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Front Cover: One step apexification with MTA in a central incisor with an open apex.
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All expressions of opinion and statements of fact are published on the authority of the writer under whose name they appear and are not necessarily those of the New Zealand Society of Endodontics, the Editor or any of the Scientific Advisers.

Arrangement
Articles should be typewritten on one side of A4 paper with double spacing and 3cm margins. The author’s name should appear under the title and name and postal address at the end of the article. If possible, the manuscript should also be submitted on computer disc, either Macintosh or PC compatible.

References
References cited in the text should be placed in parenthesis stating the authors’ names and date, eg (Sundqvist & Reuterving 1980). At the end of the article references should be listed alphabetically giving surnames and initials of all authors, the year, the full title of the article, name of periodical, volume number and page numbers.

The form of reference to a journal article is:

The form of reference to a book is:

Illustrations
Illustrations should be submitted as clear drawings, black & white or colour photographs and be preferably of column width. Radiographs are acceptable. However a black & white photograph is preferred. Illustrations must be numbered to match the text and bear the author’s name and an indication of the top edge on the back. Legends are required for all illustrations and should be typewritten on a separate page.
President’s Report

Once again the end of another year is fast approaching. I hope that you all have survived the past winter with not too many of the usual seasonal ills.

As I write this, poor Christchurch is suffering the brunt of nature’s force with continued aftershocks from the massive earthquake of several days ago. So much damage to all those lovely old buildings, but thankfully not much physical damage to the residents. I think everyone in New Zealand must have at least some friend or family in the region so we have all been touched by the event. Probably a timely reminder to us all that we live on a young country that still likes to party.

The Trans Tasman Endodontic Congress was a great success, with excellent speakers, such as Dr Stanley Malamed who was over last year for the conference in Wellington, Dr Asgeir Sigurdsson from the Eastman in London, Professor Harold Messer from Melbourne and our own Dr Robert Love from the University of Otago, to name but a few.

I would also like to bring to the members’ attention another very useful site that is being developed at the moment by International Association of Dental Traumatology. There is also a link to this site from the NZSE site. The International Association of Dental Traumatology has developed a dental trauma guide which is available online. While it is still incomplete it is fantastic and I have had cause to use it on more than one occasion already. I really do urge all members to check it out!

Once again I would like to thank all of the committee members for their hard work over the past year and Tina for putting together the journal. We are always on the lookout for interested individuals that would like to get involved with the society on a committee level. If anyone is interested please feel free to contact either myself or our secretary James, our emails are available on the society web site.

All the best and here’s to summer!

Sara Jardine
Dear members,

Diagnosis forms an integral part of successful endodontic treatment. The two review papers on digital radiography and sensibility testing in primary teeth contribute current knowledge to this aspect of endodontics. Two cases of teeth with open apices and treated with one step MTA-apexification are reported. Thank you very much to Variyini Yoganathan, Anna Kim, Artika Soma and Shalin Desai for their contributions.

Deborah Creagh is standing down as treasurer of the New Zealand Endodontic Society after many years of service. A special thanks to Deborah and her practice manager, Glennis Smith, for their dedication and hard work over the years.

I wish you all a happy and restful festive season.

Tina Hauman
Digital Radiography in Endodontics: advantages and disadvantages

Varayini Yoganathan

Introduction
Dental radiography was first attempted by Otto Walkhoff in 1895, two weeks after he had read of Wilhelm Roentgen’s use of X-rays for successful visualization of the human body. To achieve his image, Otto subjected himself to twenty five minutes of radiation exposure. In his report he documents “it was a true torture, but I felt a great joy at the sight of the results when I become aware of the importance of the Roentgen rays for dentistry.” Edmund Kells and Weston Price in 1899 realized the potentials of radiography in endodontic treatment for determining root lengths and the inadequacies of root fillings.

The relationship between endodontics and radiography has continued into the 21st century, where we depend on accurate and reproducible images for key endodontic stages; diagnosis, treatment planning, treatment procedures, and reviewing healing at recall appointments (Versteeg et al 1997). The images provide a source of vision in a profession which is largely dependent on tactile feel.

Conventional radiographic images have changed over time with improving image quality, contrast, and the speed at which images are formed. However improvements in film imaging have been overshadowed in recent times by the emergence of digital radiography systems. Introduced by Francis Mouyen in 1987, they have become a popular diagnostic tool and a mainstay in dental practices worldwide. A study focusing on the incorporation of new dental technologies in New Zealand general practices revealed that 35% had purchased a digital imaging system and 95% of these practitioners utilized the system on an everyday basis. Of those that were not using digital radiography, a large proportion (75%) had intentions to purchase digital imaging technology in the future (Tay et al 2007).

With many imaging systems available for use, it is important that commercial success is not the sole determining factor for purchase of imaging equipment. An appreciation of the imaging process, and an understanding of each system’s advantages and disadvantages in the practice of endodontics, should be considered.

Radiography
Radiography utilizes wave like forms of electromagnetic radiation in the form of photon particles. The X-ray unit emits photon particles which pass through structures in the head and neck to provide an image. Structures which are dense, such as bone, appear radio-opaque as limited photons are able to pass through to the capture device. Less dense structures allow the passage of more photons, producing a radiolucent image.

Technology has seen improvements in the imaging aspect of radiography from the use of conventional film to charge coupled devices, imaging phosphor plates, and more recently computer tomography.

Principals of Imaging
Conventional
Intra-oral film consists of silver halide grains in a gelatine matrix. On exposure to X-ray photons the silver halide particles are sensitized. The film is then prepared for chemical processing, where the sensitized silver halide particles turn black. Conventional film acts as the radiographic sensor with consequent image display.

Two dimensional digital imaging
Instead of silver halide grains the image is created through picture elements and small light sensitive elements. The picture elements are known as
pixels and can range in shades of grey depending on the degree of X-ray exposure. Pixels are arranged in columns and rows unlike the random distribution of crystals in standard film. Digital imaging is different to film in that sensors act only as the radiographic sensor while the image is visualized on screen.

Acquisition of a digital image can be indirect, semi-direct, or direct. In indirect acquisition the image from a conventional film is scanned onto a computer screen. Semi-direct image acquisition has an intermediate phase, which requires laser scanning before an image can be seen on screen. Direct image acquisition produces an image on the monitor immediately after an X-ray exposure.

Three dimensional digital imaging
Conventional radiography, regardless of film or digital capture device, provides partial information. Compression of three dimensional objects onto a two dimensional image has been noted in literature as a diagnostic hindrance (Cohenca et al 2007). To rise above this limitation, taking of additional radiographs with the modified paralleling technique can be attempted. Taking of the supplementary images does not guarantee that additional anatomical or diagnostic information will be revealed (Matherne et al 2008).

Three dimensional image techniques have been suggested as adjuncts to conventional radiographs. Techniques can include magnetic resonance imaging, ultrasound, tuned aperture computed tomography, computed tomography and cone beam computed tomography (Patel et al 2009).

Image Acquisition Systems
Imaging phosphor plates
Phosphor storage plates (PSP) use photo-stimulatable luminescence technology for image capture instead of film. Plates are composed of a flexible polyester base coated with a crystalline emulsion of europium activated barium fluorohalide compound. The plates come in similar sizing to conventional film, and the entire facing surface is used for image capture. Prior to use, the plate is bagged in a disposable plastic pouch to avoid cross-contamination. The patient is set up similarly to conventional radiography techniques for the lower exposure times. Once the X-ray energy reaches the plate, phosphor particles convert the energy into visible light and create a latent image that is stored on the plate. The plate is removed from the plastic pouch and placed in a scanner, which deflects a laser beam over the plate to release light energy. A photomultiplier within the scanner detects the released energy and translates it into an analogue signal which is then digitized on a computer screen. This process can take anywhere between 20 seconds to two minutes, depending on the number of plates placed in the scanner. Once the image appears on the computer, it is available for archiving and image enhancement. The used plate still contains a portion of the latent image; in order to clear the image, the plate must be flooded with a bright light source.

Charge Coupled Devices
Charge coupled devices (CCD) share similar technology to that found in digital cameras. Their sensor has a silicon chip with wells called pixel arrays. On exposure to X-ray photons, electrons are deposited in the wells, and transmitted to a sequential pattern by charge coupling. The analog signal is translated in a digital signal which is transferred to the computer to provide an almost instant image on the monitor.

The newer alternative to CCD technology is complementary metal oxide semiconductor (CMOS). CMOS sensors do not employ charge transfer, resulting in increased sensor reliability and lifespan. In addition, they need less system power to operate and cost less to manufacture. Evaluation of objective, task-based, image quality of the CMOS and CCD detectors has failed showed any distinction in diagnostic capabilities between the pair (Kitagawa et al 2003).

The cable used in CCD and CMOS is stiff, and can pose difficulty in the placing the sensor in the region of interest. Wireless sensors are available, but they are generally more expensive and can be subject to electronic interference from external sources.

Cone Beamed Computer Tomography
Cone beam computer tomography (CBCT) was introduced in the late 1990s to supersede computer
tomography (CT) imaging in maxillofacial regions and appears to be a safe and effective adjunct for endodontic imaging. CBCT has lower radiation exposure in patients than conventional CT due to improved image receptor sensors, quick scanning times, and pulsed X-ray beams.

To obtain the image the patient sits, or stands upright as a cone beam, the source of the x-ray and sensor, rotates synchronously around the patients head. All of the data volume is collected in one rotation, and depending on the scanner, the rotation around the head can be either 180° or 360°. The volume of data captured by the CBCT is represented by voxels, essentially a 3-D pixel. There are two CBCT categories; limited (dental or regional) and full (ortho or facial). The limited category is more appropriate in single tooth endodontic cases as it provides images with higher resolution. However, where multiple teeth in different quadrants require treatment, a larger field of view is preferred.

CBCT allows users to view regions of interest in any desired plane and is patient friendly. Occupying the same size as panoramic imaging machines, together with a responsive interface makes CBCT incorporation into practices realistic (Scarfe 2006). There are increasing reports within the endodontic community that CBCT imaging can be utilised to manage endodontic cases (Cohenca et al 2007).

Potential endodontic applications for CBCT
A major advantage of CBCT is the three-dimensional geometric accuracy compared with two-dimensional imaging (Murmulla et al 2005). Axial, coronal and sagittal images eliminate obstruction from other structures, so tooth roots and the periapical structures can be observed on all three orthogonal planes. The information could be utilized in planning prior to endodontic surgery to visualize key structures such as the inferior alveolar nerve, maxillary sinus, and the mental foramen.

Lofthag-Hensen et al (2007) determined that CBCT could diagnose periapical changes earlier than two-angled periapical radiographs. Endodontic treatment is more successful in teeth which are treated early prior to radiographic signs of periapical disease. Thus earlier detection of periapical disease.

Mah et al (2003) determined that the radiation dose from CBCT was comparable to the radiation encountered in a full mouth series using conventional films. A single scan from CBCT can provide all the information required to manage dental alveolar trauma, as luxation and alveolar injury can be assessed. This would eliminate the need for multiple images at different angles, as would be required by conventional radiography techniques.

Application of CBCT in endodontics is growing with case reports documenting their use in root fractures, differentiation between periapical cysts and granulomas, and assessment of healing. However, their use should be prudent as they still have more ionizing radiation associated with a single scan than the other imaging systems.

Advantages of Digital Imaging
Radiation dose reduction
No matter how minute the radiation dose, it may result in some deleterious effect in a small proportion of the population. A study on endodontic radiography and the risk of somatic disease found that 10900 endodontic X-ray surveys would need to be performed to achieve the threshold changes required for the development of cataracts. The same study estimated that the chances of developing leukaemia due to dental X-rays were 1 in 7.6 million (Danforth and Torabinejad 1990). There will always be patients who take exception to the repeated exposure to X-rays in endodontics, even when safety precautions in the form of lead aprons and thyroid collars are used. Digital radiography uses lower radiation and could ease patient concerns.

A commonly listed advantage of digital radiography is that there is a dose reduction between 60-70% in comparison to conventional film. Two studies show that for a single exposure to attain a ‘diagnostically acceptable’ image, digital imaging had less dose requirements compared to conventional film (Hayakawa et al 1997, Wendell et al 1995). Berkhout et al (2004) reported that CCD had lower dose requirements than PSP, while Bhaskaran et al (2005) found that the reverse was true.
Working time

In practice, much as in life, time is considered a valuable commodity for both practitioner and patient. Digital radiography is considered to be a time saver due to the elimination of chemical processing, which can tie up the dental auxiliary. Dentists who switched from conventional film to digital imaging reported a 30 minute reduction in time dedicated to radiographic procedures (Wenzel and Møystad 2001).

Dental students using digital radiography for root canal treatment reported that they saved more time with a CCD sensor than with the PSP system (Wenzel and Kirkevang 2004). Tsuchida et al (2005) have confirmed that less time is required when using CCD wireless sensors in comparison to wired sensors and conventional film. The wired cable is delicate and can be subject to inadvertent damage from the patient’s bite. It also adds to the overall dimensions of the sensor, making placement in the region of interest more complicated.

Improved communication

Typically, radiographs used in endodontics are small, they can be difficult to visualize without magnification, and need backlighting to show detail. Digital imaging allows radiographs to be visualized in larger dimensions on a monitor and allows patients to feel included in their treatment planning when the clinician takes time to explain and discuss radiographic findings.

A study assessing patient satisfaction depending on whether the dentist’s information based on film radiographs or digital images failed to find a difference in patient satisfaction between the two modalities (Christensen 2010). The study was conducted in an oral surgery setting for wisdom teeth which were already condemned to extraction, and may not reflect patients who seek endodontic treatment.

Wider dynamic range

The dynamic range describes the range of exposures over which an image and contrast will be formed. One of the hurdles in conventional film radiography is adjusting the exposure within the appropriate dynamic range, to achieve image contrast. Film has a narrow dynamic range, so it is not forgiving of over or under exposure. Digital receptors respond and produce data over a wide range of X-ray exposure values.

PSP have been consistently reported to have the widest dynamic range, so under or over-exposure in these capture devices are unlikely to require image re-takes (Borg and Gröndahl 1996). CCD sensors have a smaller dynamic range and can bloom at over exposure, so re-takes may be required. CMOS sensors have narrower dynamic ranges than previous CCD sensors; but CMOS sensors do not necessarily have blooming issues (Borch et al 2008). When the pixels in a certain area are ‘burnt out’ and materialize black or ‘dead’ in the image, it is called blooming. A reason for this is that an overflow of energy takes place in some of the sensor ports when the dynamic range is exceeded, and pixels in certain areas are oversaturated. This reduces the quality of the image and can complicate the interpretation in the cervical areas, where it may first appear.

Elimination of chemical processing

‘Dark room disease’ or hypersensitivity to glutaraldehyde, aldehyde and solvent sensitivity, can occur in operators and auxiliaries who are subject to hazardous chemical processing substances (McLoughlin 2005). Darkrooms for film processing should ideally have external outlets to move toxic chemicals from the practice ventilation. Digital imaging eliminates the need for chemicals and is beneficial to the environment.

Chemicals and wet processing have been acknowledged as a major contribution to un-diagnostic film images, requiring re-takes. Solid state sensors do not require additional processing following exposure, so this source of error is diminished. PSP has an intermediate step where the plates are fed into the scanner for processing. It can prove unfavourable to the image if there is inadvertent exposure to light, or delayed scanning of the image by more than ten minutes (Akdeniz 2005).

Image storage

Archiving and circulation of digital images have advantages over conventional films. Digital images are captured in original, uncompressed, image format. The intraoral image files utilize between 290 and 16,000 KB of storage space depending on their resolution (Wenzel et al 2007).
Compression is possible before storage and this permanently changes the original image data.

Eraso et al (2002) have found there is a harsh impact of high compression on the detection of periapical lesions and dentinal caries. Others have found that moderate compression rates did not impair the diagnostic yield of periapical lesions (Koenig et al 2004). Nevertheless, for primary image storage it is recommended that no image compression is used, and that an automatic backup function secures all electronic data in the dental clinic (Mupparapu 2006).

Digital images can be subject to change by software manipulation, invisible to the clinician, and with the intent to defraud (Horner et al 1996). In one study, artificial dental disease was added to digitized radiographs and the recommended treatment plans were approved by insurance companies (Tsang et al 1999). It has been suggested that a standard authentication procedure should be implemented for digital radiographs to protect the radiographic examination from fraud (Calberson 2008).

Disadvantages of Digital Imaging

Sensor dimensions

CCD sensors have bulky plastic encasements, are inflexible, and with the exception of wireless sensors they have a cable, which complicates positioning. Phosphor plates have sharp edges, and the plate cannot be bent to improve tolerance by the patient. The digital receptors can therefore cause problems for the patient and the operator during the examination.

Patients report more discomfort with the solid state digital sensors than with PSP (Bahrami et al 2003). A corresponding study compared patient discomfort during examination with three sensors, two phosphor plates and film for exposure of mandibular third molars. All digital receptors felt more unpleasant than the film (Matzen et al 2009); PSP plates were less unpleasant than sensors, and thick sensors with a cord were more unpleasant than thinner sensors and sensors without a cord. Interestingly, in periapical radiography no difference was established in the perception of discomfort between a sensor with a cord and the identical type of sensor without a cord.

Sensor defects

Mechanical trauma can influence the lifespan of PSP plates and sensors in dental practice. This could affect the cost-effectiveness of these systems compared to film.

In a clinical setting, 0.4% of 16,000 scanned PSP images showed errors due to faulty plates and 0.2% due to scanning (Chui et al 2008). A separate study showed that the chief reason for the replacement of plates was damage to the phosphor layer (Roberts and Mol 2004). Recent makes of PSP plates have improved scratch resistance, requiring more loads before damage is incurred. A study found that older plate types were determined non-diagnostic after having been used approximately 50 times (Bedard et al 2004).

Physical damage can occur to the CCD sensors if they are dropped on the floor or if a patient bites firmly onto the surface. In a questionnaire involving general dental practitioners, approximately 50% of sensor users stated that they had had technical problems with their sensor, 30% of which resulted in repair (Wenzel and Møystad 2001).

Cross-infection

Precautions against cross-contamination should be taken when using digital receptors as opposed to film for intraoral radiography. A two-layer barrier prevents contamination of the receptor (Hubar and Gardiner 2000). The same digital receptors are used to examine multiple patients throughout the day, with a high risk cross-contamination. PSP plates are carried from the mouth to the scanner and potentially create more concern than solid-state sensors. The sensors can be wiped with an alcohol-impregnated tissue, but it has not been studied to what degree the plates tolerate wiping. None of the digital receptors can be sterilized.

If the plastic envelope covering the storage PSP plate was cleaned with soap or wiped with an alcohol-impregnated tissue before it was opened and the PSP plate placed in the scanner, cross-contamination was not a problem since bacteria from the oral cavity could not be cultured from the plates (Negron et al 2005). Of concern, Hoskett et al (2000) found that the traditional plastic sheaths covering the sensor leaked after a single exposure in approximately half of the cases.
Conclusion

Endodontics is dependant on radiographic images for all of its key stages. It is important that these images are produced at the lowest radiation exposure to the patient, whilst still yielding critically important information required for decision making. Digital radiography has proved to be a suitable alternative to conventional film, and has revolutionized the way endodontists obtain their radiographic imaging in the 21st century. New technologies such as CBCT have shown promise as supplementary radiographic measures.

References


Pulp testing is a crucial component of diagnosis of the condition of the pulp and should be performed along with history taking, clinical and radiographic examinations, and other tests. As it is not possible to correlate the histopathological status of the pulp to the outcome of conventional pulp tests alone, the outcome of any one pulp test should not form the sole basis for diagnosing the pulp status of a tooth and should be considered in combination with all available data (Reynolds 1966, Lundy & Stanley 1969, Hyman & Cohen 1984). Currently, the most common tests for this purpose are sensibility tests. A major limitation of these tests is that they subjectively imply vitality by measuring mostly the ability of the pulp’s A-delta fibres to respond to a stimulus (Abbott & Yu 2007) and, thus, do not provide any information about the vascular supply to the pulp. Bhaskar and Rappaport (1973) demonstrated in their study of 25 traumatized teeth that conventional vitality tests such as electrical pulp tests (EPT) and thermal tests are in reality sensibility tests of the nerves and have no direct relationship to the vitality of the pulpal tissue. Teeth that temporarily or permanently lose their sensory function will be nonresponsive to ETP, but these teeth may retain an intact vasculature. To understand the role of pulp testing in assessing pulp status in the primary dentition, it is important to firstly understand the general limitations and properties of conventional techniques in assessing the teeth.

**Thermal Tests**

**Cold**

Recommended cold tests include carbon dioxide snow (CO2, -78 °C), dichlorodifluoromethane (DDM, -50 °C) and 1, 1, 1, 2-tetrafluoroethane (TFE, -26 °C). The latter has been reformulated from DDM because of environmental concerns, and is commercially available. CO2 snow and DDM have proved to be significantly more effective than electric pulp testers in producing positive responses on sound premolars in a group aged 9 to 13 years (Fuss et al. 1986). Fuss et al. (1986) also demonstrated that there is no difference in positive responses between the young and adult groups when CO2 and DDM were used as pulp testing agents. Therefore, sensitivity testing with cold appears to be a more effective method than electric pulp testers in young permanent teeth.

CO2 can be as cold as -78 °C, but in clinical use its temperature rises to -56 °C (Bender 2000). TFE has shown to be more effective than CO2 snow at reducing temperature when applied in vitro through PFM and all-ceramic restorative systems for 10 to 25 seconds (Miller et al. 2004). It seems that the size of the area of contact of the testing agent on the tooth makes a difference.

Older tests, such as ethyl chloride and ice are shown to be only about 40-60 % accurate when compared to DDM, CO2 snow and the electric pulp tester and are thus not recommended (Fuss et al. 1986, Abbott & Yu 2007).

**Heat**

Heat application initially stimulates A-delta fibres (Narhi 1985) and with further stimulation, C fibres are activated and the pattern of pain changes (Narhi et al. 1982). However, heated gutta-percha and hot water do not seem to give consistent results (Linsuwanont et al. 2008) and due to its low diagnostic accuracy heated gutta-percha is not recommended as a pulp vitality test (Petersson et al. 1999).

**Electric pulp test (EPT)**

Electric pulp tests require isolation and conducting media, are sometimes painful and may thus be frightening to patients and create behavioural problems in children who often lack the cognitive ability to understand the situation (Chambers 1982).

It appears that sensitivity to electric stimulation
of the erupting permanent tooth is directly related to the state of root development, the amount of secondary dentine, the development of the plexus of Raschkow and consequently the extent of nerve fibre entrapment (Klein 1978). Klein (1978) demonstrated a highly significant correlation between apex formation and pulp response to the electric pulp tester on the anterior teeth of 93 children aged six to eleven years of age. This may be explained by Fearnhead (1962), who stated that full innervation of the teeth may develop four or five years after eruption. The stage of dental development should be taken into consideration when the dentist is evaluating the response to electric pulp stimulation, with EPT not considered a reliable method for testing young teeth (Fulling & Anderson 1976, Klein 1978).

It has been shown that the mean threshold response (MTR) varies with tooth type, condition of the incisal/occlusal enamel and the electrode placement site (Bender et al. 1989, Lin et al. 2007). This may be attributed to the thickness of enamel and the density of neural elements in different areas of the pulp (Lilja 1980). Directions of tubules at the testing site are also important (Bender et al. 1989).

**Situations causing false-positive EPT results:**
- Non-vital teeth with large metallic restorations are capable of conducting electrical impulses to the periodontal tissues (Rowe & Pitt Ford 1990) or to the adjacent teeth (Myers 1998).
- Multi-rooted teeth with vital tissue in one root but not in the others (Grossman 1981, Peters et al. 1994).
- Liquefaction necrosis of the pulp (Ehrmann 1977)
- Stimulation of the periodontal nerves (Narhi et al. 1979).
- Saliva can contaminate the ETP tip and act as liquid media giving rise to the possibility of false positive reading (Camp 1994, Mickel et al. 2006).
- Improper techniques (Abbott & Yu 2007).

No response may indicate pulp necrosis, calcific metamorphosis, previous trauma or a tooth that has had a pulpotomy or a root canal filling. In addition, drugs, i.e. narcotics and alcohol can influence the results of pulp testing (Degering 1962, Carnes et al. 1998). Although symptoms are not reflections of histopathological status of the pulp, there is a statistically significant link between histologic evidence of total pulp necrosis and failure of the tooth to respond to pulp tests (Marshall 1979, Seltzer & Bender 1984).

One of the limitations of conventional pulp testing is the lack of reproducibility. Reiss and Furedi (1933) and Schaffer (1958) observed that patients may respond differently to an electric pulp tester on different days and at different hours of the same day. The context in which pain is experienced changes the response to pulp testing. For example, Dworkin & Chen (1982) showed in their study that the subjects showed a significantly heightened pain response when tests were conducted in the dental environment when compared with a non-dental setting. Emotional state (i.e. stress of the patient, anticipating pain and anxiety) can alter the response to pulp testing (Cooley & Robinson 1980, Grossman 1981). Therefore, the results of pulp testing are changeable factors and may lead to an initial misdiagnosis of endodontic pathology (Eli 1993).

Overall, ETP and thermal tests show an approximately 10% error margin in their ability to diagnose vital and non-vital pulps in the permanent dentition (Petersson et al. 1999).

In addition to pulp testing, test cavities, percussion, palpation and anaesthetic tests may be performed. Test cavities test whether A-alpha fibres are still intact; percussion indicates whether there is significant periodontal inflammation in the apical region; none of these additional tests indicate per se the vitality of the pulp. Tooth percussion and palpation are not very reliable in young children because of the psychological aspects involved. Assessments of tooth mobility are not reliable as during the active stage of physiological resorption primary teeth with normal pulps may exhibit varying degrees of mobility. Conversely, pulpally involved teeth may have very little mobility.

It has been said that electric tests and thermal tests are not reliable in primary teeth (Cohen & Burns 2002, Flores et al. 2007). Johnsen et al. (1979) speculated that permanent teeth may have a greater ability than primary teeth for conduction of action potentials leading to the perception of sharp pain. However, the results of comparison
of the sensory functions of the two dentitions to electric pulp testing are inconclusive. Part of the reason for the unreliability of the response in the young child to pulp testing appears to be attributed to apprehension, fear, or management problems leading to inaccurate results.

**Other tests that have been suggested as an aid to oral diagnosis**

**UV light** – Dentine and enamel fluoresce in ultraviolet light (Benedict 1928, Hartles & Leaver 1953). Foreman (1981) suggested that the absence of fluorescence of pulpless teeth under ultraviolet light in non-vital teeth may be due to diapedesis occurring during inflammation leading to an increase in the iron content of the dentine around the pulp chamber. He demonstrated ultraviolet light to be a useful diagnostic aid when used as an adjunct to other vitality tests, but having practical limitations (Foreman 1983).

**Transillumination** – Hill (1986) hypothesized that a tooth loses its translucency as the pulp becomes non-vital and investigated the efficacy of transillumination in detecting non-vital teeth. He demonstrated with his own teeth that this method can be a useful adjuvant to conventional methods of pulp testing despite its subjectivity and difficulties with teeth with large amalgam restorations. No study has been carried out on children.

Mumford (1976) and Ehrmann (1977) have described the key uses of pulp testing in clinical practice including diagnosis of pain, prior to operative procedures, investigating radiolucent areas, post-trauma assessment, assessment of anaesthetics and assessment of teeth which have been pulp-capped or required a deep restoration. No study has been carried out on children.

**Assessment of pulp status** – Poor correlation exists between clinical symptoms and histopathologic conditions and this complicates diagnosis of pulp health in children (Mass et al. 1995). Difficulties in assessing pain in children will be discussed later. Spontaneous pain in primary teeth is usually associated with degenerative changes in the root canals (Guthrie et al. 1965), so primary teeth with a history of spontaneous pain should not receive vital pulp therapies (Camp 2008).

Trauma – 1 in 3 children receive traumatic injuries to the primary dentition (Andreasen & Ravn 1972, Glendor 2000). Results of diagnostic procedures are difficult to interpret in trauma (Andreasen & Pedersen 1985). Traumatized primary teeth may develop a grey-black discoloration and are reported to have necrotic pulps in 50%-82% of the cases (Borum & Andreasen 1998). In one study, 72% of primary incisors with gray-black discoloration following concussion or subluxation failed to develop radiographic and/or clinical evidence of pathosis (Sonis 1987). This may indicate that pulps of the primary teeth can remain necrotic, which may become a nidus for subsequent infection (Holans & Fuks 1996). Although injured primary teeth with gray discoloration can be interpreted as an early sign of pulp necrosis, some of them may become yellow or return to normal colour (Schroder et al. 1977). Therefore, colour change of the tooth alone without other findings is not a reliable indicator of pulp status; nevertheless, if the pulp vitality is determined early after trauma, exposure to hazards of delay in treatment and unnecessary pulp removals will be avoided (Bhaskar & Rappaport 1973).

**The differences in transmitting pain between primary and permanent teeth**

There has been much controversy over the sensitivity of primary dentine. The common misconception is that primary teeth are less sensitive than permanent teeth, with permanent teeth possessing a greater proportion of myelinated fibers (Johnsen & Johns 1978). The pulpal neural density has been shown to be lower in primary teeth than permanent teeth (Johnson et al. 1983, Rodd & Boissonade 2001), despite its overall distribution within primary teeth being similar to that of permanent teeth (Rapp et al. 1967, Egan et al. 1999). However, the degree of neural density does not necessarily indicate the tooth’s capacity to perform a sensory function (Monteiro et al. 2009). Sensation may be related to the numbers and types of associated nerve fibres (Erlanger and Gasser 1937), however, there is paucity of information regarding this. Egan et al. (1999) concluded that local anaesthesia is still necessary when treating children with primary teeth and “age and comprehension of the young patients make it difficult to determine sensitivity of primary teeth”. Rodd et al. (2001) found that
while there was a highly significant increase in neural density with caries in both primary and permanent teeth, there was no correlation between overall neural density and reported symptoms regardless of type of teeth. To sum up, there is no proof that the primary tooth would not be equally sensible to pain.

Mumford (1971) found that there is no difference between pain perception threshold of retained deciduous teeth with resorbed roots in patients aged 12 years or more and normal permanent teeth with EPT (Mumford 1971). In addition, there appear to be no significant differences in overall innervation density according to the degree of root resorption in either the pulp horn or mid-coronal region of caries-free primary teeth (Monteiro et al. 2009). In view of this, rather than the density of innervation directly relating to pain perception, it appears that pain perception is a secondary function, with intradental nerves playing a more important role in defense and healing (Rodd & Boissonade 2000). Monteiro et al. (2009) concluded that without contrary functional evidence, it is still upheld that primary teeth could retain the potential for sensation well into the advanced stages of root resorption.

Proposed reasons for unreliability of conventional pulp testing are considered. Firstly, reliability of pain history in young subjects is doubtful (Rodd & Boissonade 2000). Secondly, the neurobiology of dental pain is very complex; it is a multifactorial experience consisting of sensory-discriminative, emotional, cognitive, and motivational dimensions (Sessle 1987). A variety of factors including inflammatory mediators may modify intradental nerve activity. Central changes, induced by peripheral dental inflammation or injury, are likely to affect pain perception (Chiang et al. 1998). Another facet of pain is the ‘psychological’ factors that are related to stress, motivation, depression and emotional aspects intrinsic to the painful experience (Barr 1983, Sessle 1987).

With this in mind, the interpretation of a child’s response to pulp testing becomes further complicated because the perception of pain to a noxious stimulus in young children depends on their cognitive ability and their previous experience of pain (Gaffney & Dunne 1986), differences in their backgrounds and the language that they learn and use to describe pain. Children’s behavioural responses also change over time. For example, a child with a history of extensive pain experience may not display the same level of distress behaviour to a noxious stimulus as a child who has experienced less pain.

There are many behavioural, physiological, and psychological methods available for assessing pain in children of different age groups (McGrath 1987). It is important to have methods that satisfy the criteria for validity, sensitivity, and reproducibility of pain assessment in children. Visual analogue scales can be used to assess pain in children over 5 years of age and Asfour et al. (1996), using a set of visual analogue scales, were able to successfully demonstrate the reliability of pulp testing using EPT and ethyl chloride on deciduous teeth of children aged 7-10 years.

With the limitations of conventional pulp testing and their associated complexities in primary teeth, the clinician may be more inclined to become reliant on clinical examination alone searching for signs of inflammation, severe dental caries, leaking restorations and draining sinus tracts. However, there are alternative methods for testing the vitality of teeth which do not rely on subjective responses and/or cause pain, such as measuring the blood supply of the pulp.

1. Laser Doppler flowmetry (LDF)

LDF was first tested on human teeth in 1986 by Gazelius and co-workers, demonstrating its ability to measure blood flow by way of flux of red cells (number of moving cells per second times their mean velocities) in teeth with normal pulps. It involves securing a fibre optic probe against the tooth surface. Infrared light from a laser is passed through the pulp. The light reflected by moving red cells undergoes a Doppler shift and can be used to provide an output measured as flux.

Many in vivo studies have proved its value in monitoring traumatized anterior teeth in both children and adults and on premolar teeth under different pulpal conditions (Olgart et al. 1988, Mesaros & Trope 1997, Lee et al. 2001, Emshoff et al. 2004). LDF has been shown to detect the level of revascularization as early as 3 - 4 weeks after trauma in children (Olgart et al. 1988, Emshoff et
Pulp Testing in the Primary Dentition

al. 2004), whilst teeth that were non-responsive to CO2 snow up to 76 days after replantation of teeth in a 8-year old boy showed pulpal blood flow (Emshoff et al. 2004), whilst teeth that were non-responsive to CO2 snow up to 76 days after replantation of teeth in a 8-year old boy showed pulpal blood flow (Emshoff et al. 2004). 73% were correct for the vital pulps and 95% were correct for the non-vital pulps.

LDF correctly predicted the pulp status in 84% of readings on re-implanted immature dog teeth (Yanpiset et al. 2001); 73% were correct for the vital pulps and 95% were correct for the non-vital pulps.

Despite its advantages of good reproducibility and non-invasiveness, there are disadvantages of LDF. The disadvantages of its use in children are as follows:

- Limited translucency and multiple reflectance of teeth, affecting its validity to assess the condition of the pulp (Ikawa et al. 1999).
- Highly reliable but only under specific and carefully controlled conditions (Evans et al. 1999).
- Sensitivity of the device to motion (Ramsay et al. 1991).
- Blood pigments within a discoloured tooth crown e.g. from trauma can interfere with the laser transmission (Heithersay & Hirsch 1993).
- Patient should be placed in a similar position in the dental chair each time while the recording is done, as body position might affect the reading (Firestone et al. 1997).
- High set-up cost (Sigurdsson 2008).

Fratkin et al. (1999) validated the use of LDF as a means of detecting pulpal blood flow in deciduous incisors. These authors showed that the LDF readings were different for primary incisor teeth after pulpotomy or extraction compared to the same teeth at an earlier time.

2. Pulse oximetry
The pulse oximeter has been used since the late 1980s in medicine as a non-invasive device for monitoring the oxygen saturation and pulse rate of patients in intensive care settings or during sedation (Blackwell 1989). Two wavelengths of light (infra-red and red light) are emitted from diodes to give a ratio of the absorption of wavelengths for oxygenated and deoxygenated blood. The percentage of oxygenation in the blood is calculated from the ratio. Using a modified probe to fit the curvature of a central incisor, Schnettler & Wallace (1991) achieved comparable results to EPTs and cold testing in detecting non-vital and vital permanent teeth. The accuracy of readings may be hindered by excessive carbon dioxide levels, movement of the probe (Schnettler & Wallace 1991) and calcific changes within the pulp and when the arterial pulsatile blood flow is low (Gopikrishna et al. 2009). Patient variables such as low peripheral perfusion, increased venous pulsations, haemoglobin disorders, vasoconstriction, hypotension, and body movements will contribute to false or delayed readings (Jafarzadeh & Rosenberg 2009). Environmental factors that may limit accurate measurements include electrocautery near the sensor and ambient light interferences (Mardirossian & Schneider 1992, Gandy 1995). Nevertheless, pulse oximetry is an objective, atraumatic tool for verifying vitality in traumatized teeth and it has the potential to analyse the stage of pulp pathology. Inconsistent readings were found with a custom-fitted probe by Kahan et al. (1996) who rejected the use of pulp oximetry as a diagnostic tool. Goho (1999) however confirmed the validity of pulp oximetry using a modified probe to fit maxillary central and lateral incisors of deciduous and permanent dentition of a group of children aged 4 to 10y, and its value in vitality testing was confirmed by Radhakrishnan et al. (2002) and Calil et al. (2008). Consistent pulse oximeter readings were recorded by using a custom made pulse oximeter sensor holder and comparing it with electric pulp testing and cold tests on recently traumatized maxillary incisors (Gopikrishna et al. 2007). The negative predictive values were 81% with the cold test, 74% with the electrical test, and 100% with pulse oximetry. The positive predictive values were 92% with the cold test, 91% with electrical test, and 95% for the pulse oximeter. Further research is indicated using a smaller, better-fitting sensor designed specifically for use on primary teeth.

3. Photoplethysmography
Photoplethysmography is another non-invasive way to detect blood flow within the pulp. This works by haemoglobin absorbing certain wavelengths of light, while the remaining light passes through the tooth and is detected by a receptor. It has been shown to be useful in testing the vitality of permanent teeth in vivo and in vitro (Shoher et al. 1973, Ikawa et al. 1994, 1999). Lindberg
et al. (1991) compared photoplethysmography and LDF and found them to be similar, with photoplethysmography having less signal contamination from periodontal blood flow. An in vivo study has shown that photoplethysmography can detect pulpal blood flow in young permanent teeth in patients aged between 7 and 14 (Miwa et al. 2002). These workers suggested that it may be easier to detect pulpal blood flow in young patients where abundant pulpal blood flow is expected rather than in the elderly or adult subjects. This technique has not been developed further.

Other techniques have been developed to detect vitality of the pulp but have not been tested on children. These include the following:

4. Optical reflection vitalometer (ORV)
   This is based on pulse oximetry, the difference being that the absorption is measured from reflected light instead of transmitted light. Preliminary test showed promising results, but further research is required (Oikarinen et al. 1996).

5. Ultrasound Doppler
   This was first described by Thierfelder et al. (1978). A recent study found significant differences between non-vital and vital upper anterior teeth of the permanent dentition (Yoon et al. 2010).

6. Dual wavelength spectrophotometry (DWS)
   DWS uses visible light which is filtered to near infrared range and measures oxygenation changes in the capillary bed, rather than the blood vessels. Although it is small, portable, relatively inexpensive and does not require eye protection, it only measures the presence of haemoglobin and not the circulation of blood (Nissan et al. 1992).

7. Transmitted laser light (TLL)
   TLL is similar to LDF, but overcomes the disadvantage of LDF recording signals from non-pulpal origin (Sasano et al. 1997). The limitations are that it can at present only be used for anterior teeth due to the position of the splint and the size of the oral opening.

8. Measurement of tooth temperature
   Statistically significant differences in temperature between a vital and a pulpless tooth in the same individual have been demonstrated (Stoops & Scott 1976, Fanibunda 1986a, b) and this relationship may provide a useful means of determining pulp vitality. Later experiments (Smith et al. 2004) concluded that change in the surface temperature of teeth is not suitable as a simple means to assess pulp vitality. It has been shown that crystalline cholesteric esters or ‘liquid crystals’, when heated to their various melting points exhibit different colours up to a point (Ferguson 1969). Liquid crystals that were mixed to various ratios to produce different colours when heated to a temperature range of 30 °C – 40 °C have been employed to determine pulp vitality (Howell et al. 1970). The principle behind this was that teeth with an intact pulp blood supply had a warmer surface temperature compared with those without. Vital teeth showed a rise in temperature, whereas non-vital teeth did not show any increase in temperature. Little research has been performed using this technique. Computerised infrared thermographic imaging has also been employed but the technique was found to be complex and required the subjects to be at rest for 1 hour prior to testing (Kells et al. 2000).

7. Pulp haemogram
   This is included as it was a preliminary method to assess pulpal vitality and not sensitivity. No clear relationship was found between clinical signs and symptoms of pulpitis and the dental pulp haemogram, where the first drop of blood taken from the exposed pulp of 53 permanent and deciduous teeth was subjected to a differential white cell count (Guthrie et al. 1965).

Conclusions
   Ideally, vitality tests should be objective, painless, reproducible, assess pulp blood flow, inexpensive, quick and easy to use, and effective for heavily restored teeth and when the pulp size is reduced. None of the available pulp tests meets all these criteria. Therefore, assessment of the vitality of primary teeth, as with permanent teeth, should involve a combination of history, thorough clinical exam, radiographs and appropriate use of pulp-tests.
References


Management of Open Apices in Traumatised Incisors
Artika Soma and Shalin Desai

Introduction
Although dental injuries can occur at any age, the permanent teeth at the active age range of 8-12 years are commonly involved (1). The most vulnerable teeth are the maxillary central and lateral incisors followed by the mandibular central and lateral incisors (2).

Trauma, resulting in pulp death in immature teeth, poses a management problem due to open root apices and thin root canal walls. Apexification is defined as a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulps (3). Although apexification with calcium hydroxide has been reported to have a high level of success (4), the fracture strength of immature teeth filled with calcium hydroxide will decrease by half within a year (Andreasen et al. (5). Calcium hydroxide apexification has further disadvantages such as the prolonged time required for barrier formation (9-24 months), patient compliance and failure of the temporary seal (6).

One-visit apical barrier placement has been suggested to overcome these problems. This involves the nonsurgical condensation of a biocompatible material into the apical end of the root canal. The rationale is to establish an apical stop to allow immediate filling of the root canal (7). Advantages of one-step apexification include shorter treatment time, development of a good apical seal and creation of a periradicular hard tissue.

Mineral trioxide aggregate (MTA) packed with, or without, a resorbable matrix has become an established one-step root-end closure procedure (8, 9).

CASE REPORT 1
An eight year old boy reported to the urgent care unit (UCU) at the School of Dentistry, University of Otago in November 2007 for assessment and management of tooth 11 following an avulsion injury. All his maxillary anterior teeth were traumatised when he fell over in the school yard. He presented forty-five minutes after the injury and with tooth 11 stored in milk. Tooth 21 had sustained a luxation injury and the maxillary anterior gingivae were lacerated. Treatment was provided under nitrous oxide sedation. Tooth 11 was replaced into the socket and splinted from 53 to 63, using orthodontic wire and composite.

Radiograph 1: Maxillary occlusal (November 2007).
Radiograph 2: Mandibular occlusal (November 2007).
One month after injury the patient presented for a review. Tooth 11 was slightly mobile and extruded. No additional treatment was provided, no radiographs were taken and he was referred to the Paediatric Department.

At the two month review in the Paediatric Clinic, the splint was partially debonded and tooth 11 was repositioned by extruding it and placing it buccally (Figures 1 and 2). Periapical radiographs showed evidence of external root resorption (Radiograph 3).

The splint was removed a week later and root canal treatment was commenced and a calcium hydroxide dressing placed. The patient was then referred to the endodontic clinic for further management.

Endodontic assessment of tooth 11 showed a slightly grey discoloured tooth (Fig 3) with a palatal access cavity temporised with IRM (Fig 4). The tooth was non-responsive to cold and electrical pulp tests, tender to percussion and showed a Grade I+ mobility.
The periapical radiograph (Radiograph 4) showed a single incompletely formed root with thin walls and a wide apical foramen. The irregular outer wall on the distal aspect of the root suggested external root resorption while apical bone loss was visible as a radiolucency (3 x 4 mm). A diagnosis of apical periodontitis and external root resorption was made.

The patient was non-compliant and previous restorative work was done under general anaesthesia. For this reason, single visit root canal treatment was done under general anaesthesia with the aid of an operating microscope. Rubber dam was placed, the existing temporary restoration was removed and the access cavity was modified. Chemomechanical debridement was carried out with minimal instrumentation using a no. 30 K-file in the canal with passive irrigation using 4% sodium hypochlorite activated with an ultrasonic tip on a size 30 K-file. CollaTape was placed at the apex of the tooth and approximately 7 mm of white MTA was packed using a MTA applicator and Schilder pluggers. Indirect ultrasound was used to condense the MTA. The remainder of the canal was filled with Fuji IX to approximately 5 mm below the CEJ (as opposed to 2 mm) as the tooth was placed in an extruded position with more of its root exposed. The rest of the root and access cavity was sealed with composite resin and the incisal edge of the tooth was reduced (Radiograph 5).

At the four month review in September 2008, tooth 11 was asymptomatic and all the anterior teeth, apart from tooth 11, tested positive to cold. Tooth 11 still had a mobility of Grade 1+ and the colour of the crown was the same or slightly darker than at the previous visit (Figure 6). None of the teeth were tender to percussion and probing depths were within the normal range. Radiographically there was not much change since obturation (Radiograph 6).
The patient was next seen in December 2008, 7 months after obturation. The clinical status was the same as at the 4 month review. The periapical radiograph showed that the radiolucent area was becoming smaller in size with bony in-fill into the apical canal space and lamina dura was evident on the distal root surface (Radiograph 7).

At 11 months, tooth 11 was asymptomatic and the other anterior teeth (other than 11) tested positive to cold. Tooth 11 had a mobility of Grade 1. It was otherwise unchanged. Radiographically, the radiolucent area was healing (Radiograph 8).

**CASE REPORT 2**
Miss S, a 14 year old student, had sustained trauma to her maxillary anterior teeth five years earlier in 2002 (Radiograph 1). At the time, tooth 11 presented with an uncomplicated crown fracture while tooth 21 had a vertical fracture of the crown with slight sub-gingival extension. Pulp exposure was not mentioned in the clinical notes and both the incisors were restored with composite resin. At the two-month review, tooth 21 was deemed non-vital, based on its non-responsiveness to cold. Root canal treatment was commenced in UCU later completed by a paediatric postgraduate student (Radiograph 2). The tooth was reviewed nine months later (Radiograph 3). Although the coronal restoration was replaced twice by a private dentist, the tooth remained asymptomatic and the root canal treatment was considered to have a successful outcome. In March 2007, a paediatric dentist noticed secondary caries and a periapical lesion associated with tooth 21 and Miss. S was referred to the endodontic postgraduate clinic for management.

Miss. S had vertebral column surgery for kyphoscoliosis in 2000 with the placement of a metal rod. The orthopaedic surgeon recommended antibiotic prophylaxis prior to any dental procedure.

Endodontic assessment of tooth 21 showed disto-incisal, labial and palatal composite restorations with poor margins and secondary caries. Periodontal probing depths were within normal range and nothing abnormal was diagnosed during palpation.
SPECIAL TESTS
Sensibility, percussion and mobility tests

<table>
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<th>EPT</th>
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The periapical radiograph (Radiograph 4) showed incomplete development of a single root with a large apical foramen, loss of lamina dura and bone loss seen as a large radiolucency. The root canal filling was of satisfactory length and density. Secondary caries was present at the distal-gingival restoration margin.

As part of the first stage of root canal retreatment of tooth 21, all existing restorations and caries were removed. The distobuccal gingival extensions of the cavity were at the level of the gingival margin and the crown was deemed restorable and restored provisionally with Fuji IX. An access cavity was prepared through this and the gutta percha root filling was removed with Gates-Glidden burs and appropriate sized H-files.

After seven days of intracanal dressing, the root canal was irrigated with NaOCl, dried with paper points and the apical 5mm was filled with white MTA (ProRoot MTA, Dentsply, USA) using Schilder pluggers and vertical condensation. Apical fill was confirmed as satisfactory on a radiograph (Radiograph 5). A damp cotton pledget was placed over the filling material and the access cavity was sealed with GIC.

The canal was re-opened 1 week later and setting of MTA was confirmed. A 2 mm thickness coronal seal of GIC was placed over the MTA root filling and the access cavity was restored with composite resin (Radiograph 6). A 6-month review visit was advised and Miss. S was referred to the paediatric clinic for further restorative care.

At the 6 month review visit all maxillary anterior teeth were asymptomatic. Tooth 21 showed no clinical signs or symptoms of remaining apical periodontitis, with definite but incomplete healing of the apical lesion on radiograph (Radiograph 7).

At the 18 months review visit the tooth was still asymptomatic with complete healing of the apical lesion as seen on Radiograph 8.
Management of Open Apices in Traumatised Incisors

References


NEW ZEALAND SOCIETY OF ENDODONTICS
Minutes of the Annual General Meeting
held at the Christchurch Convention Centre
on Friday August 20th 2010 at 5.05pm

Present: James Fairhall (Chair), Robyn Cameron, Steve Manning, David Parkins, Denis Beale, Ted Bealing, Robyn Pahl (awaiting membership)


Minutes of previous meeting 21st August 2009: Denis Beale verified these as true and correct

MATTERS ARISING:
Email database: This has been compiled by Deborah Creagh and has been coming together very well. However, it would seem of the people present at the AGM, only half had received the recent email regarding the 2010-11 NZSE subscription. It was acknowledged that the email database was a good thing, and that it was suggested that in the future the New Zealand Endodontic Journal could also be potentially sent out via email.

Website has been going well.

CORRESPONDENCE:
Nil correspondence.

PRESIDENT’S REPORT: To be published in the New Zealand Endodontic Journal.

TREASURER’S REPORT: (Sent through from Deborah Creagh to James Fairhall)
Cheque Account: $3694.24
Savings Account: $20000.00
Term Deposits: $13314.57
$39790.19
$42950.51

These amounts do not include the recent money collected from this year’s subscriptions.

It was unanimously agreed that the subscriptions should remain at $40.00.

Deborah Creagh is to step down as Treasurer after many years of service, but will continue in the role until a replacement is found.

James Fairhall acknowledged the excellent job that Deborah Creagh and her Practice Manager Glennis Smith have done over the years.
GENERAL BUSINESS:

Trans Tasman Endodontic Conference (TTEC): James Fairhall and Steve Manning both gave a brief history of the previous dealings with the Australian Society of Endodontology regarding the TTEC. Steve Manning suggested that with regard to the organising committee of the conference everyone would need to have defined roles. David Parkins also brought up the question of whether a Conference Company such as Connexions is actually needed in the organising of a conference and was of the opinion that this was something that could be undertaken without one.

Options for a conference in Australia in 2012 include a recommendation for April/May as being a good time for New Zealand participants. With regard to the venue it was unanimously agreed that the Gold Coast was preferable to Darwin, Cairns and/or Adelaide. One concern regarding the conference is that the people present were not happy for the conference organisers, Connexions, to have their email addresses. It was suggested that the members feel they do not want their email addresses given out to anyone, and that the NZSE Committee work as an intermediary and forward any relevant emails onto the NZSE members.

NZSE Grant: It was agreed that a grant seems feasible with regard to our finances. It was also agreed that the grant should only be for endodontic projects. We were happy for the New Zealand Research Foundation to assess applications for the grant. David Parkins also put forward the idea of donating a lump sum for endodontic projects to the New Zealand Research Foundation rather than having a yearly grant. The amount suggested was $20000 compared to a suggested yearly grant of between $2000-$5000.

Donation to Dental Trauma Guide: Steve Manning believes the website www.dentaltraumaguide.org is a very worthy site and that it would be relevant for us to donate to this.

Special General Meeting: As there was not enough for a quorum at the AGM it was unanimously agreed that a Special General Meeting be held. It was proposed that this would be best held at the upcoming TTEC in Christchurch on the 4th-6th of November 2010.

Meeting closed at 5.43pm.
Welcome to the three new endodontic postgraduates who commenced their three year clinical doctorate programme in January.

Varayini Yoganathan graduated from Otago in December 2007 and moved to general dental practice in Sydney. Her father will be known to many readers as ‘Yoga’, a long-serving teacher especially on the final year clinics.

Anna Kim graduated from Otago in December 2002. She worked first for two years as a dental officer in Newcastle and then in private practice in Sydney before returning to Otago to embark on postgraduate studies.

Langley Tasmania comes to us from Niue. He graduated from the Fiji school in 2004 and then started work for the Government of Niue. He plans on returning to Government service in his country, where he will certainly be the only endodontist among a population of about 1,400.

News from the School
NOTICE

All members of the New Zealand Endodontic Society who still have not paid their annual subscriptions please do so promptly in order to retain membership for 2010.