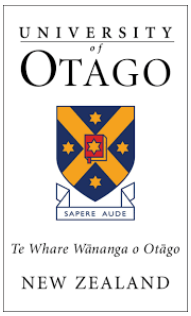

The influence of educational information on understanding and perceptions of root canal treatment

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Abstract

Patients frequently have a negative perception of root canal treatment (RCT) often due to a lack of understanding and knowledge of what the treatment involves. This may lead to patients being more anxious and fearful of their RCT. This can result in discomfort, dissatisfaction, and an increased rate of appointment cancellation or failures, or restorable teeth being extracted. Information is lacking about how patient education affects patient understanding, experience and overall perception of RCT. Research in other fields of healthcare has shown the benefit of patient education in aiding the informed consent process and enabling patients to be more accepting of their treatment, increasing understanding of treatment and decreasing anxiety. If patients are more aware of what to expect during RCT, it is anticipated that treatment would be less intimidating, perceived more positively, enabling patients to feel more informed to provide consent and less anxious throughout their treatment.

This Practice Based Research study used a mixed-methods scientific approach and had three aims. The first aim was to develop and compare educational material on RCT in written and website form with existing written material. The second aim was to determine if delivering enhanced education to patients prior to treatment influences anxiety, understanding and perception of the procedure. The third aim was to gain an understanding of the current methods used by general dental practitioners (GDPs) to provide patient education and obtain informed consent prior to RCT and to seek their feedback on the enhanced educational material for RCT.

In New Zealand (NZ), dental practitioners have access to an information sheet on RCT, produced by the New Zealand Dental Association (NZDA). In this study, a more detailed educational pamphlet and website were developed. Participants who required RCT were recruited by their GDP in private practices throughout NZ. Participants received a standardised verbal description of the treatment sequence from their dentist and were randomly assigned to one of three educational information groups: 1) the NZDA pamphlet (n=23), 2) the new pamphlet (n=21), or 3) an electronic link to a website which contained the same information as the new pamphlet (n=17). Patients completed a questionnaire before and after treatment which collected data on themes, dental pain, knowledge of RCT, anxiety, educational material, understanding and perception of RCT. Data was analysed using descriptive statistics and thematic analysis. General dental practitioners were also interviewed to provide feedback on

RCT education and to understand their process of obtaining informed consent.

An insight into the perceptions and understanding of RCT of a group of patients in NZ was obtained. Prior to commencing RCT, 42.6% of participants reported feeling anxious about having the treatment. Over one third (39%) of the participants felt anxious prior to attending the dentist. Patients found the new pamphlet and website informative and easy to understand. Over half (59.6%) of the participants felt that they had increased knowledge about RCT after education and treatment. The presentation of educational material prior to treatment increases understanding and lowers their anxiety and improves perception of treatment and meant they could more confidently make an informed decision and feel more positive about RCT.

General dental practitioners interviewed all placed great importance on having an in-depth shared discussion of treatment with their patients prior to commencing RCT and obtaining verbal consent. Written consent is not routinely gained by the GDPs. The GDPs preferred the enhanced educational material to the existing NZDA pamphlet as it was more clear and comprehensive.

The outcomes from this study, can be translated to clinical practice. It is crucial that GDPs understand that anxiety is often felt by patients prior to RCT and patients do not always present with a knowledge of treatment. The provision of enhanced educational material facilitates the informed consent process and improves the patient experience.

List of Abbreviations

ACC	Accident Compensation Corporation
ALL	Adult Literacy and Life Skills Survey
AP	Apical periodontitis
DCNZ	Dental Council of New Zealand
EDTA	Ethylenediaminetetraacetic acid
GDP	General dental practitioner
GIC	Glass ionomer cement
GP	Gutta-percha
IP	Irreversible pulpitis
MTA	Mineral trioxide aggregate
MoH	Ministry of Health
NaOCl	Sodium hypochlorite
NZ	New Zealand
NZDA	New Zealand Dental Association
OECD	Organisation for Economic Co-operation and Development
PA	Periapical
PBRN	Practice Based Research Network
PBRNs	Practice Based Research Networks
PDL	Periodontal ligament
SJWRI	Sir John Walsh Research Institute
RCT	Root canal treatment
RP	Reversible pulpitis
SAM	Sustainability Assessment of Materials
SES	Socioeconomic status
TTP	Tender to percussion

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Chapter One- Literature Review

1.1 INTRODUCTION

Patients frequently have a negative perception of root canal treatment (RCT) and this is often due to a lack of understanding or knowledge of what the treatment involves. Patients are therefore usually more anxious and fearful of RCT than they need to be. As a result of this, patients may cancel or fail to attend scheduled appointments which can lead to increased discomfort caused by their tooth (Armfield et al. 2006, Carter et al. 2014). Infection and complications can result if the tooth is left untreated, such as a cellulitis, and in rarer cases, mediastinitis, a brain abscess, septicaemia and thromboembolism which can result in considerable morbidity (McCurdy et al. 1977). Furthermore, teeth may be extracted which could have been retained (LeClaire et al. 1988, Dionne et al. 1998, Peretz and Moshonov 1998, van Wijk and Hoogstraten 2006). Information is lacking on the effect of patient education on the understanding, experience and overall perception of RCT.

Studies that have been conducted in different medical fields have reported the benefit that education has prior to commencing treatment on increasing patient understanding and comfort. Health outcomes have also been found to be improved (Krouse 2001, Jlala et al. 2010, Cornoiu et al. 2011, Hung et al. 2011, Batuyong et al. 2012, 2014, Nehme et al. 2013, Good et al. 2016, Paterick et al. 2017). Multimedia education is shown to be an effective mechanism in increasing patient understanding of treatment and decreasing anxiety in medical fields (Wakimizu et al. 2009, Ryhanen et al. 2010, Cornoiu et al. 2011, Hung et al. 2011, Batuyong et al. 2012, 2014, Nehme et al. 2013, Wood et al. 2015, Bowers et al. 2017, Pei et al. 2017).

If patients are more aware of what to expect during RCT, it is anticipated that the experience would be a less intimidating and perceived more positively, enabling patients to feel more engaged and informed to provide consent, and less anxious throughout their treatment. If practitioners recognize anxiety in patients, they are able to help to reduce it (Hamedy et al. 2013, Rajwar and Goswami 2017). Anxiety and fear questionnaires are a helpful method of gaining an understanding of how a patient is feeling and providing an enhanced patient-centred approach to treatment (Corah et al. 1978, Armfield 2010).

In New Zealand (NZ) as well as providing patients with a description of RCT, practitioners commonly provide an educational resource prior to commencing treatment which is available from the New Zealand Dental Association (NZDA). In this study, new educational material on RCT was developed in a pamphlet and website format. It was intended that the new documents provide a more comprehensive overview of RCT for patients in NZ. The new educational materials were implemented into private practices around the country. A questionnaire was developed to determine if providing participants with enhanced educational material prior to RCT influenced their anxiety, knowledge and perception of treatment.

A Medline and Scopus search of the literature was conducted from 1965 to August 2019 using the key words anxiety, dental, education, endodontic, fear, multimedia, patient, root canal, root canal treatment.

1.2 PULP AND PERIAPICAL DISEASE AND ROOT CANAL TREATMENT

1.2.1 Irreversible pulpitis and disease progression

In irreversible pulpitis (IP), the pulp may still be vital but it is severely inflamed. The longer a dental pulp has been symptomatic and the more severe the pain, the more likely that it is irreversibly inflamed. Pulpal diagnosis can be difficult due to misleading symptoms that can be associated with both IP and reversible pulpitis (RP). A wide range of symptoms can present and often a case of IP can be asymptomatic. It has been documented that a vital pulp can become necrotic with no symptoms in as many as 26-60% of cases and this has been named 'painless pulpitis' (Hasler and Mitchell 1970, Barbakow et al. 1981, Bender 2000). A typical symptom of IP is of lingering pain which is induced by a thermal stimulus. A small temperature change is adequate to initiate the pain, which is usually very sharp to begin with. Once the stimulus has been removed, a dull or throbbing pain can linger for minutes to hours. Another symptom synonymous with IR is a spontaneous pain which can wake a patient in the night. Patients may find it difficult to localize their symptoms. Radiographically, periapical pathology may not be evident in a tooth with a pulp with IP, which can add to the difficulty in diagnosis. The tooth is usually tender to percussion (TTP) when inflammation has spread to the periapical (PA) tissues (Sigurdsson 2003, Abbott and Yu 2007).

Irreversible pulpitis can be acute or chronic in nature and may or may not be associated with apical periodontitis (AP). Symptoms of an acute irreversible pulpitis usually have a sudden onset, which can be spontaneous or as a result of temperature change and can wake a patient at night. The pain can linger and increase when a patient lies down or bends over. The tooth can be TTP. Typically, no PA pathosis is evident radiographically. Symptoms of chronic irreversible pulpitis are similar but are less severe. As the periapical tissues become involved, it is more likely that disease will be evident radiographically (Abbott and Yu 2007).

When bacteria invade a necrotic pulp, they will inevitably spread through the entire pulp system and this will eventually result in a pulpless tooth if left untreated. It is impossible to determine whether or not a necrotic pulp is infected unless a PA lesion is evident. A significant amount of bone is lost prior to disease becoming evident radiographically. It has been found that a tooth with a PA lesion has an infected dental pulp space (Bergenholtz 1974). When a tooth has been rendered pulpless, it becomes infected (Sigurdsson 2003, Abbott and Yu 2007). Bone resorption takes 2-10 months to become evident radiographically and therefore, a tooth with a PA radiolucency is most likely to have a root canal system that is pulpless and infected (Jansson et al. 1993, Abbott and Yu 2007).

1.2.2 Apical periodontitis

Apical periodontitis is a term used to describe inflammation of the PA tissues that primarily occurs as a result of infection within the root canal system and is due to a dynamic encounter between microbial challenge and the host defence at the interface between an untreated, infected root canal system and the PA tissues. There is no longer a blood supply to a necrotic pulp or a pulpless tooth and therefore the defence cells of the host cannot reach the microorganisms inside the root canal. The infection is unable to be eliminated and this results in localised inflammation and may lead to destruction and resorption of PA tissues. Intra-radicular microorganisms survive on tissue fluid and inflammatory exudate from the apical foramen. Nutrition is also provided by saliva and food that can enter the root canal system via caries, cracks or fractured restorations. The formation of a PA lesion occurs if treatment is not provided (Nair 1997, Abbott 2004, Nair 2004). The destruction of periapical tissue arises as defensive elements migrate to the immediate site of infection (Nair 2004).

Pain, tenderness to percussion, palpation or biting pressure are frequent symptoms of symptomatic AP. Symptoms of AP can range from nothing to severe (Abbott 2004). The periodontal ligament is densely innervated and contains many nociceptors and mechanoreceptors. Apical periodontitis can be classified as acute or chronic in nature depending on the clinical presentation of the tooth.

The presence of multiple strains of micro-organisms within the necrotic dental pulp was first confirmed over a century ago (Miller 1894). It was not until many decades later that the crucial role that microorgansims played in AP was demonstrated (Kakehashi et al. 1965, Sundqvist

1976, Möller et al. 1981, Fabricius et al. 1982). Treatment involves removing the infected pulp, thereby substantially reducing microbial load from the root canal and replacing it with an orthograde root canal filling to prevent reinfection (Nair 2004).

1.2.3 Root canal instrumentation, irrigation and medication

Tapered root canal preparations using a crown down technique faciliate irrigation, placement of an interappointment intracanal medicament and obturation (Wu and Wesselink 1995, Wu et al 2002). Over-instrumentation of the root canal system should be avoided to prevent excessive weakening of the tooth (Haji-Hassani et al. 2015).

An irrigant is used during instrumentation as a lubricant and antimicrobial, to rinse out debris, and to dissolve organic matter. Due to the complex anatomy of the root canal, chemomechanical debridement is used as an adjunct to mechanical preparation (Meyer 1970, Baker et al. 1975, Byström & Sundqvist 1983, 1985, Vertucci 1984, Alves et al. 2011). When no irrigant was used during the instrumentation of a root canal, approximately 70% more debris remained (Baker et al. 1975).

Sodium hypochlorite (NaOCl) is a highly active oxidizing agent and has broad-spectrum antimicrobial activity. It reacts with organic debris in the root canal and facilitates cleaning. It has been used in concentrations ranging from 0.5-7% (Byström and Sundqvist 1983, 1985, Zand et al 2016, Köhler et al. 2018). The tissue dissolving properties of NaOCl can be improved when concentration, temperature, flow, agitation, and surface tension are optimized (Stojicic et al. 2010, Alves et al. 2011). The use of passive ultrasonic irrigation results in enhanced cleaning of the root canal compared to manual agitation (Al-Ali et al. 2012, Vivan et al. 2016). No one irrigant is sufficient to remove all organic and inorganic material from the root canal. NaOCl has little effect on the smear layer which is composed mainly of inorganic matter (Baker et al. 1975). Ethylenediaminetetraacetic acid (EDTA) is a chelating agent employed to remove the smear layer. The use of NaOCl and EDTA together but not simultaneously is recommended to remove the organic matter and smear layer in root canals (Goldman et al. 1982, Byström and Sundqvist 1985, Baumgartner and Mader 1987). A rinse of the canal with 10 mL of 17% EDTA followed by 10 mL NaOCl has been found to be the most effective final rinse protocol (Yamada et al. 1983).

Microorganisms invade dentinal tubules and canal ramifications (Love and Jenkinson 2002). An interappointment intracanal medicament is used to attempt to eliminate microrganisms and apical exudate, reduce inflammation and pain, induce healing, control inflammatory resorption and to prevent contamination of the root canal between appointments (Chong and Pitt Ford 1992). When no intracanal medicament was used between appointments, microrganisms surviving chemomechanical preparation of the root canal increased in number (Byström and Sundqvist 1981, 1983, 1985). Calcium hydroxide is used as an intracanal medicament due to its antibacterial action and ability to induce the formation of hard tissue (Byström et al. 1985, Hasselgren et al. 1988). A seven-day dressing of calcium hydroxide has been found to effectively reduce the number of microrganisms in the canal that survive chemomechanical preparation (Sjögren et al. 1991). Other popular medicaments that have been used include Ledermix® (Lederle Pharmaceuticals, Cyanamid GmbH, Wolfratshausen, Germany) paste containing an anti-inflammatory cortisone derivative, triamcinolone acetonide (glucocorticosteroid 1%) and tetracycline antibiotic, demethylchlortetracycline (demeclocyline 3.021%). It is a broad-spectrum antibiotic, effective against Gram-positive and Gram-negative anaerobic microrganisms that are usually found in endodontic infections (Dahlen & Haapasalo 1998). Odontopaste (Australian Dental Manufacturing, Brisbane, Australia) contains 5% clindamycin hydrochloride and 1% triamcinolone acetonide, and is often used due to the undesirable staining that can result from the use of Ledermix® (Chen et al. 2012).

1.2.4 Root canal obturation and restoration of root-filled teeth

The ideal properties of a root canal filling material include; bacteriostatic, non-irritating to PA tissues, insoluble and not effected by tissue fluids, sterile, radiopaque, dimensionally stable and seals both laterally and apically, biocompatible, has good handling and is easy to place and remove from the root canal (Grossman et al. 1982). The root canal filling should result in a seal that prevents the ingress of microorgansims and entombs any microorganisms that remain in the root canal system (Carrotte 2004). Gutta-percha (GP) has been used as a root canal filling material for approximately 140 years. Methods of filling canals with GP include cold GP (cold lateral condensation), heat-softened GP/ intracanal heating methods (warm vertical condensation, continuous wave of condensation technique, vibration and heat, a rotating condenser, precoated carriers, thermoplastic delivery systems, operator-coated carrier-

condensers) and solvent-softened GP (Ingle 1961, Schilder 1967, Johnson 1978, McSpadden 1980, Ingle and Beveridge 1985, Buchanan 1996).

In RCT, seal is important to prevent the ingress of bacteria. Gutta-percha does not adhere to the root canal wall and so a root canal sealer is applied. Sealers are used to lute the core material to the canal, to act as a lubricant between the filling material and the root canal walls, and to migrate into anatomical spaces such as accessory canals and irregularities such as resorptive defects and other spaces, not able to be penetrated by the core material (Lee et al. 2002, Ørstavik 2005). An ideal sealer should be biocompatible, adhere to the root canal wall, be dimensionally stable, provide a hermetic seal, be insoluble in tissue fluids, bacteriostatic, non-irritating, non-toxic, radiopaque, non-staining, have an adequate working time and be easy to remove (Grossman et al. 1982, Sagsen et al. 2006, Hargreaves et al. 2011). No currently available sealer possesses all of these characteristics. Sealers are classified according to their main chemical components; zinc oxide-eugenol, calcium hydroxide, glass ionomer cement (GIC) sealers, epoxy resin sealers, monoblock resin sealer systems, silicone-based, and calcium silicate/ mineral trioxide aggregate (MTA)-based sealers. Other methods of filling the root canal include using MTA hydrophilic polymers and pastes.

Root canal treatment is usually carried out on teeth that are structurally compromised due to caries, restorations or fracture. Endodontic access can require removal of the central tooth structure, further weakening the tooth. Restoration of the tooth is crucial. The technical quality of a coronal restoration is very important and it has been found to be more so than the technical quality of endodontic treatment for apical periodontal health (Ray and Trope 1995, Hommez et al. 2002). Another study found the technical quality of the root canal filling to be more important (Tronstad et al. 2000). However, it is the quality of both the endodontic treatment and the restorative dentistry that are significantly associated with the prognosis of root filled teeth (Gomes et al. 2015). Cuspal coverage is particularly important in endodontically treated molar teeth and restoration with a crown is usually required (Linn and Messer 1994, Aquilino and Caplan 2002).

1.2.5 Outcome of primary root canal treatment

Root canal treatment may occur in one or usually multiple visits. It is recommended that single-visit RCT should be reserved for vital cases and also non-vital trauma cases that do not display signs of AP. The elimination of an intraradicular infection prior to obturation cannot be reliably achieved in a single visit (Sjögren et al. 1997). If the tooth is infected, chemomechanical preparation should take place at the first appointment followed by placement of an intracanal medicament for a period of at least one week, depending on the condition of the tooth, and then obturation at a second appointment (Trope and Bergenholtz 2002). There are however reports however of successful single-visit cases performed on infected cases (Southard and Rooney 1984, Peters and Wesselink 2002, Molander et al. 2007). Recent studies indicate that there are no significant differences in healing outcome and post-operative pain levels between single-visit and multiple-visit treatment (Sathorn et al. 2005, Schwendicke and Göstemeyer 2017).

Primary RCT has a high success rate, however even treatment completed to the highest standard can fail (Sjögren et al. 1990, de Chevigny et al. 2008, Ng et al. 2011, Burry et al. 2016). The most common cause of recurrent disease is intraradicular infection (Nair et al. 1990, Nair 2004). Other causes include extraradicular infections, extraradicular actinomycosis, cystic AP, and foreign body reactions (Simon 1980, Happonen 1986, O'Grady and Reade 1988, Nair et al. 1990, 1996, Nair 2004). Healing can be judged at the end of one year but this is too early to judge persistent disease (Ørstavik 1996). Most cases heal within two years but some cases may take up to 5 years (Strindberg 1956). If there is persistent or emerging disease non-surgical or surgical retreatment may be offered.

1.3 FEAR AND ANXIETY IN THE DENTAL SETTING

1.3.1 Fear of root canal treatment

Root canal treatment enables the retention of teeth that may otherwise be extracted (Iqbal and Kim 2007, Torabinejad et al. 2007, Khan et al. 2016). Despite this, patients often associate the treatment with pain and the procedure is often feared by patients. Patients report greater fear associated with endodontic procedures and oral surgery than other dental treatments (Wong and Lytle 1991). Another study found that dental extraction, scaling and RCT provoked the highest anxiety levels when compared to other dental treatments (Stabholz and Peretz 1999). Needles, difficulty in achieving anaesthesia, fear of gagging, noise, choking, difficulty breathing and claustrophobia have also been found to induce fear in patients who require RCT (Huh et al. 2015, Dou et al. 2018). A more recent study found that endodontic treatment caused more fear in patients than other dental treatments (Oosterink et al. 2009). The cognitive conditioning and informative pathways of dental fear most frequently lead to anxiety prior to endodontic treatment (Carter et al. 2015b).

Patients frequently experience anxiety during RCT and this can be challenging for clinicians. Fear of the unknown and fear of pain have been documented as major reasons for anxiety towards RCT (LeClaire et al. 1988, van Wijk and Hoogstraten 2006, Dou et al. 2018). Patients negatively associate the treatment with pain both pre- and post-operatively (American Association of Endodontists 1987). A lack of understanding of the RCT procedure, including what to expect during and after each appointment, can lead to unnecessary anxiety or failure to return for completion of the treatment or extraction of a tooth (Dionne et al. 1998, Peretz and Moshonov 1998). Interestingly, patients who have experienced RCT are less anxious about it than patients who have never experienced it and do not associate the procedure with pain as frequently (LeClaire et al. 1988, Wong and Lytle 1991, Rousseau et al. 2002, Watkins et al. 2002, Khan et al. 2016). Ninety-six percent of patients that have undergone endodontic treatment would be happy to have another treatment if required (LeClaire et al. 1988). A study found that when patients were played soothing music during their RCT, anxiety was reduced (Lai et al. 2008).

A study has shown that when patients have more of an understanding on RCT, they feel less anxious towards their treatment. When patients were provided with positive written education

on RCT, fear of pain was reduced and compliance increased as the patient was more relaxed during treatment and more able to make treatment decisions. It has been hypothesized that when performing endodontic treatment, anxious patients may perceive the quality of treatment negatively (van Wijk and Hoogstraten 2006). If practitioners had improved understanding of the anxiety associated with RCT, patient management could be improved, patient anxiety could be reduced and as a result, there may be increased compliance and reduced failure to attend and have treatment completed. More effort must be made to educate the population on RCT and the important role that it plays in reducing pain and in the retention of teeth (Khan et al. 2016). A recent study found that young male Saudi adults were reasonably well informed about RCT and it was thought this was most likely due to social media. This study concluded that the internet should be used to make RCT more familiar among youth (Jothish et al. 2019).

1.3.2 Dental fear and anxiety

Research has been conducted to determine the causes of dental anxiety (Shoben and Borland 1954, Thomson et al. 1997, Eli et al. 2004, Appukuttan et al. 2015, Shim et al. 2015). Dental anxiety, fear and phobia are often used interchangeably and are related (Hallstrom and Halling 1984). Fear has been defined as a physiological, behavioural and emotional response to a stimulus that the patient is afraid of, whereas anxiety is dread or worry experienced prior to the feared stimulus (Armfield et al. 2006). Dental phobia is a repetitive, irrational fear that results in an overwhelming desire to fail to attend dental appointments. The degree of dental fear and anxiety differs between patients (Hallstrom and Halling 1984). It has been ranked the fifth most common fear experienced by humans (Agras et al. 1969).

Dental fear and anxiety have psychosomatic components that can impact negatively on the dental health of the individual. As a result, dental disease progresses, embarrassment results and a vicious cycle of fear is created. The most commonly reported cause of dental fear is a negative childhood experience (Berrgen and Meynert 1984, Moore and Birn 1990, Ragnarsson et al. 2003, Eli et al. 2004). Other common causes include feeling a lack of control in the dental chair, media, relatives or friends portraying the dentist in a negative light or the influence of individual psychological conditions (Moore and Birn 1990).

Dental fear and anxiety can be multi-factorial and have a complex presentation (Locker et al. 1999, Hmud and Walsh 2009). It has been found to originate via one of five different pathways;

Cognitive conditioning, Informative, Visual vicarious, Verbal threat, and Parental (Field et al. 2007, Carter et al. 2014). Other factors may affect these pathways and patients may develop fear via more than one pathway. Most frequently, the *conditioning* pathway leads to dental fear (Carter et al. 2014). This occurs when an individual learns via an experience that an action or event will have a negative outcome (Coelho and Purkis 2009). It has been suggested that there is also an innate component. The gag reflex is an example of an innate response which is thought to be a protective mechanism (Rankin and Harris 1984). It can also be a direct result of a previous negative dental experience and is often also related to personality traits (Eli et al. 1997). The *informative* pathway of dental fear originates from negative portrayal by others such as friends, family or the media. The *vicarious* pathway is an indirect pathway derived from the negative portrayal of the dental environment in the media. It is a multifaceted pathway. Patients who develop fear via the *verbal* pathway do so as a visit to the dentist was threatened when they misbehaved as a child. The *parental* pathway is a direct result of a parent's fear. It has been found that children whose mothers exhibited fear in front of them were more likely to be fearful (Ollendick and King 1991). A study conducted in 1954 (Shoben and Borland) found that dental anxiety developed in response to a previous negative dental experience (direct conditioning) or via a family member (vicarious learning). Another study determined that there are three possible pathways in which dental anxiety can develop: as a direct response to experiences in the dental environment, vicarious learning through family, peers and members of the population or due to psychodynamic or personality traits (Eli et al. 2004).

Studies conducted in other countries have found high levels of dental fear (Chellappah et al. 1990, Schwarz and Brin 1995, Oosterink et al. 2009, Kirova et al. 2010). Approximately 12% of Australians report high levels of dental fear and anxiety (Armfield et al. 2007) and similar levels of dental fear and anxiety have been reported in Iceland (Ragnarsson 1998). Other research conducted in Japan reported the highest proportion of participants (42.1%) experiencing high levels of dental fear (Weinstein et al. 1992), while a more recent study found that fear in white and Arab/ African groups more likely came about via the conditioning pathway of dental fear and anxiety than in an East Asian or Aboriginal/ Pacific Island group (Carter et al. 2015).

Studies have revealed that patients who experience dental fear and anxiety postpone or cancel their dental appointments more frequently (Armfield et al. 2006, Carter et al. 2014). They tend to be episodic dental attendees, presenting to the dentist only when they have symptoms

(Armfield et al. 2006, 2007). These patients tend to have poorer oral health than non-anxious patients (Ragnarsson et al. 2003, Mehrstedt et al 2007, Armfield 2010, Crofts-Barnes et al. 2010). As a result, they eventually present with more complex and painful conditions, heightening their anxiety, a 'vicious cycle' effect (Thomson et al. 1996, Armfield et al. 2007). Dental fear has been negatively associated with quality of life, influencing the psychological well-being, social life and vitality of a person (Mehrstedt et al. 2004). Dentally anxious patients react differently to non-anxious patients in the dental setting (Corah et al. 1978). The perception of pain is increased in anxious patients (Arntz et al. 1990, van Wijk and Hoogstraten 2009). Increased anxiety also leads to a higher risk of patient dissatisfaction (Herrera-Espiñeira et al. 2009). Anxious patients also expect more fear and pain than they actually experience (Arntz et al. 1990).

Females tend to present with higher levels of dental anxiety compared with males (Kleinknecht et al. 1973, Thomson et al. 1996, 1997, Stabholz and Peretz 1999, Armfield et al. 2006, Rajwar and Goswami 2017, Wali et al. 2019). Female dental fear and anxiety is more likely to originate via informative and conditioning pathways than in males (Carter et al 2015a). A study found that the oral health of females with dental anxiety who are routine dental attendees is better than those who are episodic attendees (Caltabiano et al. 2018). More highly educated patients experience less dental anxiety (Peretz and Moshonov 1998, Ragnarsson et al. 2003, Armfield 2006, Kirova et al 2010). One study found that in 88% of cases, the onset of fear was prior to the age of twenty years (Hallstrom and Halling 1984). Early adulthood has been considered a time where patients are vulnerable to the onset of dental anxiety (Locker et al. 2001). It has been found that dental anxiety is more commonly found in children (Lin et al 2017). One study found that patients in the 61-70-year-old age group experience a greater level of dental anxiety (Kirova et al. 2010). It has also been suggested that lower socio-economic status (SES) and past experience may be associated with an increased level of dental anxiety and also anxiety associated with RCT (Hallstrom and Halling 1984, Peretz and Moshonov 1998, Armfield et al. 2006). It has been found that patients with higher SES are better at coping with dental fear (Rankin and Harris 1984). Studies show that there may be an association between ethnicity and fear and anxiety of endodontic treatment (Carter et al 2014, 2015a, 2015b, 2018). A recent study found that refugees that have experience of torture and/ or post-traumatic stress disorder are more likely to be dentally anxious (Høyvik et al. 2019). Studies have found that seeing the local anaesthetic needle and the sight and sound of the dental drill evoked the most fear when visiting the dentist (Kleinknecht et al 1973, Wardle 1982, Rajwar and Goswami 2017). Another

study found that dental instruments cause dental anxiety (Kirova et al. 2010). Patients may express their anxiety in different ways; crying, verbally, by hyperventilating, fainting, fist-clenching or in silence (LeClaire et al. 1988).

Dental anxiety can be reduced by providing patients with written information on their treatment (Wali et al. 2019). The use of oral medications, nitrous oxide and music played during treatment have been found to reduce patient anxiety (Saxen and Newton 1999, Lai et al 2008, Ainscough et al. 2019).

1.3.3 Measuring dental fear and anxiety

Several dental anxiety scales have been developed including that Corah dental anxiety scale, the visual analog sale, the Kleinknecht dental fear survey and the Speilberger state-trait anxiety inventory (Corah 1969, Kvale et al. 1998, Hornblow and Kidson 1976, Kleinknecht 1978). It has been suggested that practitioners offer patients an anxiety and fear questionnaire when they attend for an appointment to enable the practitioner to provide an enhanced patient-centred care approach to treatment (Corah et al. 1978, Armfield 2010). Practitioners must recognize the signs of anxiety and help patients manage it (Hamedy et al. 2013).

Questionnaires can be used to determine patient anxiety and understanding of treatment (Wali et al. 2019). In this study, questionnaires were developed and given to participants prior to and following completion of RCT. Likert scale questions, categorical response options and open-ended questions were used in the questionnaires. Likert scales allow a respondent to express how much they agree with or disagree with a statement and they are a simple way of measuring an opinion, knowledge or perception (Likert 1932). Answers are typically five to seven balanced responses (Allen and Seaman 2007).

Patients who are well informed about their diagnosis and have an understanding of what their treatment involves, including its risks and possible complications, have lower anxiety levels (Dua et al. 2015). Furthermore, presenting patients with information on RCT prior to therapy is shown to reduce a patient's fear of pain, thereby making them feel more relaxed during the procedure (van Wijk and Hoogstraten 2006).

1.4 HEALTH LITERACY AND EDUCATIONAL MATERIAL IN HEALTHCARE

1.4.1 Health literacy

Health literacy is defined in The Patient Protection and Affordable Care Act of 2010, Title V by the United States Centers for Disease Control and Prevention (2016) as *'the degree to which an individual has the capacity to obtain, communicate, process, and understand basic health information and services to make appropriate health decisions.'* It is described as *'the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health'* by the World Health Organization (WHO) (2018).

Adults with low health literacy levels are less likely to better follow healthcare regimens, attend follow-up appointments and ask for help for treatment and understanding their condition (Williams et al. 1995). They struggle to understand written and oral instructions, consent forms, educational materials and labels on medication (Morrow 1980, Miles and Davis 1995, Williams et al. 1995). The health literacy of an individual is influenced by multiple factors including general literacy, knowledge of the healthcare system, and how health educational material is presented. It has been suggested that health status is better reflected by these characteristics rather than demographical characteristics such as age, SES, education level and occupation (Murero et al. 2001). Studies have found that poor health literacy has been linked to patients requiring more hospital visits, longer stays in hospital and these patients are also less compliant (Baker et al. 1997, Badarudeen and Sabharwal 2010).

Patients can adopt different coping mechanisms for dealing with health information; for example, 'monitoring' and 'blunting' styles. 'Monitoring' patients want to hear more information whereas 'blunting' patients may not want to hear much at all about their condition or their treatment (Miller 1995). Practitioners must be able to gauge this as it can affect the anxiety level of a patient. Ethically, there is a minimum amount of information that a patient must receive.

There are two ways to reduce the discrepancy between the health literacy of the audience and

the health sector demands: 1) to develop the literacy skills of the target population and/ or 2) to reduce the literacy demands of the health sector. Health literacy skills of individuals can be improved by employing resources which increase understanding of written and spoken health terminology, how to communicate with health professionals, how to fill out forms, working out dosage amounts and when to take medication. It is important when reducing the literacy demands of the health sector that the amount of information available is not reduced. It is not a 'dumbing down' process, rather a patient-centred approach for sharing information. Changes can include allowing more time for discussion, encouraging the support of family and friends, providing interpreters if required, visual aids, ensuring services are user friendly and appropriately designing health resources, letters and forms (Ministry of Health NZ 2010, United States Centers for Disease Control and Prevention 2016, WHO 2018).

Limited research has been conducted regarding what kind of educational information is appropriate and best understood by patients of all literacy levels. One study concluded that informative dental material should be written in the simplest form possible (Backdash et al. 1983). The Flesch-Kincaid Formula, which produces an overall readability grade, is commonly employed by newspapers and magazines (Morrow 1980, Alexander 1999). This formula takes into consideration the average number of words, syllables, affixes and references in a sentence (Flesch 1948). Alexander (2000) concludes that dental educational material should be written at a level of 9th grade (14- to 15-years-old) or below, according to the Flesch-Kincaid Formula so that it may be understood by a larger proportion of the population. The Lexile Analysis is another tool used to determine the understandability of written and audio material (Wilson et al. 2012). In the United States, the National Institutes of Health recommend that the readability of health information should be at a level no higher than 6th grade level (11- to 12-years-old) (National Institutes of Health 2017).

In the medical profession, the traditional paternalistic model of practice is being replaced and becoming increasingly patient-centric and it is therefore of paramount importance to understand the level of patient comprehension. This approach improves a patient's perception of risk and what treatment involves, and enables improved informed consent processes (Rutherford et al. 2018).

Dental health literacy is *'the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health*

decisions' (National Institute of Dental and Craniofacial Research 2005). It is believed that dental health literacy may be positively associated with oral health-related quality of life and is therefore important (Lee et al. 2007). Studies conducted found that dental health literacy may be a distinct entity from medical health literacy and may have an effect on oral health outcomes (Gong et al. 2007, Lee et al. 2007).

1.4.2 Patient education in dentistry

Significant research has been conducted in medicine on the influence of patient education on patient knowledge and understanding, the consent process, and in reducing anxiety levels across a range of medical disciplines. Patient understanding is increased, post-operative complications are reduced, compliance is increased and health outcomes are improved when patients are presented with written information regarding a procedure (Alexander 1999, Tait et al. 2014, Paterick et al. 2017). Information provided to patients prior to treatment can help to correct misconceptions about the treatment and make patients feel more comfortable, as they know what to expect and they are included in decision making (Armfield and Heaton 2013). It has also been found that by providing patients with informative material on the pain that may be felt during endodontic treatment, fear and anxiety levels are reduced (van Wijk and Hoogstraten 2006). Unfortunately, educational material presented prior to treatment is frequently focused on outcome as opposed to the procedure itself and what a patient can expect (Sorrell et al. 2009). It is not common to assess patient understanding of treatment prior to and after the procedure, or to present patients with standardized educational material (Krouse 2001).

Information must be presented to patients must be adequate and appropriate so that they are able to make an informed decision. Patients must be aware of the risks, benefits, outcomes and complications associated with treatment (Dua et al. 2015). There are a number of factors which influence how much information is received and retained by a patient, while anxiety and fear at the time the education is presented can cause distraction (Sorrell et al. 2009). Patients who receive adequate information experience less anxiety prior to their treatment (Nikumb et al. 2009). Anxious patients may be less satisfied with education and treatment that they receive (Herrera-Espiñeira et al. 2009). The level of patient education, literacy and readability must be considered when designing the informative material (Hendrickson et al. 2006, Sorrell et al. 2009, Woodmansey 2010). There is generally a discrepancy between patient education by

health care professionals and the reading level of patients (Alexander 2000, Ryan et al. 2014). Often educational resources contain a lot of medical jargon. There is a strong relationship between the health literacy of an individual and their health status (Baker et al. 1997, Badarudeen and Saabharwal 2010).

1.4.3 Readability of health education material

Numerous readability assessment tools have been developed which can aid in the design of health education material and include the Flesch Reading Ease scale, Flesch-Kincaid Grade, Fry McLaughlin's SMOG grading, the Gunning Fog Index, Readability Graph, Dale-Chall Readability formula, and Suitability Assessment of Materials (SAM). The Flesch-Kincaid Formula is the most commonly used readability tool. Some software programmes are able to assess readability of materials including Microsoft® Word®, which uses the Flesch-Kincaid Grade. The SAM tool has the ability to assess appropriateness of other content such as illustrations, videos and aural material as well as readability (Flesch 1948, Fry 1968, Gunning 1969, McLaughlin 1969, Alexander 2000, Badarudeen and Sabharwal 2010).

A drawback of the readability assessment tools is that most result in educational text that is over-simplified and therefore prevents necessary information from being presented. Most tools also focus only on the structure and length of sentences and not on the layout of the material, illustrations, additional aural materials and also on patient factors such as motivation and interest (Meade and Smith 1991, Badarudeen and Sabharwal 2010). Readability assessment tools are helpful in designing educational material but drawbacks exist with every method of testing. The key is that clinicians are aware of the level of patient health literacy and provide appropriate information.

1.4.4 Development of health education material

Features of an educational document that make them easier to understand include: use of words with less than two syllables; shorter sentences of eight to ten words; use of a mixture of uppercase and lowercase letters; the use of colour; use of non-italicised, sans-serif font with no abbreviations; use of simple graphics and images, highlighting of important points; no use of technical jargon and the beneficial use of white space (Morrow 1980, Alexander 2000, Dua et al. 2015). Patients prefer educational materials to contain diagnosis and treatment options in a

simplified form that they can understand (Murphy et al. 2000). The aim of an education program is not to use the intervention solely but to use it as an adjunct to existing mechanisms to enhance education, for example by encouraging increased discussion with the practitioner (Murphy et al. 2000, Sobel et al. 2009).

Using pictures in educational materials is beneficial in increasing patient attention, understanding and recall (Houts et al. 2005). Research has found that successful visual images should use simple pictures with a clear focus, use objects that patients can relate to if possible, and avoid using unnecessary distractions such as shading, texture, and lines (Dowse et al. 2010).

Feedback from practitioners and also end-users of educational material is important and often overlooked. Feedback can be obtained after education presentation in the form of a survey or focus group, and then used to further develop the material appropriately (Wilson et al. 2012, El Azem et al. 2014). Focus groups and surveys of members of the intended target audience can provide information that allows the education creator to better understand the patients and the scope of the education that needs to be covered. Audience feedback on the clarity of the material is important and should be sought to enable refinement of the educational material. When educational material is designed, the readability and literacy of the target audience should be taken into consideration from the beginning (Wilson et al 2012).

1.4.5 Multimedia education in different clinical settings

Multimedia education is effective in many different clinical environments. This technology as an adjunct to verbal education has been demonstrated to be beneficial in enhancing patient understanding and retention of information and when obtaining informed consent prior to surgery (Cornoiu et al. 2011, Hung et al. 2011, Batuyong et al. 2012, 2014, Nehme et al. 2013). Some patients have an improved understanding which enables them to make more informed decisions with regard to their treatment (Krouse 2001). It has been found to reduce both pre- and post-operative patient anxiety (Jlala et al. 2010).

The use of a film to educate patients about their prostate cancer improved their understanding of the condition (McGregor 2003). A cohort survey studied patients who had received educational audio-recordings prior to cancer treatment. The results showed that pre-operative

educational material reduced treatment decision regret and improved understanding, recall of information and confidence in treatment decision making (Good et al. 2016). In another study, Japanese children and their parents were given an educational video and brochure prior to herniorrhaphy surgery. Overall, this increased patient knowledge and decreased anxiety before surgery (Wakimizu et al. 2009). Further, for patients considering ankle ligament reconstruction surgery, prior viewing of multimedia education increased patients' retention of information and understanding of the procedure. Patients found the computer presentation most beneficial if it followed a verbal description from the practitioner (Batuyong et al. 2012). Multimedia technology and pamphlets have also been deemed useful during the consent process prior to bunion surgery (Batuyong et al. 2014). Pre-chemotherapy education in the form of a video proved useful in increasing the retention of information by some patients (Kinnane et al. 2008). Another study confirmed that the use of multimedia as an adjunct to verbal education in the informed consent process prior to knee arthroscopy increased patient retention of information and understanding of treatment (Cornoiu et al. 2011). These advantages of multimedia are in agreement with other studies (Ryhanen et al. 2010, Hung et al. 2011, Nehme et al. 2013, Wood et al. 2015, Bowers et al. 2017, Pei et al. 2017).

1.4.6 Printed versus website education

Patient education is commonly presented in printed and/ or a web-based format. A review of the literature including 14 studies was carried out comparing print and multimedia formats for presenting health educational material to patients (Wilson et al. 2012). Three studies found that patients preferred printed educational material, five resulted in multimedia being the preferred mode and six studies found there was no significant difference in preference. When preference for educational modes were considered, one study found that patients preferred printed material, 12 studies found that patients preferred multimedia material and 1 found no significant difference between printed or multimedia. Reduction of anxiety was also compared when patients were presented with either printed or multimedia health education material but there was no significant difference identified. The conclusion of this comparative analysis was that generally, there was no difference between the two methods of educational presentation and in the majority of studies, they both were equally as effective as each other (Wilson et al. 2012).

Printed materials for patient education have the advantage of enabling as much or as little time

to review the information and patients can select areas to read preferentially prior to others. They are also easy to carry around and access without any equipment (for example, a computer or tablet device). Printed materials, however, rely on a threshold literacy level and they cannot show motion and detailed steps of a procedure. Multimedia education can present a detailed step-by-step procedure by using a video, and audio can be used as an adjunct. This combination can be easier to comprehend for patients with lower literacy skills as it is less reliant on reading comprehension. The multimedia form can also allow patients to review previously viewed material (Wilson & Wolf 2009, Wilson et al. 2012, Batuyong et al. 2014). However, factors such as access to technology, internet connection and the ability to stream an application of a certain size may affect the access to this form of education (Gerber et al. 2005, Wilson et al. 2012).

Research has been conducted to compare the effectiveness of regular (written form and by an educator) and multimedia education in patients with Type-2 diabetes, in improving their knowledge of the condition and insulin injection skills. It was found that multimedia education improved the quality of patient care and it was more effective than regular health education in improving patient knowledge and injection skill (Huang et al. 2017). Other studies have found that multimedia education improved patient understanding of treatment and reduced anxiety (Jlala et al. 2010, Tait et al. 2014).

Research conducted in a school to determine the effect that an educational leaflet had on education of parents about emergency management of tooth avulsion, found that a pamphlet was effective in providing simple information. It was considered a favourable method for conveying information easily. For a deeper understanding of the treatment, information presented as additional CDs and DVDs would be more beneficial (Al-Asfour and Andersson 2008). Patients' age and education have been found to affect the preferred source of information. In research conducted on lay people's preferred form of information on tooth avulsion, it was found that younger people were effectively targeted using technology such as the internet whereas older people preferred the TV over the internet. Information presented by health professionals was preferred overall (Al-Sane et al. 2011).

In a study assessing patient education using a computer multimedia application in patients with diabetes who had low literacy, it was found that fewer patients with low literacy owned a computer compared to those patients of higher literacy. Older patients have also been found to use computers less than younger patients. Making computers or the technology available to all

patients in the clinic as opposed to relying on patients to view the multimedia application out of the clinic (for example, at home) may overcome the barrier of lack of patient access to the information. It has been suggested that technology that uses a touch-screen as opposed to a keyboard may be beneficial for older individuals, those who have lower literacy, or patients with less computer experience (Gerber et al. 2005).

1.5 HEALTH EDUCATION IN NEW ZEALAND

1.5.1 Health literacy in New Zealand

In NZ, the Ministry of Health (MoH) (2015) describes health literacy as *'the capacity to find, interpret and use information and health services to make effective decisions for health and wellbeing'*. The MoH has developed a framework for health literacy as it recognizes that both improved health outcomes and reduced healthcare costs can be attributed to better health literacy practice. A combination of the roles of the health system, health organisations, the health workforce and individuals and whānau (Māori for an extended family or community of related families who live together in the same area) is important in health literacy (Health Literacy NZ 2018). The health workforce forms a core component of the framework and a key action of the workforce is to provide appropriate resources for the intended population by using a variation of media and approaches by employing different technologies. It is also important that the health provider identifies and prevents any barriers from inhibiting an individual taking action on the new information received.

When developing educational resources for healthcare in NZ, the framework recommends using reference material such as Rauemi Atawhai: A guide to developing health education resources in New Zealand (MoH 2015). According to this document, all health education resources should *'be easily understood by the main audience, encourage improved health outcomes for the main audience, provide the right information, at the right time, in the right place, using the right format for the main audience and build the health literacy of the main audience'*. It provides principles to guide the author when developing the educational material. These principles include clarity, simplicity, use of lay terms at an appropriate reading level and the use of images. Of these principles, preparation is key. Time should be spent understanding the target audience, defining the target population and determining goals prior to developing the resource. The author is encouraged to maintain a close relationship with the audience, stakeholders, colleagues and experts and to work in a team if possible, to ensure regular feedback while developing the material. It is important to document feedback, discussions and reasons for decision making throughout the developmental process to enable justification (if required) and for use in development of potential future resources. The framework recommends continued testing of new ideas with all involved and the audience and a trial distribution of the educational material can also be very beneficial. The Rauemi Atawhai guide

recommends addressing health literacy in two ways when developing health education material. It is important that the audience understands the resources. This can be improved by using clear, user-friendly language, additional media such as a DVD or online information or videos, face-to-face discussions and by including images or photographs. These methods and principles of education presentation have been found to be beneficial in increasing patient understanding (Morrow 1980, Alexander 2000, Krouse 2001, Houts et al. 2005, Wilson et al 2012, Dua et al. 2015). The educational resource should also aim to improve and/ or develop the health literacy skills of the patients so that the health issue can be managed appropriately. This would enable the patient to better understand and use vocabulary that relates to their condition and therefore improve understanding discussions with the clinician (MoH 2015).

Research has found that the health literacy of an individual has more of an influence on their health status than ethnicity, gender, SES and highest educational level achieved (Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, American Medical Association 1999). Knowledge of the health condition, the health system, literacy skills and the state of the information encountered determine the health literacy of the individual. Health literacy demands are increasing because people are living longer and as a result, they present with a range of health conditions. Increasingly, individuals are taking responsibility for their health and decision making, advancing technology and more health information is available (MoH 2015). The health literacy level of the NZ population has been determined from the Adult Literacy and Life Skills Survey (ALL) (2006) which other Organisation for Economic Co-operation and Development (OECD) countries also use and is reported in Kōrero Mārama (MoH 2010). The ALL is a 500-point scale which is divided into six levels which measure an individual's proficiency in three information-processing skills; literacy, numeracy and problem solving in technology-rich environments. A minimum of 275 is the score at which an individual is thought to be able to meet complex everyday demands in life and work. According to this report, Māori had poorer health literacy skills when compared to non-Māori; 80% of Māori males and 75% of Māori females had poor health literacy skills (MoH 2010).

1.5.2 Informed consent for root canal treatment in New Zealand

The Dental Council of New Zealand (DCNZ) is the governing body for dental professionals in NZ. It provides a framework on the informed consent process which includes three criteria; *'effective communication, provision of information and make an informed choice and give informed consent'* (DCNZ 2018). Informed consent ensures that a well-informed patient can take part in making decisions about their health care (El Azem et al. 2014). As part of the informed consent process in endodontics in NZ, treatment aspects which require discussion on their likelihood of occurring (if relevant to the particular case) are instrument separation, perforation risk, possibility of missing a canal, canal obstructions, post-operative pain and flare-up risk, persistent disease long term, discolouration of the tooth, hypochlorite irrigant extrusion, prognosis and follow-up.

In NZ, dental practitioners have access to an information sheet, last reviewed in February 2019, on the basics of endodontic treatment, provided by the New Zealand Dental Association (NZDA). Approximately 98% of dentists in NZ are members of the NZDA. Some practitioners develop their own educational material and consent forms and most practitioners, over time, adopt a set "speech" that they deliver to patients prior to commencing every root canal treatment. Other practitioners draw diagrams to illustrate the tooth and its root canal(s).

1.5.3 Practice based research networks to enhance health education

Practice based research networks (PBRNs) involve collaborations between universities and community practitioners to carry out research which is relevant to clinical practice (Mold and Peterson 2005). The gaps that often existed between research and practice are closing as the importance of translational research is being emphasized by PBRNs.

New Zealand's first PBRN was formed in 2013, called Applied Research through Clinicians' Hands by a clinical research group of the Sir John Walsh Research Institute (SJWRI), Faculty of Dentistry at the University of Otago, Dunedin, NZ. This network of general dentists and academic colleagues has provided important information on the use and philosophies towards direct pulp capping treatment in NZ (Friedlander et al 2015).

Practice based research networks have been successfully used internationally in the design and usage of educational materials in healthcare. The Engaging Communities in Education and Research collaboration in Colorado resulted in several collaborations aimed at providing better education and research in medical and healthcare institutions (Westfall et al. 2012). One PBRN was conducted to determine primary healthcare providers' preferred methods of obtaining information (Andrews et al. 2005).

1.6 CONCLUSION

Patients who require RCT can be fearful, anxious and have a negative perception of the treatment. This is often due to a lack of understanding. Health education presented to patients prior to a variety of medical treatments have been shown to reduce anxiety and improve understanding and health outcomes. Information is lacking on the effect of providing patients with different formats of educational material on RCT prior to commencing treatment. It is anticipated that patients have different preferences to how material is provided delivery and that more comprehensive information may make them feel less anxious and have a better treatment experience.

1.7 THESIS AIMS AND HYPOTHESES

1.7.1 Thesis aims

1. To develop and compare educational material on RCT in written and website form with existing written material in NZ.
2. To determine if delivering enhanced education to patients prior to treatment influences anxiety, understanding and perception of the procedure in NZ.
3. To determine GDP perception of the educational materials and current method of patient education in NZ.

1.7.2 Specific objectives

1. To develop and produce improved educational documents in written and multimedia forms that inform patients about RCT
2. To evaluate patients' understanding and perception of RCT prior to treatment.
3. To determine patients' preferred mode of RCT education.
4. To evaluate the effect of patient demographics on the perception of different modes of educational material.
5. To determine GDP consent methods and perception of education prior to RCT.

1.7.3 Thesis hypotheses

Patients in NZ feel less anxious and have a better understanding of RCT when they are presented with education prior to treatment. Some patient demographics influence patients' perceptions of the educational material but overall there is no significant preference in the way that the education is presented. General dental practitioners in NZ place importance on patient education prior to RCT and prefer to provide patients with additional educational material to their discussion of treatment.

Chapter Two- Methods

2.1 INTRODUCTION

A mixed-methods approach and a purposeful sampling technique was used to conduct this study. The proposed protocol was peer reviewed. The lead researcher who carried out the study and is mentioned in the sections below is the DClinDent (Endodontics) candidate.

2.2 MĀORI CONSULTATION

Māori consultation was undertaken with the Ngāi Tahu Research Consultation Committee (Letter of engagement, Appendix I).

2.3 ETHICAL APPROVAL

Ethical approval was obtained from the University of Otago Human Ethics Committee (Health) (H17/097 – Full approval letter, Appendix II).

2.4 PROJECT FUNDING

A University of Otago Fuller Scholarship of $3,000 was awarded.

2.5 STUDY DESIGN

2.5.1 Participants

This study had two types of participants:

1) Patients requiring RCT from GDPs
2) GDPs

2.5.1.1 Patients

Sixty-one patients (participants) were involved in the study. Practitioners discussed the study with patients who met the inclusion criteria and provided them with an information sheet on the study and invited to participate (Appendix III). If patients agreed to participate in the study, written consent was obtained (Appendix IV).

Inclusion and exclusion criteria

Inclusion criteria

- Primary RCT required on one or more teeth
- Aged 18-years-old or over
- Any ethnic group
- Possible previous experience of RCT on another tooth

Exclusion criteria

- Endodontic retreatment required on the tooth
- RCT related to recent trauma (<2 years ago)
- Aged under 18-years-old
- Patient cannot consent

2.5.1.2 General dental practitioners

This was a practice based research study involving a collaboration between the University and private GDPs. Eleven GDPs from eight private dental practices in Auckland, Hamilton, Timaru, Dunedin and Invercargill were recruited to participate in the study and their role was to recruit patient participants for the study.

The lead researcher worked closely with the dental practitioners. Prior to commencement of

the study, the research was discussed with the practitioners at a face-to-face or telephone meeting and they had the opportunity to ask questions. If they had any further queries after commencing the data collection, they were able to contact the lead researcher for clarification by telephone, in person or via email.

Practitioners were calibrated at the beginning of the study in order to ensure all patient participants (referred to from here on as 'participants') gave a standardized verbal description of RCT and what to expect during and after treatment. Practitioners discussed treatment with participants in their usual manner and the lead researcher provided a check-list to ensure that all GDPs included the same information (Appendix VII). The GDPs included discussion of why the RCT was required, what the treatment involved, restoration of the tooth, the possibility of referral to an endodontist during treatment, time and cost estimation and the risks involved. As part of normal informed consent processes participants had the opportunity to ask questions and decline treatment.

The GDPs were competent in modern RCT techniques including the use of rotary/reciprocating files for root canal preparation and were asked to perform RCT for the participants using their usual technique. The cost of treatment was determined by the practitioner in line with their practice fee schedule.

2.5.2 Study sample size

The lead researcher liaised with a biostatistician who was familiar with this type of study design and provided ongoing statistical support. It was determined that a sample size of 40 for each group would enable sufficient power to detect differences in analysis of variance between the groups with 80% power and $P \leq 0.05$. Generally, in observational studies, a sample size of at least 120 is optimal to allow for generalisation. The final number of participants that were recruited for the study was 61. The study was purely exploratory with limited ability to generalise as the sample was small and therefore mixed methods was used to substantiate the results.

Patient participants were recruited to the study and provided an anonymous numeric code which was linked to the practice. All participants were required to complete an anonymous questionnaire before and after treatment and were randomly assigned to one of the three groups

using Microsoft Excel® (Microsoft). This was to ensure that all of the documents filled out by each participant could be matched if required. Participants were randomly assigned to one of the three groups according to the order in which they presented to the GDP.

Three modes of educational material were compared:

Group 1 – Dental practitioner's usual method of education prior to treatment, which commonly included receiving a handout from the NZDA (reviewed in February 2019) (Appendix V).

Group 2 – A specifically designed pamphlet developed by the candidate with detailed information related to RCT, considered improved by the researchers (Appendix VI).

Group 3 – A website – an online application developed by the lead researcher containing information related to RCT that could be viewed on a device.

Participants were recruited from December 2017 to March 2019. At conclusion of the study, a total of 61 participants were randomly assigned to one of the three groups. Twenty-three of the participants randomly received the NZDA pamphlet/ education from their practitioner prior to RCT. Twenty-one of the participants randomly received the new pamphlet and 17 of the participants randomly received the new website on RCT.

2.5.3 Patient participant questionnaire

Two questionnaires were designed to collect quantitative and qualitative data and explore themes related to participant demographics, dental pain, knowledge of RCT, anxiety and perception of treatment. The Dental Anxiety Scale (DAS) (Corah et al. 1978) was modified and used in the design of the anxiety and fear sections of the questionnaires. Likert scales were used to gauge an understanding of participant perspectives and feelings towards specific aspects of dental and root canal treatment. In the survey, fear and anxiety are considered to be different but they are grouped as one construct. Questionnaire One was provided to participants to complete prior to receiving the education and commencing their RCT (Appendix VIII). Questionnaire Two was completed by participants at the end of their treatment (Appendix IX). The questionnaires included Likert scale questions, categorical response options and open-ended questions.

Questionnaire One included 24 questions and spaces for comment. Twenty-one Likert-scale

questions and three areas that allowed for comment. The questionnaire had four subscales relating to demographics, RCT knowledge and experience, dental and RCT anxiety and symptoms.

Questionnaire Two included 17 questions and spaces for comment. This included eight Likert-scale questions and nine areas that allowed for comment. All of the questions were related to the clarity and utility of the educational material and whether or not it influenced feelings of anxiety, understanding or perception of RCT.

The instrument was developed partly from the literature and clinical experiences. It was a new instrument, not validated. While the importance of instrument validation and standardization were acknowledged, the study was focused on exploration of the prevalence and frequency of the phenomenon of anxiety broadly conceptualised to include fear rather than measurement of it. As such, the instrument was not validated, with the goal that the answers to the associated open-ended responses would substantiate the data obtained through the quantitative measures. The survey was constructed by the lead researcher and was developed in such a way to collect both quantitative and qualitative data to enable themes to be found to generate hypotheses.

2.5.4 Educational material

Two types of educational material were used: NZDA pamphlet on RCT and new educational material on RCT. Differences between the two types of material are shown in Table 2.1. Design principles that were used in the new material included, simple description of aspects of the RCT procedure and treatment, the use of lay-terms, illustrations, photographs and a website for presentation.

NZDA pamphlet	**New material**
Paper only	Paper and electronic
Double-sided A5 pamphlet	Double-sided A4 pamphlet
Covers topics: why RCT is required, pain, restoration, success, complications and cost	Covers topics: why RCT is required, pain, x-rays, treatment steps, antibiotics, restoration, success, complications, cost and alternatives to RCT
Includes 5 illustrations	Includes 4 illustrations, 2 x-ray images and one photograph

Table 2.1- Comparison of presentation and content of educational materials

2.5.4.1 NZDA handout

The NZDA handout is a double-sided, A5 pamphlet available for NZDA members to purchase for providing education on RCT to their patients. The pamphlet has an introduction then information on treatment is divided into six categories which are headed with questions. The first page of the pamphlet includes information on 'why RCT is necessary' and 'pain relief during treatment'. There is a large simple diagram illustration of a tooth containing a root canal. The second page covers information about restoration of the tooth, number of visits required and antibiotics, some treatment risks and that the cost of treatment depends on a number of factors. Four simplified illustrations of a healthy tooth, an abscessed tooth, a tooth with a file in the root canal and a root canal treated tooth, restored with a crown are included.

2.5.4.2 New pamphlet

The new pamphlet was a double-sided A4 pamphlet developed by the lead researcher which provided more detailed information than the NZDA pamphlet. This material was presented to participants at chairside and they were able to take it away for further review before their next visit. The pamphlet is divided into 12 sections, most of which are headed with a question. The pamphlet begins with simplified information about a tooth, root canal and why RCT is required. Categories that follow provide information about what RCT is, pain relief during and after treatment, radiographs, an outline of treatment steps during appointments, antibiotics, restoration, success, risks involved, cost and alternative options to treatment. The pamphlet includes four stylized illustrations of a tooth during treatment. Two types of radiographs that are frequently taken during RCT are depicted. A photograph of a tooth isolated with a dental dam and clamp is also included.

2.5.4.3 New website

The website was developed by the lead researcher using WordPress® (WordPress.org). It contains exactly the same information as the information provided to Group 2. Each heading corresponds to information and illustrations, radiographs or a photograph and is presented on a separate page. Upon entering the website, there is a pull-down menu in the top right corner. This allows the reader to scroll down to view the exact heading that they are interested in. The link to the website is http://rootcanaltreatment.otago.ac.nz/.

2.5.5 General dental practitioner interviews

Six individual interviews of GDPs were conducted to gain an understanding on their method of consent and patient education and to receive feedback on the different educational modes (Appendix XI-XVI). Two of the GDPs interviewed were involved in the recruitment and treatment of participants. Interviews were semi-structured and included seven questions (listed below) aimed at gaining an understanding on the practitioner's method of obtaining consent prior to treatment and patient education and to receive feedback on the different educational modes (Appendix X):

1. What sort of education or information do you currently give your patients before root canal treatment?
2. How do you obtain informed consent from your patients prior to RCT?
3. How does the new pamphlet on RCT compare with the NZDA RCT handout?
4. How does the website on RCT compare with the NZDA RCT handout?
5. Do you think the website is accessible/ easy to use for all patients? If no, why?
6. Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?
7. Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?

Interview were conducted face-to-face and were recorded using a voice recorder and transcribed by the lead researcher.

2.5.6 Data Analysis

Quantitative and qualitative analyses were performed on the data using IBM® SPSS® Statistics (Version 25 IBM Corp. Released 2017. IBM SPSS Statistics for Macintosh, Armonk, NY, USA: IBM Corp) Software to evaluate the influence of the educational materials on the understanding of RCT as well as anxiety and perception of treatment. Likert scale questions and catergorical data were analysed quantitatively. Relationships between variables were explored using Chi-square tests (using continuity correction, Pearson's Chi-square value, phi coefficient and Cramer's V), correlation using Spearman's rho and paired t-tests.

Qualitative thematic analysis was performed manually on the responses to open-ended questions and for the data collected from focus group interviews to identify common themes

emerging from the data. General dental practitioner interview responses were analysed thematically. The trustworthiness of the qualitative analysis was achieved through a shared intercoder reliability (non-probabilistic) involving the researcher and one of the supervisors. Further, the themes were mostly situated within contextualised quantitative questions.

Familiarization with the data (reading and noting initial ideas) was performed, coding of the data, identification of themes, and collating data into potential themes, reviewing themes by checking them in relation to coded extracts, defining and naming themes and then reporting the findings was carried out (Pope et al. 2000).

2.5.7 Flow diagram of data collection process

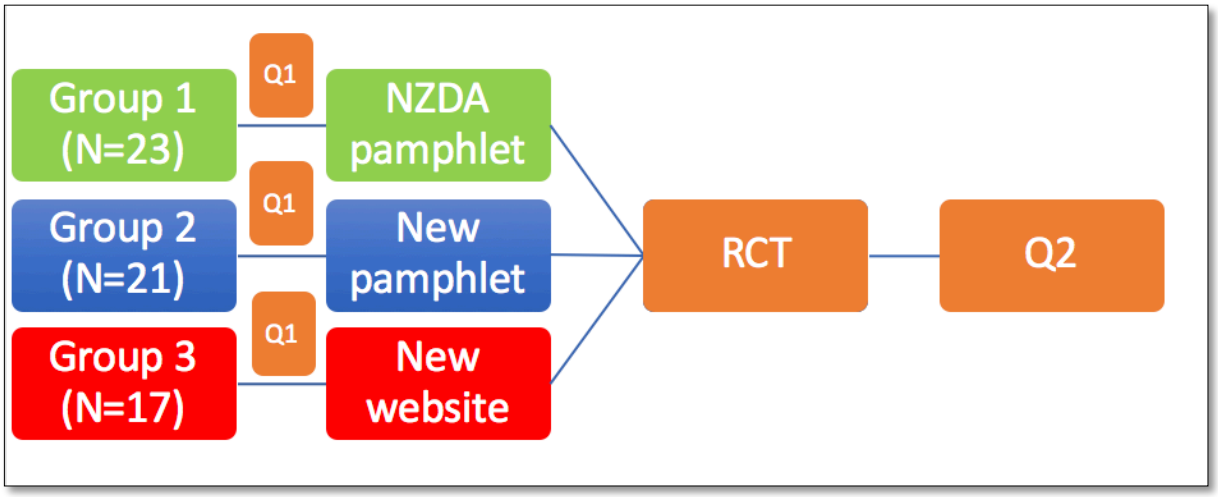

Figure 2.1- Flow diagram depicting the data collection process. Participants were randomly assigned to three groups (Group 1=NZDA group, Group 2=New pamphlet, Group 3= New website). Prior to RCT, they received and completed Questionnaire One (Q1) and the educational mode. All participants then had RCT carried out. Participants then received and completed Questionnaire Two (Q2).

Chapter Three- Results

3.1 ANALYSIS OF PARTICIPANT QUESTIONNAIRES

3.1.1 Introduction

Questionnaire One and Two collected data on demographic characteristics, dental and pain history and explored themes related to anxiety, knowledge, understanding and perception of treatment.

In some of the tables below, the number of responses does not add up to the total number of participants (n=61). This occurred when a participant did not respond to the question. Often there were greater than 61 responses as participants were able to make multiple responses to the question.

3.1.2 Participant demographics and dental attendance

Sixty-one participants were involved in the study. Over half were female and nearly three quarters were over 45 years-old. The majority of participants were of NZ European descent and most reported that English was their first language. Participants also recorded their highest level of qualification and over a third had a university qualification. Demographic information is summarised in Tables 3.1 - 3.5 below.

Demographic characteristics of participants:

Table 3.1- Gender of participants

Gender	Number (%)
Male	26 (42.6)
Female	35 (57.4)

Table 3.2- Age of participants

Age	Number (%)
18-24	2 (3.3)
25-34	8 (13.1)

35-44	6 (9.8)
45-54	15 (24.6)
55+	30 (49.2)

Table 3.3- Ethnicity of participants

Ethnicity	Number (%)
NZ European	51 (83.6)
European	4 (6.6)
Asian	6 (9.8)

Table 3.4- First language of participants

English first language	Number (%)
Yes	54 (88.5)
No	6 (9.8)

Table 3.5- Level of education of participants

Highest level of education	Number (%)
Overseas secondary school qualification	4 (6.7)
Level 1 certificate eg NCEA level	8 (13.3)
Level 2 certificate eg NCEA level 2	1 (1.7)
Level 3 certificate eg NCEA level 3	2 (3.3)
Level 4 certificate eg apprenticeship	3 (5)
Level 5 or 6 diploma eg advanced trade certificate	10 (16.7)
Bachelor's degree and level 7 qualification	11 (18.3)
Post-graduate and honours degrees	3 (5)
Master's degree	4 (6.7)
Doctorate degree	4 (6.7)
Not applicable	10 (16.7)

Many of the participants were established patients of the GDP providing the RCT (Table 3.6). Over half of the participants were regular dental attendees and approximately one quarter of participants only reported attending the dentist when they have a problem or are in pain (Table 3.7). Over half of the participants had previously had RCT and the majority of participants only required RCT on one tooth.

Table 3.6- How often the participant visits the dentist providing the RCT

Length of time with dentist	Number (%)
I have never been to see this dentist before	6 (9.8)
I have visited this dentist once before	7 (11.5)
I have visited this dentist a few times	12 (19.7)
I visit this dentist when I have discomfort/ pain/ an emergency	5 (8.2)
I visit this dentist regularly for check-up and treatment	30 (49.2)

Table 3.7- Dental attendance of participants

Frequency of dental visits	Number (%)
For a regular dental check-up at least once a year	31 (51.7)
For a regular dental check-up every 1 to 2 years	11 (18.3)
For a dental check-up once in a while	4 (6.7)
I only go to the dentist when I have a problem/ pain	14 (23.3)

3.1.3 Thematic analysis

Six main themes were identified from questionnaire responses. They were; 'dental pain', 'pre-operative knowledge of root canal treatment/ understanding', 'anxiety', 'educational material', 'understanding of root canal treatment' and 'perception of root canal treatment'.

3.1.3.1 Dental pain

Over half of the participants were experiencing pain from their tooth when they presented to the dentist (52.5%) (Table 3.8). Approximately two-thirds of participants had experienced pain for over a week and approximately one-quarter of participants had experienced pain for over three months (Table 3.9). Participants reported a range of symptoms from the tooth (Table 3.10). For most of the participants, the pain from the tooth occurred on–and-off but approximately 10% had experienced a constant pain from the tooth. Ten percent of the participants reported that the tooth had not caused any pain. The following Tables present the nature of the pain caused by the tooth/ teeth requiring RCT.

Table 3.8- Pain level at presentation

Pain level	Number (%)
The worst pain	3 (4.9)
A lot of pain	711.5)
A little pain	22 (36.1)
No pain	29 (47.5)

Table 3.9- History of pain from the tooth

Length of time tooth has caused pain	Number (%)
Less than a day	2 (3.3)
Less than a week	7 (11.5)
Between a week and a month	19 (31.1)
1 – 3 months	12 (19.7)
3 – 6 months	7 (11.5)
Greater than 1 year	7 (11.5)
It has not caused any discomfort/ pain	6 (9.8)

Table 3.10- Self-reported pain symptoms

Symptom	Number (%)
Pain with cold food or drink	29 (18.2)
Pain with hot food or drink	23 (14.5)
Don't eat on that side as painful	21 (13.2)
Throbbing pain	23 (14.5)
Pain on biting	22 (14.5)
Pain for no reason	25 (15.7)
Pain that wakes at night	16 (10.1)

A significant relationship was found between the level of pain on presentation for RCT and patient perception of treatment. The more discomfort that the tooth was causing, the worse that the participant perceived their RCT (chi square test, P=0.04).

3.1.3.2 Pre-operative knowledge and understanding of root canal treatment

Approximately one third of participants reported having previously read about RCT prior to consultation. Participants who did so, obtained information from a number of resources but the internet was most commonly used to access information on RCT. Participants also reported having prior knowledge of treatment as a result of discussions with their dentists, from pamphlets and from speaking to family and friends. The majority of participants had previous experience of RCT (67.2%) and therefore gained prior knowledge of RCT through experience.

Qualitative findings indicated that participants presented with a range of knowledge about RCT prior to their treatment. Some participants had no knowledge whereas others had a reasonable understanding of the treatment. Other participants had made negative associations with RCT prior to treatment and some participants had an understanding of the treatment as they had previous experience of RCT.

Some participants knew nothing:

"Nothing," **(participants 18, 151, 157, 158, 167)**.

"Not much at all," **(participant 250)**.

Some participants had some knowledge:

"No more pain," **(participant 22)**.

"A last attempt to keep a tooth with bad decay," **(participant 217)**.

Other participants had a reasonable knowledge of the treatment:

"It allows a tooth that has had pulp damage to be restored. It needs to seal the canals to prevent further infection. It needs to be dressed and allowed to settle before final tooth restoration occurs. Once the damage to the nerves has occurred, the tooth will be non-vital," **(participant 7)**.

"Decay and/ or fillings are removed. The root canals are cleaned and files, along with antibiotic treatment is placed into the canals. The second treatment requires time (1 week) after the first treatment to ensure there is no infection or problems with the tooth settling. A filling is put in place and if required a crown is also put in place," **(participant 122)**.

"I know that the roots need to be drilled and filled with a dressing to kill off any bacteria. Then a second visit is required to put a permanent filling in the tooth and in approx. 6 months a crown is required," **(participant 220)**.

"Step 1 involves removing infected pulp from the root canal and inserting medication to alleviate the inflammation. Step 2- the insert is removed and the cavity is packed and a filling caps the tooth to seal it from future infection," **(participant 221)**.

Some patients had negative associations with the treatment:
"Is painful and expensive," **(participant 8)**.
"…It is also very expensive," **(participant 220)**.
"…costly," **(participant 216)**.

Some participants had knowledge as they had previous experience of RCT:
"I knew about the treatment as I had it done on another tooth at the Otago Dental School more than 40 years ago," **(participant 11)**.
"I have already had a few. Infection from a cavity spreads into the pulp, down the root into the bone. Typically, the pulp needs to be removed and replaced with a filling," **(participant 93)**.
"Quite a bit- this is my third!" **(participant 95)**.
"Reasonable amount. This is the third time I have had this type of work," **(participant 123)**.
"Had one done before at the Dental School. Temporary thing, removing pulp, filling forcefully," **(participant 164)**.

3.1.3.3 Anxiety

Over half of the participants reported that they did not feel anxious prior to attending the dentist (61%). Just over a third of participants reported experiencing anxiety prior to dental visits (39%). Around 20% of participants reported that they had avoided attending a dental visit in the past due to anxiety. Two participants reported feeling very anxious about RCT but overall, the same number of participants reported feeling anxious as not anxious prior to RCT, (Table 3.11).

Table 3.11- Anxiety felt about having root canal treatment

Anxiety felt about root canal treatment	Number (%)
Very anxious	2 (3.3)
Anxious	24 (39.3)
Neutral	11 (18)
Do not feel anxious	24 (39.3)

A higher proportion of females (48.5%) reported feeling anxious prior to attending the dentist than males (26.9%) but no significant association was found between gender and feeling anxious prior to attending the dentist. Females (29.4%) reported that anxiety had prevented them from attending a previous dental appointment more frequently than males (3.8%). A significant association was found between being female and postponing a dental visit due to anxiety (chi square test, P=0.03). Females reported that they were anxious prior to RCT (48.6%) more frequently compared to males (34.6%) but there was no significant association between gender anxiety felt prior to RCT.

A higher percentage of older participants (55+ years-old) felt very anxious prior to RCT compared to younger participants (<55 years-old). There was no significant association between the age of the participant and how they felt prior to RCT (chi square test, P=0.35).

In this study, participants who had no previous RCT experience felt anxious more frequently prior to treatment (70.0%) compared with those participants with experience of RCT (29.2%). Participants with previous experience of RCT reported not feeling anxious more frequently prior to treatment. There was a significant association between previous RCT experience of the participant and anxiety felt prior to the current RCT (chi square test, P=0.02).

A significant relationship was found between participants feeling anxious prior to attending the dentist and not attending their appointment as a result (chi square test, P= 0.01). Significant relationships were also found between participants feeling anxious prior to attending the dentist and feeling anxious about RCT (chi square test, P= 0.01) and between anxiety preventing a past dental visit and perception of RCT. The more likely that anxiety had prevented the participant from attending the dentist in the past, the worse the participant perceived their RCT (chi square test, P=0.03).

Qualitiative findings indicated that participants experience anxiety prior to attending dental visits for a number of reasons. Some participants reported fear of the cost of treatment:
"…cost," **(participant 19,21, 121, 158)**.
"…expense," **(participant 220)**.

Other participants were fearful due to the possibility of experiencing pain:
"Pain…" **(participant 19, 121, 158, 219, 220)**.

Some participants reported anxiety due to aspects of dental procedures:
"For me, the sound of the drills is very stressful. I'm very sensitive to high-pitched sound," **(participant 11)**.
"I dislike the sound of the drill. To me it is a bit like nails being run down a blackboard," **(participant 14)**.
"Pain, discomfort from opening my jaw wide for a long time. Feel sick after visits," **(participant 211)**.
"due to the pain medication, I am given often doesn't work," **(participant 213)**.
"Uncomfortable and unpleasant having to open your mouth for extended time and with dirt and debris in mouth," **(participant 217)**.
"Discomfort, instruments in mouth, recovery from local anaesthetic, pain," **(participant 225)**.

One participant felt anxious about RCT due to what others had said*, "You hear so many horror stories about root canals,"* **(participant 181).**

Some participants were anxious due to a previous bad experience, often during childhood:
"It probably goes back to childhood experience of going to the school dental clinic ("the murder house")," **(participant 11)**.

"poor childhood pain relief in treatment in the UK," **(participant 15)**.
"I have had several bad experiences with my previous dentist which caused huge anxiety," **(participant 16)**.
"Early treatment as a child (60 years ago) was undertaken by an old dentist with antiquated equipment and techniques (treddle machine and scary manner)," **(participant 17)**.
"negative experience," **(participant 21)**.
"As a child, I had a lot of bad experiences with the school dental nurse," **(participant 213)**.
"Residual from childhood where visits often involved fillings and painful (not often uses numbing of any sort as far as I remember)," **(participant 216)**.

Other participants reported that they experienced anxiety due to a fear of the unknown:
"Fear of unknown," **(participant 151)**.
"not sure what to expect," **(participant 222)**.
"the unknown," **(participant 272)**.

There was a statistically significant increase in the number of times that the education was viewed prior to RCT when the participant felt anxious prior to attending dental visits ($p=0.03$). After viewing the educational material, the majority of participants felt neutral or calm about RCT treatment. However, six participants still reported that they felt anxious (Table 3.12).

Table 3.12- Effect of educational material on participant anxiety

How did the education make you feel about treatment?	Number (%)
Anxious	6 (10.3)
Neutral	24 (41.4)
Calm	22 (37.9)
Very calm	6 (10.3)

The two participants that reported feeling very anxious prior to RCT (Table 3.11), both felt neutral about their RCT experience post-operatively. Most participants who reported feeling anxious prior to RCT felt that RCT was better than they expected.

3.1.3.4 Educational material

The majority of the participants found the educational material clear or very clear and all found it helpful. The majority of the participants only viewed the educational material at the dental clinic. One third of participants viewed the material 2-4 times after receiving it and only one participant viewed the material more than five times. This participant reported feeling 'neutral' towards RCT. Over half of the participants found that they learnt more about RCT after viewing the educational material.

Some participants found that the material contained good information and some participants also liked the diagrams that were included:

"The pamphlet explained what a root canal procedure was about. There was a drawing which made it very clear," **(participant 4)**.

"All the information was good and clear," **(participant 5)**.

"Information given was easy to understand," **(participant 8)**.

"… a very well-written pamphlet," **(participant 14)**.

"Clear information- informed decision," **(participant 121)**.

"Good pictures and explanation," **(participant 158)**.

"It was clear. I looked up the procedure," **(participant 219)**.

"It was explained to be in very good detail," **(participant 222)**.

"The brochure stated exactly the procedure," **(participant 225)**.

"The information was clear and explained the procedure well," **(participant 246)**.

"Good explanation of the procedure," **(participant 255)**.

"Diagrams- clearly, easy to understand written documentation," **(participant 14)**.

"Diagrams and clear treatment plan on the handout," **(participant 16)**.

"The whole pamphlet was very informative," **(participant 20)**.

"It was great to have a reference to refer to for clarification," **(participant 181)**. *"The treatment provided matched explanations in the pamphlet so I understood what had happened and what to expect,"* **(participant 272)**.

Others mentioned that the additional educational material reinforced what they had discussed with their dentist:

"The material reinforced what my dentist explained to me," **(participant 242)**.

"Very helpful. It supported what the dentist had explained…. Although the dentist had explained the procedure and I have had the procedure done on other teeth before, the pamphlet gave me the chance to understand all aspects," **(participant 272)**.

Some participants did not want to know as much information as was included in the educational material:

"*I am not a technical person so do not want to know all the process etc.,"* **(participant 17)**.

"Ignorance is bliss," **(participant 98)**.

"Generally OTT (over the top)," **(participant 125)**.

"I was more interested in just getting the work done," **(participant 126)**.

"Didn't want to know- was happy to leave up to the dentist," **(participant 153)**.

"Too much information, just skimmed. Didn't want to know everything," **(participant 164)**.

"I am the type of person who doesn't want to know too much about the procedure or I will over think what is going to happen," **(participant 213)**.

One participant wrote, *"the diagram makes me more nervous,"* **(participant 213)**.

Some participants did not look at the material:

"Didn't need any," **(participant 151)**.

"Didn't bother looking," **(participant 157)**.

"Didn't read," **(participant 160)**.

The majority of participants in all educational groups found the information in the education material 'clear' or 'very clear'. There was no significant relationship between the type of educational material that the participant received and how clear they felt the material was (chi square test, P=0.29).

3.1.3.5 Understanding of root canal treatment

Over half of participants reported having better knowledge about treatment after education and their RCT.

One participant documented that RCT was *"A last attempt to keep a tooth with bad decay*,**"** prior to commencing treatment**.** When they were asked the same question after completion of the treatment, it would appear that they had more of an understanding of RCT: *"It is a last attempt to retain a badly decayed tooth. The inside of the tooth (the nerve part) is cleaned and filled with new medicated fillings, then a crown is glued over it,"*
(participant 217).

Another participant also appeared to have a better understanding, reporting *"my dentist has explained the cause and treatment,"* prior to treatment. They wrote, *"number 47 required RCT because of damage from deep fillings the tooth was highly inflamed. The dental pulp is removed and the canals cleaned and sealed. A crown composite completes restoration,"* after receiving educational material and completion of RCT **(participant 127)**.

"Removal of dead or damaged nerve," was what one participant documented as their knowledge of RCT prior to treatment. After they received the new pamphlet and treatment was completed, they wrote*, "two stage process, removing nerve abscess causing pain. Refill tooth with filling,"* to answer the same question, **(participant 92)**.

Others felt that they did not gain any knowledge after receiving the educational material and completing RCT:
"Not much else," **(participant 157)**.
"Same, already had researched." **(participant 161)**.
"What I already knew," **(participant 163)**.
"I don't know anything more than what I previously knew," **(participant 242)**.

3.1.3.6 Perception of root canal treatment

The majority of participants felt neutral towards their RCT or that the RCT was better than they had expected after completion of treatment (Table 3.13). If participants required another RCT in the future, most felt better about having it (74.2%).

Table 3.13- Perception of root canal treatment

Perception of RCT received	Number (%)
Worse than expected	5 (8.8)
Neutral	20 (35.1)
Better than expected	17 (29.8)
A lot better than expected	15 (26.3)

Table 3.14- Opinion on receiving root canal treatment in future

I feel better about having another RCT in future	Number (%)
Strongly agree	16 (27.6)
Agree	27 (46.6)
Neutral	11 (19)
Disagree	3 (5.2)
Strongly disagree	1 (1.7)

Over half of the participants found RCT better than they expected and wouldn't feel as bad about having another RCT if required:

"Less painful than I expected. Root canals are supposed to be 'horror stories'," **(participant 15).**

"It wasn't as bad as I thought and had heard," **(participant 20)**.

"It didn't hurt at all," **(participant 40)**.

"Not as bad as people say. Worse things can happen to people every day of the week," **(participant 160)**.

"I thought it would be painful and uncomfortable but it was fine and no pain," **(participant 94)**.

"Expected it to be more painful," **(participant 151)**.

"*Much more relaxing and pain-free that what I expected,"* **(participant 222).**

"*Wasn't as bad as I expected,"* **(participant 255).**

Some patients found that the procedure was time-consuming:
"The pain was less than expected, but the duration of each treatment step made it worse," **(participant 8)**.
"The process takes a long time," **(participant 17)**.
"Not painful but time consuming," **(participant 223)**.
However, others found it to be a quick procedure:
"It went well and quickly," **(participant 125)**.
"Didn't really hurt. Pretty quick," **(participant 161)**.

Of the participants above, who found the procedure was time-consuming, Participants 8 and 17 both perceived RCT as 'worse than expected' post-operatively. Participant 223 reported feeling neutral towards their RCT post-operatively.

After the completion of treatment, a higher percentage of participants who did not feel anxious prior to the treatment strongly agreed that if they required another RCT, they would feel better about the experience (62.5%) compared with participants who felt anxious prior to RCT but this did not reach significance (chi square test, P=0.10).

There was no significant relationship between the type of educational material that the participant received and how they perceived their experience of RCT (P=0.36). The majority of participants in all educational groups 'agreed' or 'strongly agreed' that they would feel better about having RCT on another tooth if it was required and this was unrelated to the type of education material they received.

Almost half of participants reported that they would prefer a discussion with their dentist and to receive an educational pamphlet prior to commencement of treatment. Provision of online information was the least popular option for preferred method of education (Table 3.15).

Table 3.15- Preferred method of root canal treatment education

Preferred method of education	Number (%)
Discussion with dentist only	31 (37.3)
Discussion and pamphlet	37 (44.6)
Discussion and online link to website	15 (18.1)

Participants were able to make additional comments at the end of the questionnaire, *"As much information for regular patients is important and in as many forms as possible. Understanding procedures means less worry/ anxiety regarding the procedure,"* **(participant 7).**

"I did come away from the experience far more informed," **(participant 5).**

"As long as there is a discussion with my dentist first I'm happy to be given any other information," **(participant 126).**

3.2 ANALYSIS OF GENERAL DENTAL PRACTITIONER INTERVIEWS

3.2.1 Introduction

General dental practitioners who practice in private dental clinics in Dunedin, NZ and at the Faculty of Dentistry, University of Otago participated in semi-structured interviews. They were asked to provide feedback on the different modes of educational material. They also shared their current process of obtaining informed consent for RCT. Interview transcriptions can be found in the Appendix section (Appendix X1-XVI).

3.2.2 General dental practitioner characteristics

Six GDPs who regularly preformed endodontic treatment participated in the interviews. The GDPs included four females and two males and ranged in age from their 20s to 40s. They had dental experience ranging from 3 years' to approximately 20 years' experience and some had postgraduate training.

3.2.3 Thematic analysis

Five main themes were identified. They were 'provision of patient education', 'informed consent', the 'new pamphlet', and the 'new website'. The analysis of results from the GDP interviews will be provided according to these themes.

3.2.3.1 Provision of patient education

GDPs reported that they always provided their patients with information on RCT and there were two sub-themes, the process of providing patient education and how it is presented.

Patient education process

Providing patients with information about RCT involves a conversation with patients about the procedure, as one GDP reported:

"*we have pretty detailed conversations before we get started. So obviously the first chat that we have is RCT vs extraction. We will talk in detail about root canal treatment. So that involves*

cost, that is normally the thing that I lead with because for some people, that puts them straight off and they don't want to hear anything more about it so it's kind of a waste of time," **(GDP 2).**

".....usually I will talk the patient through each appointment and tell them what to expect, verbally, also let them know that there can be a varying number of canals in each tooth and it can be more difficult than you think once you begin or it can be straight forward depending on the root structure and the teeth," **(GDP 3).**

Patient education presentation

Practitioners also mentioned that they normally provide patient education in various forms. These range from a diagrammatic representation of the RCT procedure to the benefits and risks associated with RCT: *"I usually draw them a diagram usually have a bit of a discussion of what caused their problem and how we can address it and I usually present to them several options, pros, cons, risks, complications involved with each of those things and then I try and create an unbiased approach and then I answer their questions and go from there",* **(GDP 1)**.

Others would provide patients with pamphlet and handouts with more information about the RCT procedure: *"...So usually I provide a pamphlet about what to expect about the procedure, how many appointments there might be a general cost estimate,"* **(GDP 3).**

3.2.3.2 Informed consent

The practitioners place great importance on providing a thorough and comprehensive discussion of treatment prior to obtaining consent from their patients to enable shared decision-making:*''... I want to hear back from them and a discussion surrounding that (treatment),''* **(GDP 1)**.

All of the practitioners interviewed provide a verbal discussion of treatment prior to obtaining verbal consent from their patient: *"discuss what I just talked about,"* **(GDP 5)**.

Treatment risks, alternative options to treatment and possible referral to an endodontic specialist during treatment are commonly discussed by the practitioners: *"outlining the risks and complications and their options for referral or the fact that they might need referral during the appointment and I give some idea of prognosis and I do that all verbally. I don't get written consent but just write in the notes what they have been told to make that informed consent,"* **(GDP 4)**.

One of the practitioners routinely obtains written consent: *"we have a handout um that included some risks, a general description of the procedure and has a space for the patient signature and my signature,"* **(GDP 3)**.

3.2.3.3 New pamphlet

All of the practitioners were positive about use of the new pamphlet compared with the NZDA pamphlet. They thought: *"…it (the new pamphlet) was much more comprehensive and it made quite a logical progression through the treatment and gave a bit more information (compared to the NZDA pamphlet),"* **(GDP 1)**. They also thought it was clear: *"I think it is written in layman's terms, pretty simple language,"* **(GDP 3)**.

It has "*good lay terms, simple diagrams, easy to follow and like I said, it covers questions that most people ask and it gives them time to read through it in their own time,"* **(GDP 5)**.

The new pamphlet contains additional information to the NZDA pamphlet that is available to dental practitioners in NZ who are members of the NZDA: *"about antibiotics and radiation which weren't mentioned in the NZDA pamphlet,"* **(GDP 4)**.

The pamphlet has more *"information about the steps involved especially in terms of the breakdown of appointments … and it had more diagrams,"* **(GDP 3)**.

One practitioner mentioned that the new pamphlet is *"nicely laid out, diagrams are nice, no technical jargon, easy to understand and every step is covered,"* **(GDP 2)**.

It was mentioned that one dentist that their patients *"loved the images"* in the new pamphlet **(GDP 6)**. However, two practitioners mentioned that they felt that some patients may find there to be *"too much information"* in the new educational material **(GDP 1 and 3)**.

Two mentioned that they did not like some of the language and phrases used in the NZDA pamphlet as they were more *"technical"* than they would use when discussing RCT with their patient **(GDP 1 and 2)**.

One practitioner said that *"if people don't understand this (the new pamphlet) then I won't be able to make them understand either. I don't think it could be more simple."* **(GDP 2)**.

3.2.3.4 New website

The practitioners thought that the website was "*laid out clearly and so you are able to access it,"* **(GDP 1)** and *"you can easily find that information"* **(GDP 3)**.

"It had the tabs which made it easy to follow through. Again, it was quite patient friendly and very directed at a lay person's understanding," **(GDP 4)**.

Practitioners thought that patients may like the website due to the tab which *"is easy to click on what you want to know so instead of having to read through everything, you get to pick the thing that you are interested in and click on that which maybe some patients would like because reading is exhausting,"* **(GDP 2)**. Patients *"can go straight to what their concern is and find the answer,"* **(GDP 5)**.

One practitioner thought that *"it was a really straight-forward website," and therefore could be accessed by all patients"* **(GDP 1).**

Most practitioners had concerns about older patients not being able to use or access a website: *"Most patients would find it quite easy to access however, not everyone is online these days for example, the elderly, in rest homes, probably wouldn't be able to access a website,"* **(GDP 2)**.

"I think that anyone that can use a computer would find it easy to use. Elderly patients and people that aren't familiar with using computers might struggle but they wouldn't be able to use any computers so it wouldn't be a reflection of the website," **(GDP 4)**.

One practitioner liked the website but also thought that when compared with the pamphlet, it may not be as easy to access: *"probably not so much for people who aren't as computer savvy but, in general, I think giving the website nowadays, it is great. Again though, like when it is your hand (the pamphlet) and you are sitting there waiting, you're going to look at it whereas in a situation where you have to take that extra step (the website),"* **(GDP 6)**.

3.2.3.5 Preferred educational documents

All of the practitioners interviewed reported that they would prefer to provide additional educational material to their patients as well as a verbal discussion prior to RCT ie. the new pamphlet or website.

Two practitioners would prefer to present patients with additional material in both the new pamphlet and website format so that they had a choice*: "I think a combination of the website and the new pamphlet would be more appropriate,"* **(GDP 1).** *"Probably both the new pamphlet and the website. It's handy because people lose stuff all the time so having a link is quite good."* **(GDP 2)**.

Other practitioners would prefer to have information in just the written form to give to their patients: *"I would most prefer to give them the new pamphlet because it is a physical thing that they can look at, they can look at it…. whereas with the website, they have to go through the process of logging online and actually looking it up themselves which a lot of people may not do,"* **(GDP 3)**.

"I would probably go for the new pamphlet because then they have it, there's no chance that they may forget the website," **(GDP 5).**

Provision of the website was preferred by one of the GDPs: *"I like the idea of a website because now with a lot more people going paperless, and text messaging, you could text the website to the patient so they have got access,"* **(GDP 4).**

3.2.4 Summary

Trends and some significant associations between patient characteristics, and anxiety and their understanding and perception of treatment prior to and after the completion of their RCT were identified. Overall, results indicate that participants found the educational material clear and helpful. It improved their understanding of RCT and fostered a more positive patient experience but the opportunity for patients to have treatment explained by the dentist was very important.

General dental practitioners place importance on providing a pre-operative discussion of RCT with their patient. The GDPs liked the new educational pamphlet and website as they were comprehensive and clear. They prefer to provide their patients with additional educational material to enhance the informed consent process and to improve patient experience.

Chapter Four- Discussion and Conclusions

4.1 DISCUSSION

4.1.1 Introduction

In NZ, regulations within the scope of practice require GDPs to provide patients with a description of treatment (Dental Council of New Zealand, 2018). An educational resource is available through the NZDA and is commonly used by NZ GDPs. In this study, new, comprehensive educational material on RCT was developed in pamphlet form and as a website and distributed to eight private dental practices around NZ. General dental practitioners from the practices recruited participants who required RCT and met inclusion criteria. Participants filled out questionnaires before and after RCT.

The study evaluated the effect of enhanced educational material prior to RCT on patient anxiety, understanding and perception of treatment. The hypothesis was accepted. Patients generally felt less anxious and had a better understanding of RCT when they were presented with education prior to treatment. Some patient demographics influenced patients' perceptions of the educational material but overall there is no significant preference in the way that the education is presented.

4.1.2 Limitations and strengths of the research

The limitations of the research relate to the questionnaire and educational material design, sample size, randomization, and comparison of educational materials. As a result of the small sample size recruited for this research, it can be considered as a pilot study for future research.

The two newly developed experimental modes of education contained the exact same information but were presented differently. They contained more comprehensive information compared to the NZDA pamphlet. The information in new modes may not have been equivalent to the NZDA pamphlet and this variation in information and delivery of the material may have resulted in biased results. Due to the small sample size, no intra-participants comparison of the educational materials was made but the materials were compared between the different groups. Future research with a larger sample could include intra-participant comparison of the three different materials.

It was only possible to recruit 61 participants and so a larger study is required to validate the current findings and generalize to the population. However, the study provides a useful pilot and offers preliminary findings. Patient focus groups were not carried out but in this study but could be a possible idea for future research.

General dental practitioners were chosen to participate as they were acquaintances of the lead researcher. As a result of the use of purposeful sampling of GDPs, it is unknown if the participants were representative of all patients in NZ requiring RCT.

There were several possible reasons for recruitment difficulties and the most evident was busy practice environments and appointment scheduling. This frequently meant that there were challenges for GDPs to recruit potential patients. When a patient requires RCT, they often present acutely and in pain. The appointment length for these ‘relief of pain’ visits are often short, perhaps only 30-45 minutes. During this time, GDPs have to complete a history, reach a diagnosis, discuss treatment options, and provide ‘relief of pain’. Some of the dentists reported that this meant there was often insufficient time to invite participation in the study, provide an information sheet answer questions related to the study, obtain written informed consent, enable the patient time to fill out the questionnaire and read the educational material prior to commencing the treatment. When patients presented without pain, time was less of a problem. As a result, some participants in the study completed Questionnaire One and read the educational material after the commencement of treatment. This may have influenced the

results.

It is important in PBRN studies that clinicians are appropriately trained to ensure standardization of study methods (Gilbert et al. 2011). Despite calibration of GDPs prior to the study, compliance with the research protocol caused difficulty for some practitioners and some admitted to a lack of randomization. This was also attributed to a busy practice environment. One found that it was quicker to give participants the NZDA pamphlet as it was shorter for the participant to read as opposed to the other options. When they were time-short, they assigned the participant to the NZDA group. This may have biased results.

The strength of using a mixed methods research approach enables the researcher to take advantage of the benefits of quantitative and qualitative data (Johnson and Onwuegbuzie 2004, Creswell and Plano Clark 2007). Further, mixed methods research offers a greater depth of understanding research questions and findings are able to be translated to clinical practice (Onwuegbuzie and Leech 2005). The goal of this method of research is not to replace either a qualitative and quantitative approach but to take advantage of the benefits of both forms of research and to minimize the weaknesses. Mixed methods research often results in research that is superior to monomethod research (Johnson and Onwuegbuzie 2004, Creswell and Plano Clark 2007). To improve the quality and reliability of the findings this study used two methods of data collection from patients and GDPs. Questionnaires completed before and after RCT collected data on demographics, understanding and perception of RCT while interviews of GDPs provided contextual feedback from clinicians around process and usability of the educational material. By using the two methods, feedback from both the providers and the end-users of the educational material were obtained. This enabled a comprehensive understanding and analysis of the perspectives of both parties who use the material to be achieved.

Quantitative methodologies are used to determine causality, the generalizability and the size of effects whereas qualitative health methodologies investigate why and how something occurs, to develop theories or to determine one's experiences. Qualitative data can be used to assess the viability of quantitative results and quantitative data can be applied to explain qualitative findings (Fetters et al. 2013). Mixed methods research draws on the strengths of both and has proven useful in investigating health and healthcare processes and systems (Fetters et al. 2013). A mixed methods study design has been employed in different studies in the dental setting (Friedlander et al. 2015, Schwendicke et al. 2016, Templeton et al. 2016). In this study, qualitative data was collected to support quantitative results. Themes were found from the

results and hypotheses were then formulated using Grounded Theory methodology. In this study, hypotheses were developed after participant responses were gathered and grouped according to main themes. It is called hypothesis-gathering research as opposed to hypothesis-testing research. The grounded theory is based on two principles: questioning instead of measuring and also, generating hypotheses using theoretical coding (Chigbu 2019).

Different designs of mixed methods can be used (Palinkas et al. 2011, Fetters et al. 2013). A convergent design is often referred to as a concurrent design and when this type of mixed methods research is carried out, the qualitative and quantitative data are collected and analysis is carried out within a similar period. The two forms of data are collected and then merged following analysis in a parallel type of design (Fetters et al. 2013). In the present convergent mixed methods study, both quantitative and qualitative data was collected and analysed within a similar timeframe.

4.1.3 Pre-operative knowledge of root canal treatment / understanding

When patients have more of an understanding on RCT, they feel less anxious about their treatment (van Wijk and Hoogstraten 2006). Study participants presented to GDPs with a range of preexisting knowledge on RCT. As a result, it is important to ensure that adequate education is provided to enable patients to make informed treatment decisions and to feel more comfortable and less anxious about treatment. Patients must be aware of the risks, benefits, outcomes and complications associated with treatment (Dua et al. 2015).

4.1.4 Anxiety

Participants frequently reported feeling anxious prior to attending the dentist and as a result, dental appointments some participants admitted to having missed dental appointments in the past. Anxiety experienced prior to attending the dentist was found to be due to multiple factors: a previous negative experience that occurred in childhood, fear of the unknown, a dislike of the procedure, the drill, keeping their mouth open for extended periods of time, a fear of pain and also due to the perceived high cost of treatment. The results of the current study align with others who have highlighted similar reasons for patients experiencing anxiety in the dental setting (Berrgen and Meynert 1984, Moore and Birn 1990, Ragnarsson et al. 2003, Eli et al.

2004, Huh et al. 2015, Dou et al. 2018). Further, studies have shown that patients often associate RCT with pain and so treatment is often feared (Wong and Lytle 1991, Stabholz and Peretz 1999, Oosterink et al. 2009).

Females reported feeling anxious prior to attending the dentist more frequently than males. More females reported that anxiety had prevented them from attending a dental appointment in the past compared with males. There was a significant association between being female and postponing a past dental visit due to anxiety. Female participants also felt anxious prior to their RCT more frequently than males however there was no significant association found between gender and being anxious prior to RCT. Other studies have concluded that females tend to demonstrate higher levels of dental anxiety compared with males (Kleinknecht et al. 1973, Thomson et al. 1996, 1997, Stabholz and Peretz 1999, Armfield et al. 2006, Rajwar and Goswami 2017, Wali et al. 2019).

Patient age has been shown to influence anxiety in adults. The present study found that a higher proportion of older participants (55+ years-old) felt very anxious prior to RCT compared with younger participants (18-55 years-old) but this was not significant. This trend supports the findings of Kirova et al. 2010 who identified that there was a greater level of anxiety in 61-70-year-olds.

No significant association was found between the educational qualification of the participant and how they felt prior to RCT. Studies have found that more highly educated patients experience less dental anxiety (Peretz and Moshonov 1998, Ragnarsson et al. 2003, Armfield 2006, Kirova et al 2010). More highly educated patients experience less anxiety with regard to their RCT (Peretz and Moshonov 1998) and they are better at coping with dental fear (Rankin and Harris 1984).

Some researchers have suggested that there may be an association between ethnicity and fear and anxiety of endodontic treatment (Carter et al 2014, 2015a, 2015b, 2018). No significant difference between the first language or ethnicity of participants and level of anxiety was found however the sample size was small.

Participants who had previously experienced RCT more frequently reported that they did 'not feel anxious' about receiving RCT compared with participants who were having RCT for the first time. A higher proportion of participants who had not had a previous RCT felt anxious prior to RCT compared with those participants who had had a previous RCT. There was a significant association between having had a previous RCT and feeling calm about the current RCT required. This is in agreement with other studies which have found that patients who have experienced RCT are less anxious about treatment than patients who have not (LeClaire et al. 1988, Wong and Lytle 1991, Rousseau et al. 2002, Watkins et al. 2002, Khan et al. 2016).

Prior to commencing treatment, twenty-six participants reported feeling anxious about having RCT. There was a statistically significant increase in the number of times that a participant viewed the educational material prior to treatment if they were anxious. The majority of participants felt neutral or calm about RCT after viewing the education, however six participants still reported feeling anxious after viewing the educational material. There may have been external factors that contributed to this. Studies have found that presenting patients with educational material prior to commencing their dental and RCT reduces anxiety (van Wijk and Hoogstraten 2006, Dua et al. 2015, Wali et al. 2019). Therefore, it is important that clinicians are able to recognize signs of anxiety and appropriately manage and educate patients in an attempt to reduce patient anxiety (Khan et al. 2016).

4.1.5 Educational material and understanding of root canal treatment

Patient education is an essential part of patient care and it improves health outcomes, understanding and compliance and reduces post-operative complications (Alexander 1999, Tait et al. 2014, Paterick et al. 2017). Education involves providing patients and their caregivers the necessary information on clinical conditions, procedures, or required treatment regimens intended to improve the health status of the patient. Practitioners should provide information and allow shared discussion with their patient enabling patients to ask questions. Additional education material, for example, in the form of a pamphlet or a website can be provided as part of the informed consent process.

Patients are less anxious and have a better understanding of their RCT when they are well informed about the treatment (van Wijk and Hoogstraten 2006, Khan et al. 2016, Jothish et al. 2019). Obtaining informed consent prior to RCT is crucial and the current study found there

was unanimous agreement amongst GDPs that it was important to provide patients with information about RCT. Similar observations have been made by van Wijk and Hoogstraten (2006) who found that fear and anxiety levels were reduced as a result. All of the GDPs interviewed currently have a discussion with patients about what RCT involves, benefits and risks associated with performing or not undergoing the procedure. Practitioners use various forms of patient education, ranging from conversation to providing patients with pamphlets and others sources of information. They believe that equipping patients with such information enables them to make an informed decision, and to prepare them for the procedure. Further, it ensures that a well-informed patient can take part in making decisions about their health care (El Azem et al. 2014). Provision of consent by patients prior to treatment can be verbal or written. The DCNZ, the regulatory body for all oral healthcare professionals in NZ, requires GDPs to comply with a code of practice related to the informed consent process (DCNZ 2018).

The new pamphlet designed for the study provides a comprehensive overview of RCT. It is simple and written in lay terms. It is important that the educational material is appropriate to enable the patient to make an informed decision so the new pamphlet is clearly laid out and includes stylised diagrams and photographs to aid in discussion of RCT including the risks, benefits, outcomes and complications associated with treatment (Dua et al. 2015). The majority of participants felt that the educational material was clear and helpful in their understanding of RCT. They found the information and the diagrams included in the educational material helpful. Studies have found the use of images beneficial for patient understanding of treatment (Houts et al. 2005, Dowse et al. 2010).

The GDPs found the new pamphlet more comprehensive and easier to understand than the NZDA pamphlet. The importance of the information being thorough, written in lay terms, and illustrations to explain the treatment was emphasized by the practitioners. Research indicates that these are key features of an educational document that make them easier for the patient to understand (Morrow 1980, Alexander 2000, Houts et al. 2005, Dua et al. 2015). The GDPs liked that all treatment steps were included in the pamphlet and that alternatives to treatment were also mentioned, which are crucial components of educational material (Murphy et al. 2000).

The same information in the pamphlet is presented in the website however the website form of education was favoured less than the pamphlet by GDPs. The website has a pull-down tab which enables the reader to select their topic of interest as opposed to being presented with all of the information as in the pamphlet. A website/ multimedia method of presentation is effective in patient education, improving understanding and reducing anxiety (McGregor 2003, Al-Asfour and Andersson 2008, Wakimizu et al. 2009, Ryhanen et al. 2010, Hung et al. 2011, Wilson et al. 2012 Nehme et al. 2013, Wood et al. 2015, Bowers et al. 2017, Pei et al. 2017). It is important to have an understanding the preferred method of education of GDPs in NZ as they know their patient cohort and applicability of the materials.

As well as being easy to understand, it is important that educational material is accessible. Research has found that factors such as access to technology, internet connection and the ability to stream an application of a certain size may affect the access to multimedia education (Gerber et al. 2005, Wilson et al. 2012). As today's population becomes increasingly familiar with technology, the aging population may be more comfortable with accessing online information in the future. The GDPs believed that the website will be accessible for most of the population but older people or those who do not have access to the internet may not be able to view the website. Older patients have been found to use computers less than younger patients (Gerber et al. 2005). This could be overcome by having the website available on a device which can be viewed in the clinic prior to the patient leaving. The same study also recommends that a touch-screen as opposed to a device with a keyboard may make such technology more user-friendly (Gerber et al. 2005).

Most of the participants would prefer to have a discussion of treatment with their dental practitioner and to receive a supplementary pamphlet about treatment prior to RCT. In contrast, a discussion and receiving supplementary information online was not viewed as favourably. Fewer participants were randomly assigned to the website group in the study compared to the groups that received the pamphlets. This may have affected this response to the preference of presentation of education. Due to the small sample size, these results may not be generalisable.

A review of the literature comparing print and multimedia formats for presenting health educational material to patients concluded that there was no difference between the two methods of educational presentation and in the majority of studies, they both were equally as effective as each other (Wilson et al. 2012). The aim of an education programme is not to use

the intervention solely but to use it as an adjunct to existing mechanisms to enhance education, for example by encouraging increased discussion with the practitioner (Murphy et al. 2000, Sobel et al. 2009). In the current study, the presentation of the educational material was found to increase patient understanding and reduce anxiety for most patients but there was no significant difference between the different educational modes.

Some of the participants reported that the educational material was too comprehensive and they would prefer not to know about the treatment. Some of the GDPs also mentioned that some patients do not want to know about the treatment. 'Blunting' patients prefer not to be educated about their treatment (Miller 1995). Practitioners should recognize that this is the case for some patients. Ethically, there is a minimum amount of information that practitioners need to provide prior to treatment. Presentation of an educational pamphlet could be an option in this situation as then it is up to the patient to read.

Feedback on the educational material was obtained from both GDPs and patients. Studies have found that it is important to gain feedback from both practitioners and the end-users of education material to enable further development (Wilson et al. 2012, El Azem et al. 2014).

4.1.6 Perception of root canal treatment

Post-operatively, most of the participants felt that the treatment was better than they expected and if they were to require another one in the future, they felt better about it. One study found that the majority of patients that have undergone RCT would be happy to have another treatment if required (LeClaire et al. 1988).

Participants who were more anxious prior to RCT perceived the treatment less favourably compared to less anxious participants. The more discomfort that the tooth was causing, the worse that the participant felt that the RCT experience went. Dentally anxious patients react differently to non-anxious patients in the dental setting (Corah et al. 1978). A study found that more anxious patients may be less satisfied with education and treatment that they receive (Herrera-Espiñeira et al. 2009). It has also been found that anxious patients expect more fear and pain from treatment (Arntz et al. 1990, van Wijk and Hoogstraten 2009).

4.1.7 Translation of findings to clinical practice

It was apparent from the findings of the current study that participants often report feeling anxious prior to attending the dentist and prior to RCT. This anxiety can prevent some patients from attending their appointment. Presenting patients with educational material prior to RCT improves understanding. After receiving education and having RCT completed, participants in this study often felt that the treatment was better than they expected and they felt less anxious about a future treatment if required, as a result. Although the results must be considered within the constraints of a small sample size the findings still assist in informing the usefulness of providing enhanced educational material to patients in GDP.

It is important that patients receive information from their dentist prior to RCT to enable them to make an informed choice. It is not necessarily the way that the education is presented to patients, but the fact that they receive information with regard to their treatment prior to RCT that is important. It is intended that the pamphlet and website created for the purposes of this research could also be implemented into private practices in NZ to be available for patient who require RCT. Recommendations could also be made to the NZDA regarding improvements to the current pamphlet.

4.1.8 Recommendation for future research

To determine whether there was a difference between the different types of education received, recruitment of a larger sample involving more dental practices and provision of the different modes to each participant would enable comparison and generalization of findings. Patient focus groups were not carried out as part of this study but would enable triangulation of findings to strengthen understanding.

4.2 CONCLUSION

This thesis presents a valuable insight into patient understanding, anxiety and perceptions about RCT and the importance of providing supplementary educational material to patients prior to treatment and the usability and value of enhanced material for clinicians. Overall, GDPs and participants found the new educational material clear, comprehensive and helpful and it fostered a more positive patient experience. The presentation of additional educational material, regardless of the mode, prior to RCT increases understanding and improves anxiety and perception of treatment for patients. It is assumed that patients are then able to more confidently make informed decisions and feel better about RCT. Practitioners must recognize that anxiety is commonly felt and understanding is often lacking prior to treatment and provide comprehensive education and discussion to improve patient experiences of RCT.

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Appendices

Appendix I. Maori consultation

NGĀI TAHU RESEARCH CONSULTATION COMMITTEE
TE KOMITI RAKAHAU KI KĀI TAHU

Tuesday, 04 July 2017.

Dr Lara Friedlander,
Faculty of Dentistry - Department of Oral Rehabilitation,
DUNEDIN.

Tēnā Koe Dr Lara Friedlander,

The influence of educational information on patient understanding and perceptions of root canal treatment

The Ngāi Tahu Research Consultation Committee (the committee) met on Tuesday, 04 July 2017 to discuss your research proposition.

By way of introduction, this response from The Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum it states ″Ngāi Tahu acknowledges that the consultation process outline in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago″. As such, this response is not ″approval″ or ″mandate″ for the research, rather it is a mandated response from a Ngāi Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (in that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

As this study involves human participants, the Committee strongly encourage that ethnicity data be collected as part of the research project. That is the questions on self-identified ethnicity and descent, these questions are contained in the latest census.

The Committee commedns the researchers for undertaking to disseminate findings to relevant Māori health organisations and to Professor John Broughton and Malcolm Dacker, who are involved in Māori Dental Health, University of Otago.

The Ngāi Tahu Research Consultation Committee has membership from:

Te Rūnanga o Ōtākou Incorporated
Kāti Huirapa Rūnaka ki Puketeraki
Te Rūnanga o Moeraki

We wish you every success in your research and the committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 04 July 2017 to 4 January 2019.

Nāhaku noa, nā

Mark Brunton
Kaiwhakahaere Rangahau Māori
Research Manager Māori
Research Division
Te Whare Wānanga o Otāgo
Ph: +64 3 479 8738
Email: mark.brunton@otago.ac.nz
Web: www.otago.ac.nz

Appendix II. Ethical approval

H17/097

Academic Services
Manager, Academic Committees, Mr Gary Witte

24 August 2017

Dr L Friedlander
Department of Oral Rehabilitation
Faculty of Dentistry

Dear Dr Friedlander,

I am again writing to you concerning your proposal entitled "**The influence of educational information on patient understanding and perceptions of root canal treatment**", Ethics Committee reference number **H17/097**.

Thank you for your email of 23rd August 2017 with response attached addressing the issues raised by the Committee.

On the basis of this response, I am pleased to confirm that the proposal now has full ethical approval to proceed.

The standard conditions of approval for all human research projects reviewed and approved by the Committee are the following:

Conduct the research project strictly in accordance with the research proposal submitted and granted ethics approval, including any amendments required to be made to the proposal by the Human Research Ethics Committee.

Inform the Human Research Ethics Committee immediately of anything which may warrant review of ethics approval of the research project, including: serious or unexpected adverse effects on participants; unforeseen events that might affect continued ethical acceptability of the project; and a written report about these matters must be submitted to the Academic Committees Office by no later than the next working day after recognition of an adverse occurrence/event. Please note that in cases of adverse events an incident report should also be made to the Health and Safety Office:

http://www.otago.ac.nz/healthandsafety/index.html

Advise the Committee in writing as soon as practicable if the research project is discontinued.

Make no change to the project as approved in its entirety by the Committee, including any wording in any document approved as part of the project, without prior written approval of the Committee for any change. If you are applying for an amendment to your approved research, please email your request to the Academic Committees Office:

gary.witte@otago.ac.nz

jo.farrondediaz@otago.ac.nz

Approval is for up to three years from the date of this letter. If this project has not been completed within three years from the date of this letter, re-approval or an extension of approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

The Human Ethics Committee (Health) asks for a Final Report to be provided upon completion of the study. The Final Report template can be found on the Human Ethics Web Page http://www.otago.ac.nz/council/committees/committees/HumanEthicsCommittees.html

Yours sincerely,

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8256
Email: gary.witte@otago.ac.nz

c.c. Professor K M Lyons Department of Oral Rehabilitation

Appendix III. Participant information sheet

Participant Information Sheet

Study title:	Influence of educational information on patient understanding and perception of root canal treatment	
Principal investigator:	**Name** Lara Friedlander **Department** Department of Oral Rehabilitation **Position** Endodontist/ Senior Lecturer	Contact phone number: 03 479 7126
Student Researcher	**Name** Lucy Sullivan **Department** Department of Oral Rehabilitation **Position** DClinDent (Endo) Postgraduate	03 479 7062

Introduction

Thank you for showing an interest in this project. Please read this information sheet carefully. Take time to consider and, if you wish, talk with relatives or friends, before deciding whether or not to participate.

If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

What is the aim of this research project?

This study aims to determine if information provided to patients before root canal treatment influences their dental experience.

Who is funding this project?

This study is funded by the Faculty of Dentistry, University of Otago.

Who are we seeking to participate in the project?

We need 200 participants who are over 18 years of age and of any ethnic group who require root canal treatment of a tooth. Participants must not have had root canal treatment previously on the same tooth.

If you participate, what will you be asked to do?

We will ask you to fill out two short questionnaires during your treatment. The first at your consultation appointment and then after your treatment has finished. This will not identify you and take approximately 5-10 minutes. At your first visit, your dentist will discuss your treatment with you and at the same visit you may also receive extra information about root canal treatment in either pamphlet or electronic form. You will be able to take the pamphlet with you or be given the link to view the website away from the clinic . You will have the ability to ask questions related to your treatment. At the end of your treatment you will be asked to fill out a second questionnaire which will take approximately 5 minutes. Questionnaire data will provide information related to patient understanding of root canal treatment, dental experiences and perceptions of treatment.

You may be asked to participate in an interview where you can share your views on the educational material that you received and help to further develop it. This is optional and further information will be provided to you before you agree to this. You can still participate in the study even if you are unavailable to participate in an interview.

No extra appointments will be required to participate in this study and normal fees for root canal treatment will apply. These will be discussed by your dentist.

Is there any risk of discomfort or harm from participation?

Participants require root canal treatment which is a common dental procedure. The research will not cause any additional discomfort or harm to participants.

What data or information will be collected, and how will they be used?

Information will be collected from two questionnaires. Common themes from the responses will be reported in a thesis and published to improve knowledge .Participants may also be selected to participate in an interview.

What about anonymity and confidentiality?

The data collected will be used solely for the purposes of this research. If you are selected and wish to participate in an interview, it will be audio recorded, but your response will remain anonymous. No material that can personally identify you will be used for this study. Only the researchers directly involved in this study will have access to the raw data. Data obtained as a result of the research will be retained in secure storage for at least 10 years as required by the University's research policy. The

results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand).

If you agree to participate, can you withdraw later?

You may withdraw from participation in the project at any time and without any disadvantage to yourself.

Any questions?

If you have any questions now or in the future, please feel free to contact either:

Name Dr Lara Friedlander **Position** Endodontist/ Senior Lecturer **Department** Department of Oral Rehabilitation	Contact phone number: 03 479 7126
Name Professor Nicholas Chandler **Position** Head of Discipline of Endodontics **Department** Department of Oral Rehabilitation	Contact phone number: 03 479 7124
Name Dr Ben Daniel **Position** Coordinator and Senior Lecturer **Department** HEDC, Educational Technology	Contact phone number: 03 479 5362
Name Lucy Sullivan **Position** DClinDent (Endodontics) Postgraduate **Department** Department of Oral Rehabilitation	Contact phone number: 03 479 7062

This study has been approved by the University of Otago Human Ethics Committee (Health). If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (phone +64 3 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Appendix IV. Participant consent form

Study number:
Practice location:

Influence of educational information on patient understanding and perception of root canal treatment

Principal Investigator:
Dr Lara Friedlander
MDS(Endo) PhD(Otago) FRACDS
Endodontist / Senior Lecturer
Sir John Walsh Research Institute
Faculty of Dentistry
University of Otago
03 479 7062
lara.friedlander@otago.ac.nz

Student Researcher:
Lucy Sullivan
DClinDent (Endo) Postgraduate
Faculty of Dentistry
University of Otago
03 479 7062
prelu930@student.otago.ac.nz

CONSENT FORM FOR PARTICIPANTS

Following signature and return to the research team this form will be stored in a secure place for ten years.

Name of participant:……..

1. I have read the Information Sheet concerning this study and understand the aims of this research project.
2. I have had sufficient time to talk with other people of my choice about participating in the study.
3. I confirm that I meet the criteria for participation which are explained in the Information Sheet.
4. All my questions about the project have been answered to my satisfaction, and I understand that I am free to request further information at any stage.
5. I know that my participation in the project is entirely voluntary, and that I am free to withdraw from the project at any time without disadvantage.
6. I know that as a participant I will fill out a questionnaire before and after root canal treatment.
7. I may be asked to participate in an interview to discuss the educational material and my experience of the treatment. Further information will be provided to me prior to deciding to participate.

Study number:
Practice location:

8. I understand the nature and size of the risks of discomfort or harm which are explained in the Information Sheet.
9. I know that I may decline to answer any particular question(s) ,and /or may withdraw from the project without disadvantage of any kind.
10. I understand that root canal treatment will be carried out following normal clinical protocols.
11. I know that when the project is completed all personal identifying information will be removed from the paper records and electronic files which represent the data from the project, and that these will be placed in secure storage and kept for at least ten years.
12. I understand that the results of the project may be published and be available in the University of Otago Library, but I agree that any personal identifying information will remain confidential between myself and the researchers during the study, and will not appear in any spoken or written report of the study.
13. I know that there is no remuneration offered for this study, and that no commercial use will be made of the data.

Signature of participant:	Date:

Name of person taking consent	Date:

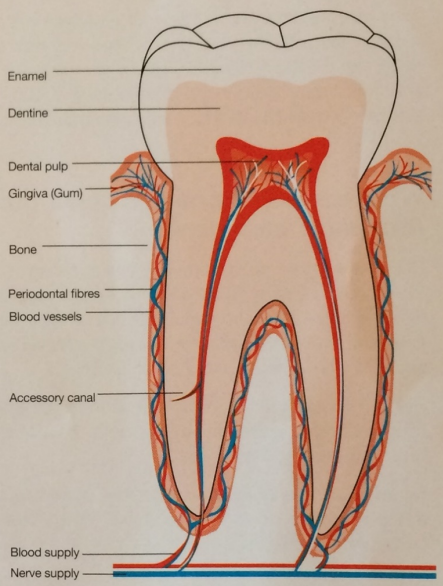
Appendix V. Pre-existing New Zealand Dental Association (NZDA) double-sided, A5 pamphlet on RCT.

Advice Series: The latest information for your oral heath

Root Canal Treatment

Inside a tooth is a fine space called the root canal. The root canal contains the dental pulp which consists of nerves and blood vessels. If the dental pulp becomes diseased or dies a toothache or an abscess may occur.

In the past these problem teeth were extracted but now your dentist can offer you root canal treatment to care for these teeth.



The healthy tooth

Why is root canal treatment necessary?

Root canal treatment is most often needed for the relief of pain. A number of conditions can lead to irreversible damage of the dental pulp.

- Decay
- Deep fillings
- Trauma
- Tooth fracture
- Infection

Sometimes there is no apparent cause.

Is root canal treatment painful?

Local anaesthetic and modern painkillers are used to provide comfortable treatment. Usually painful symptoms improve once treatment is started.

Continued over...

New Zealand Dental Assoc. | For the common good since 1905. NZDA.org.nz

How is a tooth restored during root canal treatment?

It is very important that any restoration adequately seals the root filling from infection by bacteria from the mouth.

Teeth requiring root canal treatment often have large fillings or extensive damage and will require a crown to restore them properly. These teeth are also weaker and the added protection of a crown is recommended.

How successful is root canal treatment?

If the root canals are able to be fully cleaned and sealed and the tooth properly restored then treatment has a very high success rate. The treatment may take several visits to complete with temporary fillings and dressings placed in the tooth between visits. Antibiotics are sometimes prescribed when an infection is present.

What complications can occur during root canal treatment?

Because the root canals are very fine and curved in some teeth, it may be difficult to clean the canals completely. Occasionally a piece of a file may break off in the root canal due to the strain placed on these fine instruments. Sometimes these are retrievable but they may also be sealed in the root canal as part of the filling.

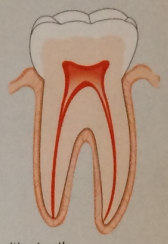
Pain or discomfort may occur between appointments due to ongoing tenderness of the tissues around the tooth, or a flare-up of an abscess, or a hair-line crack in the root.

An abscess or ongoing pain will rarely persist following root canal treatment. If this occurs the tooth will require some further treatment. Occasionally a surgical procedure may be required if discomfort persists.

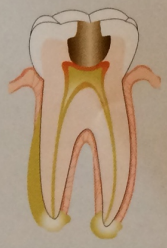
In some cases your dentist may refer you to a specialist endodontist for this treatment.

What is the cost?

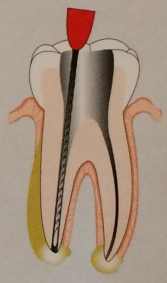
Your dentist will be able to give you an estimate after a thorough examination. The cost will depend on the difficulty and the time spent treating the tooth.



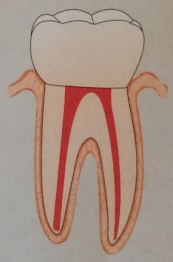
Healthy tooth



Tooth with dental abscess



File in place to clean and shape root canal



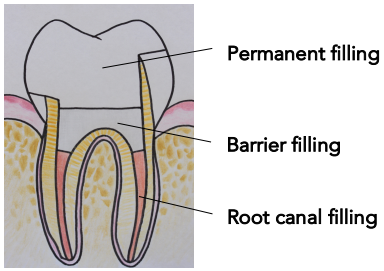
Root canal treatment completed and tooth crowned

New Zealand Dental Assoc. | For the common good since 1905. NZDA.org.nz

Check which treatment is best for you and the costs involved by talking to your dentist.
Find out more: *healthysmiles.org.nz*

6. If the tooth has settled down, the root filling(s) can be placed.
7. A permanent filling is provided for the crown.

Root canal treatment and filling complete



Are antibiotics required?

Not often. Your dentist will let you know if antibiotics might help. It is important that you let your dentist know if you have any feelings of fever or swelling.

Is any further treatment of this tooth needed?

Teeth that need root canal treatment are weak because they have often had a big filling or large amount of decay and there has been a hole cut in the top of the tooth to get to the root canals. To protect the tooth from breaking, a stronger laboratory made crown (cap) may be required.

What is the success of my treatment?

Treatment is usually very successful when the root canal is cleaned and filled.

Risks of root canal treatment

No treatment of any part of the body is without risk. Problems might include:

1. Mild pain between appointments
2. Bacteria return and cause reinfection
3. Fracture of the tooth as it is weak
4. Darkening of the tooth
5. Instrument breaking in the root canal
6. Perforation (an accidental hole made in the tooth)

What happens if the treatment is not successful?

Sometimes the root filling can be done again or surgery to the end of the root may be an option. This is a minor surgical procedure. The gum is peeled back and a filling is placed in the end of the root. Your dentist will advise you of the best option or refer you to a specialist for a second opinion.

Cost

The cost will depend on the tooth and how many appointments it takes to treat the tooth. Your dentist will discuss this with you.

What are alternatives to root canal treatment?

If you choose to do nothing and do not have root canal treatment, at some stage the tooth will cause you a bigger problem as the infection remains. Extraction is the only option and possibilities for filling the gap are:

- Dental implant- a device that is surgically placed in the jaw bone, with a replacement tooth crown on top.
- Bridge- a false tooth joined to the one or two of the adjacent teeth.
- Removable denture (plate)

Root Canal Treatment

The tooth

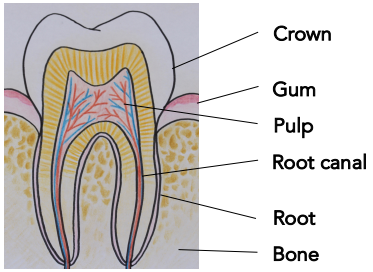
A tooth consists of a 'crown' and a root.

The crown is the part of the tooth which can be seen in the mouth. The root is the part in the jaw bone under the gum.

Teeth can have one or several roots.

Inside a tooth is a space called a root canal. This goes from the crown to the end of every root and contains the pulp.

Healthy Tooth



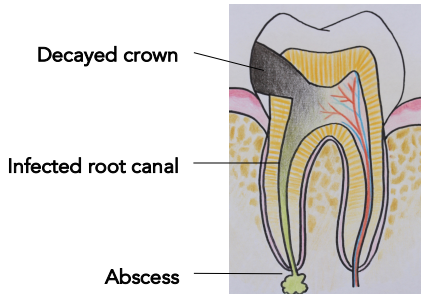
The pulp can become diseased and die. If this happens, the patient feels pain/ gets a toothache, or a swelling/ abscess may occur. Sometimes the patient will feel nothing.

The pulp may become diseased and/ or die for a number of reasons:

- Decay
- Deep filling
- Trauma (accident)
- Tooth fracture (wear and tear)
- Gum disease

If there is disease, the tooth may be saved or extracted. Saving it involves root canal treatment.

Tooth with a dental abscess as a result of decay



Saving a tooth has advantages over removing it:

- No gap
- Easier to eat and talk
- Teeth can move and gum problems can happen after a tooth is extracted

What is root canal treatment?

Treatment involves removing the infected pulp (nerve) from the root canal and replacing it with a filling. Depending on the tooth type there may be 1-5 root canals. Treatment normally takes two or more appointments. It can take longer if the tooth is very infected or if it has complicated roots. After the pulp is removed, a medication is put in the root canal space. At a later appointment, the filling is placed inside the root canal.

A dentist can carry out your root canal treatment, but if it seems difficult, you may be referred to a root canal specialist called an Endodontist.

Is root canal treatment painful?

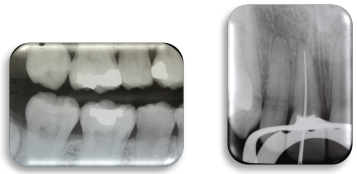
The tooth is numbed with local anaesthetic before treatment begins. The tooth might be sensitive after an appointment for 1-2 days. Your dentist may advise pain relief.

Are X-rays required?

X-rays are necessary during treatment so the length and shape of your roots can be seen. The number of X-rays needed depends on your tooth.

The radiation dose from dental X-rays is very low.

Two common types of X-rays taken during treatment



Treatment steps

Generally, several steps are required to finish your root canal but your dentist will advise you.

Appointment 1

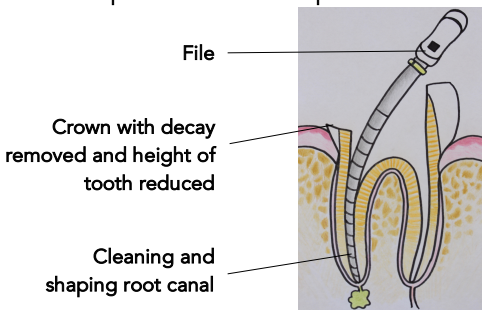
1. The tooth is numbed.
2. A dental dam is placed over the tooth.

Dental dam on a molar tooth

The dental dam keeps saliva and bacteria outside the tooth. It stops bad-tasting materials from getting in your mouth. The dental dam is essential for safety and your dentist will make it comfortable for you.

3. Decay/ deep fillings/ fractured parts of the crown are removed.
4. The root canals are found.
5. The root canal(s) is cleaned and shaped with antibacterial liquid and tiny instruments (files).

File in place to clean and shape root canal



6. An X-ray may be taken.
7. The inside of the canal(s) is shaped.
8. Medication is placed into the cleaned root canal(s) and the crown gets a temporary filling.

The dentist will let you know when to return for the next appointment and how many more appointments will be needed.

Appointment 2

1. The tooth may be numbed.
2. Placement of dental dam.
3. Temporary filling and medication may be removed.
4. There is continued cleaning of the root canal.
5. X-ray(s) may be taken.

Appendix VII. Practitioner information

The influence of educational information on patient understanding and perceptions of root canal treatment

Standardised verbal material for practitioners

Thank you for playing a key part in helping to conduct this research. It is important that all practitioners are calibrated in the discussion of what root canal treatment involves with patients, to allow for the most reliable results.
Please ensure discussion of all material below with your patient prior to provision of one of the four educational modes and treatment:

Please ensure discussion of the key details below with your patient (in lay terms):

1. The dental pulp and why their pulp has become diseased or has died
    a. decay,
    b. deep filling,
    c. trauma/ accident,
    d. tooth fracture/ wear and tear,
    e. gum disease
2. What root canal treatment involves
3. The restoration of the tooth and possibility of a crown in the future
4. The possibility of requiring a referral to an endodontist
5. An estimation of the time required for completion of treatment
6. Cost of the treatment
7. The risks that are involved with treatment
    a. Sensitivity after treatment
    b. Fracture of the tooth and/or root
    c. Instrument separation
    d. Persistent disease and the possibility of requiring retreatment of root-end surgery
    e. Perforation
    f. Discolouration of the tooth

Appendix VIII. Questionnaire One

Study number:
Practice location:

Consultation Appointment Questionnaire

Thank you for sharing your thoughts. We appreciate the time you have taken to help with this research. All of your information and answers will be kept confidential. No individual's answers will be identified. Participation is voluntary; you are not obliged to participate. However, if you decide to participate you are free to withdraw at any time. If you would like any more information, feel free to contact:

Principal Investigator:
Dr Lara Friedlander
MDS(Endo) PhD(Otago) FRACDS
Endodontist / Senior Lecturer
Sir John Walsh Research Institute
Faculty of Dentistry
University of Otago
03 479 7062
lara.friedlander@otago.ac.nz

Student Researcher:
Lucy Sullivan
DClinDent(Endo) Postgraduate
Faculty of Dentistry
University of Otago
03 479 7062
prelu930@student.otago.ac.nz

The project has ethical approval from the University of Otago:
http://www.otago.ac.nz/council/committees/committees/HumanEthicsCommittees.html

Please answer all questions. When presented with a tick-box, please mark the appropriate box with a tick as below:
☑

Patient details

Gender:
- ☐ Male
- ☐ Female

Age:
- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55+

Ethnicity:
- ☐ NZ European
- ☐ European
- ☐ Maori
- ☐ Pacific Peoples
- ☐ Asian
- ☐ Middle Easter/ Latin American/ African
- ☐ Other

Study number:
Practice location:

Is English your first language?

- ☐ Yes
- ☐ No

What is your highest level of education?

- ☐ Overseas secondary school qualification
- ☐ Level 1 certificate eg NCEA level 1
- ☐ Level 2 certificate eg NCEA level 2
- ☐ Level 3 certificate eg NCEA level 3
- ☐ Level 4 certificate eg apprenticeship
- ☐ Level 5 or 6 diploma eg advanced trade certificate
- ☐ Bachelor's degree and level 7 qualification
- ☐ Post-graduate and honours degrees
- ☐ Master's degree
- ☐ Doctorate degree
- ☐ Not applicable

Questionnaire

How long have you been seeing the dentist who is performing your root canal treatment?

- ☐ I have never been to see this dentist before
- ☐ I have visited this dentist once before
- ☐ I have visited this dentist a few times
- ☐ I visit this dentist when I have discomfort/ pain/ an emergency
- ☐ I visit this dentist regularly for check-up and treatment

What do you know about root canal treatment?

Have you ever had root canal treatment before?

- ☐ Yes
- ☐ No

Study number:
Practice location:

How many of your teeth currently require root canal treatment?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5+
- ☐ Don't know

Have you looked for information about root canal treatment before your visit today?

- ☐ Yes
- ☐ No

If yes, where did you get your information?

- ☐ Pamphlet/ handout
- ☐ Internet
- ☐ Spoken to family/ friends
- ☐ Spoken to my dentist
- ☐ Other

Are you a University of Otago dental school patient?

- ☐ Yes
- ☐ No

If yes, how long have you been on the waiting list for your root canal treatment?

- ☐ 0 – 1 month
- ☐ 1 – 3 months
- ☐ 3 – 6 months
- ☐ 6 – 12 months
- ☐ 1 – 2 years
- ☐ Greater than 2 years
- ☐ Don't know

How often do you visit a dentist (choose 1)?

- ☐ For a regular dental check-up at least once a year
- ☐ For a regular dental check-up every 1 to 2 years
- ☐ For a dental check-up once in a while
- ☐ I only go to the dentist when I have a problem/ pain
- ☐ I never go to the dentist

Study number:
Practice location:

Does your tooth require root canal treatment because it was damaged/ injured in an accident?

- ☐ Yes
- ☐ No

Pain and anxiety

Do you ever feel anxious (nervous, scared) before to going to the dentist?

- ☐ Yes
- ☐ No

If yes, briefly explain why:

_____

_____

_____

Has anxiety ever stopped you from going to the dentist?

- ☐ Yes
- ☐ No

How anxious do you feel about your root canal treatment?

- ☐ Very anxious
- ☐ Somewhat anxious
- ☐ Neutral
- ☐ Do not feel anxious

How much discomfort/ pain is the tooth causing **today**?

- ☐ The worst pain
- ☐ A lot of pain
- ☐ A little pain
- ☐ No pain

How long has the tooth been causing discomfort/ pain for?

- ☐ Less than a day
- ☐ Less than a week
- ☐ Between a week and a month
- ☐ 1 – 3 months
- ☐ 3 – 6 months
- ☐ Greater than 1 year
- ☐ It has not caused any discomfort/ pain

Study number:
Practice location:

How frequently has the tooth caused discomfort/ pain?

- ☐ On and off
- ☐ Constantly
- ☐ It has not caused any discomfort/ pain

How would you describe the discomfort/ pain that the tooth causes?
(Tick as many of the boxes as are applicable)

- ☐ Pain when eating/ drinking *cold* food/ drink
- ☐ Pain when eating/ drinking *hot* food/ drink
- ☐ I don't eat on that side because it causes pain
- ☐ Throbbing pain
- ☐ Pain on biting
- ☐ Pain without any reason
- ☐ Pain that wakes you up at night
- ☐ It does not cause discomfort/ pain

Any other comments?

Thank you for completing the questionnaire.

Appendix IX. Questionnaire Two

Study number:
Practice location:

Treatment Completion Questionnaire

Thank you for sharing your thoughts. We appreciate the time you have taken to help with this research. All of your information and answers will be kept confidential. No individual's answers will be identified. Participation is voluntary; you are not obliged to participate. However, if you decide to participate you are free to withdraw at any time. If you would like any more information, feel free to contact:

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The project has ethical approval from the University of Otago:
http://www.otago.ac.nz/council/committees/committees/HumanEthicsCommittees.html

Please answer all questions. When presented with a tick-box, please mark the appropriate box with a tick as below:

Questionnaire

Now that you have finished your root canal treatment please tell us briefly what you know about it.

Prior to your treatment, your dentist explained the procedure to you and may have given you some educational information related to your treatment (pamphlet or via an electronic device with a screen).

How clear did your find the information?

- ☐ Very clear
- ☐ Clear
- ☐ Neutral
- ☐ Unclear
- ☐ Very unclear

Study number:
Practice location:

Briefly explain your answer.

After the consultation appointment, how many times did you look at or read the information before your root canal treatment began?

- ☐ Only at the dental surgery
- ☐ 2 - 4 times
- ☐ More than 5 times

Briefly explain your answer.

How helpful was the educational information to your **understanding of root canal treatment?**

- ☐ Very helpful
- ☐ Helpful
- ☐ Neutral
- ☐ Unhelpful
- ☐ Very unhelpful

What part did you find most helpful?

Did you learn more about root canal treatment from the educational material than what you already knew?

- ☐ Yes
- ☐ No

Briefly explain your answer.

Study number:
Practice location:

What part of the educational material was most helpful?

_____
_____
_____

How did the educational information make you feel about attending for root canal treatment?

- ☐ Very anxious
- ☐ Anxious
- ☐ Neutral
- ☐ Calm
- ☐ Very calm

If you were anxious, what part of the treatment made you feel this way and why?

How would you describe your experience of root canal treatment?

- ☐ Much worse than expected
- ☐ Worse than expected
- ☐ Neutral
- ☐ Better than expected
- ☐ A lot better than expected

Why did you make this response?

After finishing this root canal treatment, I feel better about having another if I had to.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree

Study number:
Practice location:

How would you prefer to be receive your information about root canal treatment?
(Tick as many of the boxes as are applicable)

- ☐ Verbal discussion with my dentist
- ☐ Discussion with my dentist and written handout
- ☐ Discussion with my dentist and on-line link information

Any other comments

Thank you for completing the questionnaire.

Appendix X. GDP interview questions

Dentist/ focus group questions

What sort of education or information do you currently give your patients before root canal treatment.

How do you obtain informed consent from your patients prior to RCT?

How does the new pamphlet on RCT compare with the NZDA RCT handout?

How does the website on RCT compare with the NZDA RCT handout?

Do you think the website is accessible/ easy to use for all patients? If no, why?

Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?

Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?

Any other comments?

Appendix XI. GDP 1 transcribed interview

Dentist/ focus group questions
Interview 1

What sort of education or information do you currently give your patients before root canal treatment?
- I spend a bit of time with patients, I usually draw them a diagram usually have a bit of a discussion of what caused their problem and how we can address it and I usually present to them several options, pros, cons, risks, complications involved with each of those things and then I try and create an unbiased approach and then I answer their questions and go from there.

How do you obtain informed consent from your patients prior to RCT?
- Along similar lines I feel as though I have established informed consent where there is a bit of a 'to and from' when I'm discussing through complications and risks and time involved and the cost involved. Patients are reacting to that and asking questions, rather than me just if I tell you this, it doesn't necessarily mean that I have consent. I want to hear back from them and a discussion surrounding that.

How does the new pamphlet on RCT compare with the NZDA RCT handout?
- I think on one hand NZDA pamphlet is good because it's quite brief, it's to the point, it has a brief kind of run-down of things that happen but it uses some interesting terminology for a few things, some stuff that, for example a 'sterilising solution' I don't think is the case, and words like 'drilling a hole through the tooth' I don't think is great and it doesn't talk about some of the other consequences with like file removal and some of the other problems whereas the other pamphlet that was presented to me, I thought was much more comprehensive and it made quite a logical progression through the treatment and gave a bit more information.

How does the website on RCT compare with the NZDA RCT handout?
- The website was to a similar degree of the form- laid out clearly and so you are able to access it.

Do you think the website is accessible/ easy to use for all patients? If no, why?
- Yes, it was a really straight forward website.

Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?
- Yes

Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?
- I think a combination of the website and the new pamphlet would be more appropriate than the NZDA.

Other comments

- I think it is important that we educate patients as much as possible. I wonder if there might be a little bit too much information in there for a select few people (in the new pamphlet) but overall, it's much more comprehensive and the terminology is definitely more something than I can agree with than the NZDA.

Appendix XII. GDP 2 transcribed interview

Dentist/ focus group questions
Interview 2

What sort of education or information do you currently give your patients before root canal treatment?
- I like to think everything. We have pretty detailed conversations before we get started. So obviously the first chat that we have is RCT vs extraction. We will talk in detail about root canal treatment. So that involves cost, that is normally the thing that I lead with because for some people, that puts them straight off and they don't want to hear anything more about it so it's kind of a waste of time. So, I lead with the cost, definitely talk about how many appointments are needed in general depending on complexity. Always inform them on how long the appointments will be. Then talk about the risks which I like to sit with for quite a bit. Very important just to cover my own backside. The three main things that I like to talk about are pain, failure and separation of instruments. The first one is pain, and we discuss why that is and if we can't get you numb, we may just have to give you a course of antibiotics and just get you back on a day that we can get you numb. The second one is failure. If we can do it well, normally we can do it well but even if it is done well, it can still fail. And I just like to tell patients that tiny little files and sometimes tiny things can snap. I explain to them that is that happens, I'll let them know, try and take it out, sometimes we can leave it in but sometimes I'm going to have to send you to a specialist. So that's the other thing, if it's too hard for me, you might have to go somewhere else.
I don't get written consent. I write it in my notes in quite significant detail.

How does the new pamphlet on RCT compare with the NZDA RCT handout?
- It's much better overall. I'm not saying this one (NZDA) is bad but I think some of it might be a little bit more technical than I think I would explain it (NZDA). They're missing a few details. I think the diagrams on this one (new pamphlet) are really nice. Good things about this pamphlet; no technical jargon whatsoever, not even mentioning gingiva- just call it a gum, patients don't know what that is. I find it really easy to understand. I think most people would look at this and get a pretty good idea of exactly what would happen and I do think that it is in a nice order as well. It kind of covers everything that you need to know. It has given me some good ideas as well for example, I don't talk to patients about the x-rays and maybe I should start doing that. Some people might not like the idea, so that might have consented to treatment but now they're like 'maybe I don't want radiographs' so what do I do now, I can' do RCT without radiographs. It is handy as a clinician if we are explaining something, to be able to refer to this pamphlet (new) to make sure we have covered all bases.
It's nicely laid out, diagrams are nice, no technical jargon, easy to understand and every step is covered. This is great because I really do like to go through everything in quite specific detail and I have never really seen it on anything else.
The other thing is I like the replacement options on it as well because that is really important too.

How does the website on RCT compare with the NZDA RCT handout?
- Just the same as what I said before but the only thing is it is easy to click on what you want to know so instead of having to read through everything, you get to pick the thing that you are interested in and click on that which maybe some patients would like because reading is exhausting.

Do you think the website is accessible/ easy to use for all patients? If no, why?
- Most. Most people do now have internet and access to that kind of thing so whether it is on a phone, lap top or tablet. Most patients would find it quite easy to access however, not everyone is online these days for example, the elderly, in rest homes, probably wouldn't be able to access a website. Most people that wouldn't be able to access a website, will not be able to give informed consent anyway, so it will be people with dementia or some kind of mental disability or illness that prevents them from being able to access and being able to understand so it their case it would be pointless anyway. So, in general, most people could access this.

Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?
- Yes. I would hand it out for sure. It is very basic language. If you can't understand it, again maybe are you able to give informed consent anyway. If people don't understand this then I won't be able to make them understand either. I don't think it could be more simple.

Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?
- Probably both the new pamphlet and the website. Its handy because people lose stuff all the time so having a link is quite good.

Appendix XIII. GDP 3 transcribed interview

Dentist/ focus group questions
Interview 3

What sort of education or information do you currently give your patients before root canal treatment.
- So usually I provide a pamphlet about what to expect about the procedure, how many appointments there might be a general cost estimate. Usually I will talk the patient through each appointment and tell them what to expect, verbally, also let them know that there can be a varying number of canals in each tooth and it can be more difficult than you think once you begin or it can be straight forward depending on the root structure and the teeth. I let them know usually that they may have some inter-appointment discomfort or pain as part of the procedure, generally that settles down um and I also let them know that generally they need to have some kind of restorative kind of work done following the procedure so most likely a crown if it's a molar an also I let them know that there is a chance they may need to be referred to an endodontist if it becomes too difficult and also there is a chance it will fail.

How do you obtain informed consent from your patients prior to RCT?
- So again, we have a handout um that included some risks, a general description of the procedure and has a space for the patient signature and my signature and we would go through that before the procedure and put it in the file.

How does the new pamphlet on RCT compare with the NZDA RCT handout?
- So, I found it to be more comprehensive. It had more information about the steps involved especially in terms of the breakdown of appointments and what's going to go on at each appointment and it had more diagrams and yeah, generally just more information and a little bit more straightforward for me to follow.

How does the website on RCT compare with the NZDA RCT handout?
- The website I think is reflective of the pamphlet, each page is the same so a similar answer to what I just said; it's more comprehensive, there are more categories so you can click like what is the cost roughly or like what is the treatment success for example and you can easily find that information.

Do you think the website is accessible/ easy to use for all patients? If no, why?
- Yes, I think maybe only complaint is that when I first went on it I thought oh it's really short, it's only one page and then I realised that I had to click on the upper right menu button and then I saw the categories and I was like oh yea, this is easy to use.

Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?
- Yes, I think it is. I think it is written in layman's terms, pretty simple language. I imagine for some patients, they wouldn't want this much information and that would be their choice to whether they read it or not. But yea, it is easy to understand once you read it.

Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?

- So personally, I would most prefer to give them the new pamphlet because it is a physical thing that they can look at, they can look at it, you know it's in the handbag and they can take it out when waiting in the line at the grocery store before the procedure whereas with the website, they have to go through the process of logging online and actually looking it up themselves which a lot of people may not do

Any other comments?

- I wondered if perhaps in the 'what is the success of my treatment' category, whether that could've been elaborated a little bit just because it only says that it is usually very successful but it doesn't really cover the fact that sometimes root canals do fail and that sometimes, the next but I think talks about risks and does include bacteria returning and causing reinfection um but I think just in that category 'what is the success' that might be where a lot of the one I want to know and you can't really give proper percentages but perhaps a little more elaboration on that would be helpful.

Appendix XIV. GDP 4 transcribed interview

Dentist/ focus group questions
Interview 4

What sort of education or information do you currently give your patients before root canal treatment.
- When I was practising in Australia, I gave my patients the Australian Dental Association equivalent to the NZDA handout.

How do you obtain informed consent from your patients prior to RCT?
- I do that verbally, before the appointment, outlining the risks and complications and their options for referral or the fact that they might need referral during the appointment and I give some idea of prognosis and I do that all verbally. I don't get written consent but just write in the notes what they have been told to make that informed consent.

How does the new pamphlet on RCT compare with the NZDA RCT handout?
- I think the new one is clearer for a patient to understand. I think it is more patient-friendly so I think they can follow through. It probably addresses some concerns that patients might have more about antibiotics and radiation which weren't mentioned in the NZDA pamphlet.

How does the website on RCT compare with the NZDA RCT handout?
- It had the tabs which made it easy to follow through. Again, it was quite patient friendly and very directed at a lay person's understanding.

Do you think the website is accessible/ easy to use for all patients? If no, why?
- I think that anyone that can use a computer would find it easy to use. Elderly patients and people that aren't familiar with using computers might struggle but they wouldn't be able to use any computers so it wouldn't be a reflection of the website.

Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?
- It is. The only thing that I think would be good is when there is talk about radiation dose being low for radiographs, the thing that I always find with root canal patients is that they are often concerned about how many radiographs need to be taken and why, it just says that it (radiation) is 'low', but what is it low compared to? Is it low compared to a CBCT or is it low compared to their whole radiation experience in life? There I think it might be good to include a little thing of say, this might be equivalent to you sitting in the sun for an hour, or just the exposure or radiation that you are exposed to in life just in a lay person's term I think that would be cool but otherwise everything else was very clear and very easy to understand.

Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?
- I like the idea of a website because now with a lot more people going paperless, and text messaging, you could text the website to the patient so they have got access because it is kind of like one of those things that patients are quite overwhelmed at the appointment, they don't really take it on board but to receive a text message, with a website that they

could then click on, would probably be easy for this modern age but I think the paper version would be helpful for patients that don't have access to computers.

I do find the newer one is easier to understand. The thing I like about the newer one is the questions, I like how by saying it as a question, it's answering it because it's a good way for people to relate to.

For people who say I don't use the internet or I don't have access to internet on my phone or whatever, you would obviously give them the pamphlet.

Appendix XV. GDP 5 transcribed interview

Dentist/ focus group questions
Interview 5

What sort of education or information do you currently give your patients before root canal treatment.
- So I discuss the options um obviously tell them why they need a root canal, what's happened to the tooth and then discuss options like um referring them off to a specialist or myself doing it, discuss the actual procedure and what's involved and the cost of it, potential complications um I talk about the restorative requirements and options after they've had it done and what they'll need to consider once they've had the root canal, the predictive longevity or success of the treatment and whether you think it's worthwhile trying to save um and alternatives obviously like extraction or not doing it. We have made our own pamphlet and we have information on our website.

How do you obtain informed consent from your patients prior to RCT?
- So, discuss what I just talked about, um we don't actually do a written consent but we often, if we see a patient in pain, we often do an open and dress first and then send them home with information to consider options when they are not in pain and if it's an incidental finding, that's often at a consult appointment anyway and that gives a patient time to consider options.

How does the new pamphlet on RCT compare with the NZDA RCT handout?
- New pamphlet is actually much more thorough and informative. It covers common concerns that most of my patients have whereas the NZDA one doesn't.

How does the website on RCT compare with the NZDA RCT handout?
- The website um is, like I said with the new pamphlet, it covers much more information and patients can easily find, you know they can go straight to what their concern is and find the answer.

Do you think the website is accessible/ easy to use for all patients? If no, why?
- Yip absolutely. They don't need to have any dental knowledge to find what they want to know and it seems very straight forward. There's not a whole lot of stuff they have to sift through to find the answer that you want.

Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?
- yes, it has good lay terms, simple diagrams, easy to follow and like I said, it covers questions that most people ask and it gives them time to read through it in their own time.

Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?
- I would probably go for the new pamphlet because then they have it, there's no chance that they may forget the website and they'll actually get the info that they are after and then I also find that often people will read it at the time of the consult but then want to re-refer to it right before their appointment- so if they have got it there, they don't have to try

and remember the website down the track. But both the website and the new pamphlet are much more informative than the NZDA pamphlet.

Appendix XVI. GDP 6 transcribed interview

Dentist/ focus group questions
Interview 6

What sort of education or information do you currently give your patients before root canal treatment?
- So, I basically verbally describe the treatment and the alternatives etc and I explain to them what it is, how long it is going to take um what to expect during and after. So, it is just really a verbal explanation of the procedure.

How do you obtain informed consent from your patients prior to RCT?
- Just verbally.

How does the new pamphlet on RCT compare with the NZDA RCT handout?
- The feedback, I've had a bit of feedback from the people that have seen the new pamphlet. They've said that it's great to have everything in one place that you can just read through and they love the images. They're just sort of like, yea they just, they seem to be really positive about having something to read with them. So, I think it is probably as good or better than the NZDA one.

How does the website on RCT compare with the NZDA RCT handout?
- Well I think that the handout is better for the population that I see because they are an older population in general and um and so I think they prefer to just have something that they can just take away and read instead of having to go that extra step. Yea I think that is a blockage for them, having to go on a computer and type it in. I think basically, the handout is the way to go for most people.

Do you think the website is accessible/ easy to use for all patients? If no, why?
- Um yea probably not so much for people who aren't as computer savy but, yea in general, I think giving the website nowadays, it is great. Again though, like when it is your hand and you are sitting there waiting, you're going to look at it whereas in a situation where you have to take that extra step, or if the link is lost…

Do you think the material in the pamphlet and website is clear and easy for your patients to understand? Comments?
- Definitely.

Would you prefer giving your patients the NZDA handout, the new pamphlet or the website to refer to prior to their RCT? Comments?
- Well I would probably vote for your pamphlet because um I just am familiar with it, I just think it's great and I prefer it over the website just because you know, I can have a stack of them sitting right there and it is just easy to give them out.