim was time-barred.
11. Pope v. Davis	2003	M	G	1. Davis injected a long-acting anesthetic called Marcaine. The anesthetic provided the requested pain relief but, caused permanent damage to the lingual nerve. 2. failed to obtained informed consent.	D	In 1999, when Davis treated Pope, dentists in Georgia had no duty under common law to inform patients of the known material risks of a proposed treatment or procedure or to inform patients of available treatment alternatives.
12. Millet v. Schmidt	2003	F	G	During the course of the ***root canal***, Dr. Schmidt perforated the tooth. As a result, Ms. Millet suffered injuries to her gum and her lip, and an opening in the tooth.	P	Dr. Schmidt had breached the standard of care by causing a perforation during the ***root canal*** and that Ms. Millet had suffered damages as a result of the breach.
13. Estate of Fontes v. Salomone	2003	M	G	Dr. Salomone performed the root canal on Fontes's number twenty tooth. The real problem was with tooth number eighteen. Wrongful death caused by Ludwig's angina, prolonged hypoxia, right tension pneumothorax.	P	The jury found that Dr. Salomone was negligent in his treatment of Mr. Fontes and that his negligence was the proximate cause of Fontes's death. Dr. Skoly's actions constituted an intervening superseding act of negligence, defendants failed to properly prove this with the requisite expert testimony.
14. .Savage v. McConnell	2003	F	G	That a separated file was left off; Dr. McConnell was negligent for failing to notice that the file he was using "had broken	D	"It is not unusual for a file tip to break off in this process and it is not a breach of the standard of care of general dentistry when this happens."

doi:10.6342/NTU202201485

				and had become embedded in plaintiff's jaw.		
15. Condello v. Raiffe	2004	F	G	Overfilled, damaging the inferior alveolar nerve. experienced pain and numbness. (gutta percha and sealer were installed past the apex of the tooth and intruded into the bony conduit that encases the inferior alveolar nerve.)	P	Overfilling to the point of causing injury to the inferior alveolar nerve was probably not within the standard of care.
16. Pullum v. Robinette	2004	F	G	During the root canal, a file that Dr. Robinette was using broke off and became lodged in tooth number 20. Ms. Pullum experienced numbness and pain in her left lower lip and the area around her left lower jaw.	P	The jury found that Dr. Robinette was negligent and that his negligence was the legal cause of Pullum's injuries. The jury awarded Ms. Pullum $ 100,000 for past pain and suffering, and $ 50,000 for past loss of ability to enjoy life.
17. Blumenau v. Lederman	2004	M	G	Whether Dr. Lederman departed from good and accepted standards of dental care by utilizing the file as part of the fill as well in his post ***root canal treatment*** of the plaintiff?	P	Dr. Rubenstein maintains that it was departure not to remove the file or refer the patient to an endodontist for the purpose of extracting the file. On these facts the court finds that the broken file left in plaintiffs' canal was a foreign object.
18. Hawkins v. Gomez	2004	F	G	Root canal with such delay that the local anesthesia was no longer effective; failing to medicate properly and by failing to restore the tooth properly.	D	Because the patient failed to provide a sufficient record, did not state the mode or form of treatment that an ordinarily prudent dentist would undertake.
19. Hatfield v. Rioseco	2004	F	G	Failure to properly diagnose. Performed excessive root canals in a short period of time; Bleached the sinus cavity during ***root canal treatment;*** Failed to warn the plaintiff of the risks of the performing ***root canal therapy.***	D	Putting a contract label on a negligence claim will not change its essential character. It is manifestly clear that the plaintiff's allegations sound in ***medical malpractice***, not contract.
20. Kissne v. Cosmetic	2004	F	G	Commenced and completed ***root canal therapy*** on infected teeth in one visit in teeth that had previous ***root canal therapy.*** Failed to mechanically, chemically and pharmacologically treat the infected teeth before sealing the canals and restoring the teeth. Failed to warn the risks.	D	That putting a contract label on a negligence claim would not change its essential character. The court granted the motion to strike the contract count. "calling a bull a cow won't change its gender."

doi:10.6342/NTU202201485

21. Tarellari v. CWRU Sch. of Dentistry	2005	M	R	Negligent in failing to timely diagnose and treat his toothache (no antibiotics); SOC; claim for emotional distress.	D	That the proper standard of care was that of a third-year undergraduate student of general dentistry and that of a second-year graduate student of endodontics.
22. PHOTIADIS v. BUSATI	2006	F	G	Busati started a root canal in the wrong tooth and left the root canal unfinished, causing Photiadis's tooth to become infected. Busati dragged his drill across Photiadis's front teeth, causing a large chip on one tooth.	P	Dr. Busati's declaration is insufficient to qualify him as an expert. Busati's declaration is therefore insufficient to establish the absence of a material fact issue for trial.
23. Holland v. Dinwiddie	2006	M	G	1. After Dr. Dinwiddie performed a ***root canal***, Holland developed painful abscesses and infections in his mouth which caused severe swelling. 2. performance of a ***root canal***, which was started but never finished. 3. failure to adequately and timely treat the infection.	D	Barred by one-year statute of limitations for ***medical malpractice*** claims.("The statute of limitations begins to run when the plaintiff knows or in the exercise of reasonable care and diligence should know that an injury has been sustained as a result of wrongful or tortious conduct by the defendant.")
24. Destefano v. Verini	2006	M	G	A tooth cracked after the second dentist performed a ***root canal***, the second dentist created a double abutment bridge which was never fitted properly.	D	The second dentist was entitled to summary judgment because the claims against him were barred by the 2-1/2 year limitation.
25. Carlson v. Riemenschneider	2007	F	G	Failure to diagnose and treat her dental problems.	D	Respondent was not negligent and that appellant had been (poor OH/Smoke) contributorily negligent and was 100% at fault for the problems she experienced.
26. Saffian v. Simmons	2007	F	G	The patient filed a malpractice action against the dentist arising from the performance of a root canal. The dentist refused to answer the complaint, and a default judgment was entered.	P	A defendant must timely answer or otherwise file some responsive pleading to the complaint, or else be subject to a default. Deficiency in the affidavit did not relieve the dentist of his duty to timely respond.
27. Curtis v. Osmunson	2007	F	G	Failure to diagnose and treat an abscess in her mouth.	D	Because her complaint was filed more than two years later, it was untimely.
28. Ward v. Peet	2007	F	G	Peet extracted the teeth, performed the ***root canal***, and packed both sides of Halvorsen's mouth with gauze. The needle	D	The needle did not puncture Halvorsen's gum and did not cause her any pain. Consequently, Halvorsen has not shown that the evidence conclusively established an injury from the needle.

doi:10.6342/NTU202201485

				somehow became detached from the syringe and her assistant picked it up with the gauze used to pack Halvorsen's mouth.		
29. Wallace v. Farah	2007	F	G	The patient alleged a failure to warn regarding the risks of ***root canal*** procedures and a failure to possess and exercise the standard of care in the profession.	D	Plaintiff, in her pleadings, alleges failure of the standard of care; that the allegations require expert testimony to frame the standard of care issue and to address the causal nexus between conduct and injury.
30. Justo v. Perez	2007	F	G	Performed an unnecessary ***root canal*** on one tooth.	P	Wrong tooth treatment. That defendant did not perform dental work with the intention of harming plaintiff and did not render treatment in a wanton or reckless manner are insufficient to make a prima facie showing of entitlement to summary judgment.
31. Duracher v. Roy	2008	F	S	Negligently left a piece of a dental file in the plaintiff's PDL after a ***root canal*** procedure.	P	Dr. Roy's failure to discover and remove the piece of broken dental file breached the applicable standard of care for endodontists. Dr. Westfall removed a small piece of a broken dental file located outside the apex of the root of tooth number 14. (Apicoectomy)
32. Krawczyk v. DeFeo	2008	M	G+S	Dr. DeFeo negligently evaluated plaintiff's complaints of pain. Surgery without properly testing for the vitality of tooth # 14, and failed to properly diagnose that the cause of plaintiff's pain was tooth #15. (Diagnosis)	D	The burden on the moving party for summary judgment is to demonstrate a *prima facie* entitlement to judgment as a matter of law by tendering sufficient evidence to demonstrate the absence of any material issue of fact.
33. Martin v. United States	2008	F	G	Negligently failing to: (a) perform a proper root canal procedure; (b) perform a proper extraction of the teeth adjoining tooth #21; (c) obtain the informed consent of Kelly and Ms. Martin.	D	Martin gave informed consent to the emergency root canal access procedure
34. Paden v. Rudd	2008	F	G	*Negligently* injected her "nerve, vein and eye with an anesthetic which caused permanent facial swelling and paralysis. Plaintiff would not have consented to the ***root***	D	A ***medical*** provider's failure to obtain proper informed consent sounds in professional negligence and requires an expert affidavit. Thus, the defendants' purported failure to obtain Paden's

doi:10.6342/NTU202201485

				canal procedure if she had been properly informed of the material risks.		informed consent does not give rise to a claim for battery.
35. Accardo v Heller	2008	M	G	Failing to properly perform a ***root canal*** on plaintiff's tooth # 10, failing to properly diagnose an infection caused by the ***root canal*** and post installation procedure.	P	Defendant's motion is denied as to the dental ***malpractice*** cause of action (first cause of action) and granted as to the second cause of action (lack of informed consent) which cause of action is dismissed.
36. Hammonds v. United States	2009	M	G	Failing to "administer the proper antibiotic prophylactic treatment" before commencing Hammonds' pulp removal.	D	The court finds that there was no legal duty to give the plaintiff an antibiotic regime preceding the carious pulp removal. A defendant will not usually be liable for harm that is unforeseeable, even when it is proven that the defendant breached a duty.
37. Pisu v. Comprehensive Dental Health	2009	M	G	Insufficient information or failure to obtain IC. Root perforation.	P	Under the doctrine of informed consent, a physician is obligated to provide the patient with that information which a reasonable patient would have found material for making a decision whether to embark on a contemplated course of therapy.
38. Deen v. Stevens	2010	M	S	Alleging that the ***endodontist*** committed dental malpractice by recommending re-treatment instead of extraction, failing to refer.	D	Dr. Stevens informed Mr. Deen of the need to set up an appointment for the re-treatment procedure, and that Mr. Deen understood that he needed to do so but did not do it because of financial constraints.
39. Deen v. Egleston	2010	M	G	Professional negligence or loss of consortium.	P/D	By failing to refer Kenneth Deen to an oral surgeon for antibiotic treatment and extraction of tooth number 9 , PERIO treatment without beginning antibiotic treatment.
40. Grey-Monroe v Scorsese	2010	F	G	Dr. Barats was negligent in failing to treat decay and infection of the root system of plaintiff's tooth number 9.	P	Dr. Barats was thus obligated to act by prescribing an antibiotic, performing ***root canal therapy***, eliminating the fracture portion of the tooth by way of a partial resection.
41. Donofrio v Adler	2011	F	G	A piece of metal file lodged in her tooth during a root canal procedure. patient had read and signed the informed consent form, that there was a risk that the file could	D	The doctrine res ipsa loquitur is inapplicable in this case, and that the claimant failed to meet her burden of proof, a plaintiff must present expert medical testimony.

doi:10.6342/NTU202201485

				break or separate; he immediately informed and referred to endodontist.		
42. Mihalo v Patel	2011	M	G	Plaintiff claims that Dr. Patel failed to properly diagnose and treat a necrotic tooth, caused him to sustain a chemical burn on his gum and upper lip causing scarring and swelling and nerve damage, and further caused a foreign material, gutta percha, to become lodged in the apex above tooth # 8, causing perforation requiring extraction of the tooth and restoration.	P	The plaintiff's expert states that there is a factual dispute regarding whether or not a dental dam was used during the procedure performed by Dr. Patel and that his failure to use the protective barrier is a departure from the standard of care and could result in the development of the type of injury sustained by Mr. Mihalo.
43. Nilsen v Franklin Dental Health	2011	M	G	Dr. Ladyzhenskaya did a ***root canal*** procedure on tooth No. 4/5 and, during the course of that procedure, he suffered severe pain. Eventually, his cheek became red and swollen.	P	Plaintiff's expert testified that defendants' negligence was predicated upon the formulation of plaintiff's treatment plan and in the administration of sodium hypochlorite during the ***root canal*** procedure on tooth No. 5.
44. Robinson v. Castle	2011	M/F	G	Defendants performed an "inadequate ***root canal***" on plaintiff, as a result of which she has had to seek "additional and ongoing dental services.	D	"Failed to consult a specialist" or "perform an adequate" ***root canal*** are insufficient on the issue of causation.
45. Hanna v. Merlos	2011	F	G	Defendant diagnosed "tooth #3 as good without taking an x-ray," when in fact "tooth #3 was abscessed and the only way the gum area could be healthy again was to have a ***root canal***." Installed the wrong sized crown on #3 and had failed to perform root canals on that tooth and another tooth.	P	Defendant had misdiagnosed and negligently treated plaintiff's dental conditions. (1) failed to do an x-ray prior to ruling out the need for root canals, (2) continued to misdiagnose both teeth, even after they became infected, (3) failed to perform necessary root canals on both teeth, and (4) placed an inadequate crown on tooth #18.
46. Lucisano v. Bisson	2011	F	G	Negligence and apicoectomy failure to obtain informed consent.	D	Requiring the plaintiff to obtain a written opinion of a similar health care provider that "there appears to be evidence of medical negligence."
47. Rojo v. Young	2011	M	G	This action sounds in dental malpractice and lack of informed consent. Three days after the extraction of #32 and root canal of #31, plaintiff complained of numbness.	P	Departure from the standard of care for Dr. Young to fail to refer plaintiff to the proper specialists for the procedures; purported consent form is not competent for extraction. endo 31 was released.
48.Zulick v. Melnick	2012	F	S	Performed a root canal procedure on the wrong tooth of Zulick's minor child, failed to	P	Granted in part action cannot be brought in the name of the mother for her daughter; "similar

doi:10.6342/NTU202201485

				diagnose and treat the correct tooth, negligence, breach of contract and lack of informed consent.		health care provider" opinion letter; Res ipsa loquitur.
49.Gortarez v. Queiroz	2012	F	G	File separated inside the mesial-lingual canal.	D	Separation of an endodontic file during a root canal procedure is a well-known risk of such procedures. The fact that a file separates during an endodontic procedure is not indicative of treatment that falls below the dental standard of care.
50. Drago v Etess	2012	F	S	Apicoectomy invaded the sinus cavity; failing to diagnose and treat plaintiff for an infection, failing to provide informed consent.	P	Dr. Etess inappropriately treated the periapical abscess at tooth #14 permitting it to spread, resulting in erosion into the palate of the mouth, causing a fistula and thin bone of the maxillary sinus and infection into the maxillary sinus. Departure from accepted practice.
51. Raiden v. Interdent	2012	F	S	Defendants were negligent in failing to perform the procedure on the proper tooth #3, performing an unnecessary procedure and devitalizing tooth #30, failing to prevent infection	S	Settlement: Mediation will be held on November 8, 2012.
52. Cavanaugh v. Sherberg	2012	F	G	Sherberg perforated through the wall of the plaintiff's tooth and failed to inform the plaintiff of the perforation.	P	The failure to halt treatment prior to perforation of the tooth and refer the plaintiff to a ***endodontist*** was a breach of the standard of care.
53. Goltsman v. Swager	2012	M	G+S	The complaint is that the apicoectomy performed on Goltsman's number 27 tooth did not relieve his pain.	D	The court found that Goltsman had failed to state a claim upon which relief could be granted, he failed to meet his burden of proof as set forth in *A.R.S. § 12-563*, and he failed to comply with the preliminary expert affidavit requirement under *A.R.S. § 12-2603*. Unsuccessful medical treatment is not necessarily synonymous with ***medical malpractice.***
54. Musmacker v Morris	2012	F (by Spouse)	G	Failure to diagnose and treat this decay caused delays which resulted in further decay and crowns at those teeth. The plaintiff's expert states that there was a file left behind in tooth #30, but he does not indicate when the root canal was performed on tooth #30.	D	Decay was caused by the medication that the plaintiff was taking, her smoking, and her failure to return for routine maintenance as directed. "***endodontist*** could not remove broken files from previous dentist." but he does not indicate how it contributed or that it was the proximate cause of the tooth having to be extracted.

doi:10.6342/NTU202201485

55. Chaves v Smit	2012	M/F	G	The lentulo, after separating, extended beyond the apex of the root and was not removed, and failed to advise her of same, causing her to sustain nerve damage, pain and suffering, and embarrassment.	D	Complaint as asserted against Carl Palmblad, D.D.S. and Smile Makers is severed from the action and is dismissed with prejudice. The record does not demonstrate that Dr. Smit had a propensity for conduct which caused the plaintiff's alleged injury.
56. Lowe v. Jefferson Dental Clinics	2012	F	G	Negligence of Chiu in performing a root canal on Lowe's infected tooth.	D	No expert reports.
57. Sterkina v. Regents of the Univ. of Cal.	2012	F	G	Sterkina filed this medical malpractice lawsuit alleging that she sustained serious injuries, including terrible pain, sleeplessness, headaches and weakness, as a result of negligent dental treatment she received from three of the dentists.	D	Claim is time-barred.
58. Holliday v Milord	2013	M	G	Causes of action for negligence, lack of informed consent, improperly performed a root canal on tooth # 31, resulting in an unfavorable result, causing and permitting an infection to spread.	D	Treatment rendered by Dr. Milord did not cause the plaintiff to have an infection or to exacerbate any pre-existing infection, and was not a substantial factor in causing any of the injuries alleged by the plaintiff.
59. Morgan v. Ohio State Univ. College of Dentistry	2013	M	R	1.Action for dental malpractice for OSU's failure to have a treatment plan in place to improve the aesthetics of his teeth 2. Informed consent.	D	Plaintiffs' failure to produce proper opinion evidence on negligence and proximate cause.
60. Bruno v. Haselkorn	2013	F	G	Departed from good and accepted standards of dental practice and failed to provide her with informed consent regarding the dental care and treatment in placing bridges.	P	Dr. Ivry opines that root canal therapy would have or should have been performed prior to cementing the upper bridge. Failure to do so led to the deep space infection in her upper jaw.
61. Santos v. Hawkins	2013	F	G	A complaint against the Hawkinses in 2008 for negligence based on allegations that she had several problems with her teeth caused by the Hawkinses' malpractice. (Endo, Perio, Prosth)	D	Santos was unable to find an expert to support her claims of dental malpractice. The Hawkinses claimed that Santos refused the referral to a periodontist because she did not think her insurance would pay for the treatment.

doi:10.6342/NTU202201485

62. McCarthy v. Dillon	2013	F	G	A small file bit separated and became lodged in McCarthy's tooth #15. Dr. McCants did not notify McCarthy about the file bit inside of her tooth. After that procedure, McCarthy experienced infections, pain and various discomforts associated with that tooth.	P	Dr.McCants failed to meet the proper standard of care for the dental services that she negligently performed on McCarthy.
63. Ceruzzi v. Paley	2014	M	G	Negligently failed to properly and timely diagnose that plaintiff suffered from an infection, and improperly performed and/or treated a root.	P	Defendant's failure to take any measures to protect the tooth from fracture, no treatment recommendation or instructions.
64. Tischio v. Simonow	2014	F	G	Failed to obtain the plaintiff's informed consent prior to the performance of the ***root canal.*** failing to disclose the known material risks, alternatives…. The plaintiff complained to Simonow of loss of sensation or feeling on the side of the face and ear tingling.	P	Unlike a ***medical malpractice*** claim, a claim for lack of informed consent is determined by a lay standard of materiality, rather than an expert medical standard of care which guides the trier of fact in its determination. The defendants failed to communicate to the plaintiff feasible alternatives to the procedure, including a root canal performed by an endodontist.
65. Torres v. United States	2014	F	G	Accepted Pulpotomy at ER, but no further treatment, the tooth caused cellulitis was extracted finally, patient alleging medical negligence, negligent abandonment per se, and a lack of informed consent.	P	The parties dispute the breaches of the standard of care and causation. Thus, defendant's motion for Summary Judgment is denied with respect to the claim for medical negligence.
66. McQuade v. Ghazal Mt. Dental Group	2014	M	G	Complications resulting from an emergency ***root canal*** procedure.	P	The district court determined that the affidavit was sufficient to allege dental malpractice against Dr. Shehata, and denied her motion to dismiss.
67. Holder v. Schwarcz	2014	F	G	(1) Filing past the apex of tooth 19. (2) Breaking a file at the end of the distal root of tooth 19. (3) Sealing the fragment in plaintiff's tooth without telling her. (4) Negligently drilling into tooth 20.	P	The jury returned a verdict in favor of plaintiff in the amount of $67,500. Because Schwarcz had rejected the case evaluation award of $25,000, the trial court awarded plaintiff case evaluation sanctions of $151,555.
68. Harvin v. Roth	2014	F	G	The Defendants' treatment was unnecessary, failed to meet, the standard of care	P	Plaintiff conceded that she signed a form, but a consent form is not dispositive of informed consent. Her expert states that the dental records

doi:10.6342/NTU202201485

				and was the proximate cause of Ms. Harvin's injury and damages.		indicate that no treatment of the kind provided was necessary.
69. Newberry v. Silverman	2015	M	G	That the root canal "had been incomplete, and defendant Silverman did not go past the curve of the root when performing the root canal. As a result, plaintiff's tooth became abscessed."	D	Fails to plead "enough facts to state a claim to relief that is plausible on its face," the complaint may be dismissed. Fraud claim was remanded, ***claims of dental malpractice, negligence, and infliction of emotional distress are time-barred.***
70. Denison v. Waterford Dental Health P.C	2015	M	G	Nogacek did not prescribe, administer, order, or recommend the use of antibiotic medications during or after the dental procedure. William Denison became ill and was hospitalized for multiple infections, acute renal failure.	P	For the forgoing reasons, the court denies the defendants' motion to dismiss negligent dental procedure and wife's loss and detriment.
71. Ashcraft v. Kennedy	2015	F	G	Prior to RCT, patient experiencing shortness of breath, chest pains and body chills after administered an injection of Septocaine.	D	"Callously abandoned his patient in a condition of suffering" and negligently permitted her to drive herself home when she was clearly not in any condition to perform such a task.
72. .Chinnock v. Renaissance Ctr	2015	M	S	That doctors failed to properly instruct him on the need to have his ***root canal*** capped, which resulted in a heart attack.	D	Failed to provide expert ***medical*** testimony necessary to establish negligence and the causal link.
73. Powell v. Marlais	2016	M	G	1. Failing to properly diagnosis and treat his abscessed tooth. 2. Refuse to prescribe antibiotics. 3. Failed to send their patient to a trained specialist an ***Endodontist.***	D	Plaintiff fails to demonstrate any chance of success on the merits of his underlying action.
74. Kleser v. Rosenthal	2016	M	G	Failed to provide adequate treatment for his injured tooth.	D	Rosenthal acted promptly and exercised his professional judgment at every point of interaction with Kleser. No reasonable jury could conclude that he was deliberately indifferent to Kleser's dental needs.
75. Smith v. Kyung Seok Ko	2016	M	G	A file being used by the defendant broke during RCT, "the defendant failed to remove the file and left the file in the plaintiff's mouth."	D	1. Res ipsa loquitur is a rule of common sense and not a rule of law which dispenses with proof of gross negligence. 2. An expert would be necessary.

doi:10.6342/NTU202201485

76. Horlacher v. Cohen	2017	F	G	Entered tooth #31's cap with a drill causing a fracture with *bone marrow* oozing into tooth #31 infection and fracture of molar #31. (hemisection)	D	The motion (1) must concern one of nine listed grounds and (2) must be filed within the time for pleading.
77. Novea v. Rankovic	2017	F	G	Allege that defendants failed to disclose to plaintiff material risks of her dental condition. IC; Complications that could result from misdiagnoses. Plaintiff began experiencing pain affecting one of her endodontic molars.	D	The complaint is barred by the statute of limitations.
78. Van den Heuvel v. United States	2017	M	G	Plaintiff claims that during multiple ***root canal*** treatments, Dr. Sinclair was distracted and conversing with other clinic employees, which resulted in plaintiff's tooth not being properly repaired.	D	No evidence from an expert that the defendant breached the standards guiding the dental procedures necessary to complete a ***root canal*** is not "within the common knowledge of laymen."
79. Rorick v. Silverman	2017	F	G	Defendant Silverman had not completed the ***root canal*** procedures completely or correctly and had left a piece of a file in one of her teeth while performing the root canals." She "began to experience headaches, tooth decay and infections with these same teeth."	P	Silverman alleged that Rorick's malpractice claim was time barred, the Court denied the motion. Defendants' motion to enforce the previous settlement.
80. Osman v. Cavalieri	2017	M	G	After the conclusion of the treatment, the plaintiff suffered from severe swelling in the right side of his face and was diagnosed with a dental abscess.	D	The amendment, coming after the expiration of the statute of limitations, is not permitted.
81. McLemore v. Hurtado	2018	M	G	Hurtado accidentally jabbed McLemore in the inner cheek with an instrument, and then apologized. The drill went in too deep and McLemore winced in pain.	D	McLemore's notice of intent to sue, and his complaint, were filed after the expiration of the one-year limitations period.
82.Price v. Callis	2019	F	G	Broke several drill bits improperly performing the root canal, and Dr. Aronoff fraudulently concealed Dr. Callis's error.	P	Statute of limitation. Endodontist standard of care.
83. Patrick v. United States	2019	F	G	During the ***root canal*** procedure, Dr. Rowe perforated the buccal surface of Patrick's tooth, without informing her, the tooth was eventually extracted.	D	Doctors' efforts to repair Patrick's damaged tooth (***medical*** care provided) did not deviate from the applicable standard of care. Patient failed to present expert witness testimony that defendant breached the standard of care.

doi:10.6342/NTU202201485

84. Lopez v Fryd	2019	F	G	Alleging that defendant failed to provide appropriate treatment and failed to diagnose and treat decay and periodontal problems.	P	Defendant's expert was silent regarding the allegations of failing to perform indicated ***root canal*** treatments, causing and/or ignoring a fractured post, and ignoring decay.
85. Carpenter v. Daar	2020	M	G	Infection after RCT.	D	Defendant is a general dentist, not a specialist, and finds that the opinion author, who is board certified in ***endodontics***, is not a similar health care provider to the defendant.
86. Ampolsky v. Ira J. Zohn	2020	M	S	Improper anesthesia.	P	Plaintiff sufficiently pleaded a medical negligence claim.
87. Bennett v Drescher	2020	F	G	1. #13 Incomplete endo (canal calcified)-crowning-loss-endodontist-extraction 2. Dr. Grossman departed from the SOC in negligently placing the post on an improper angle resulting in a supra-crestal perforation causing pain and suffering and the need to extract the tooth." 3. Ext of wrong tooth #12. 4. Using of questioned #14 as abutment. 5. Lack of IC for Immediate Implantation.	P/D	Dr. Drescher was brought in to extract tooth #13 and that Dr. Drescher "made a mistake" and extracted tooth #12., claims is granted only to the extent that that Plaintiff's claim of "miscommunication" for extraction of tooth #12 as to Dr. Matthew Grossman is granted.

doi:10.6342/NTU202201485

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1999 LL.M.	**SooChow University, School of Law** Master of Laws	**Taipei, Taiwan**
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■ Teaching Experience

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doi:10.6342/NTU202201485

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doi:10.6342/NTU202201485