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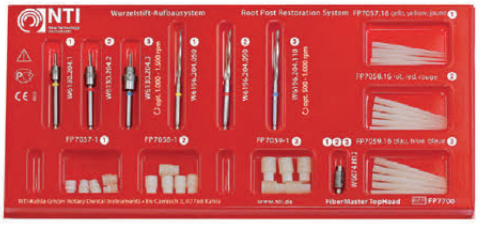

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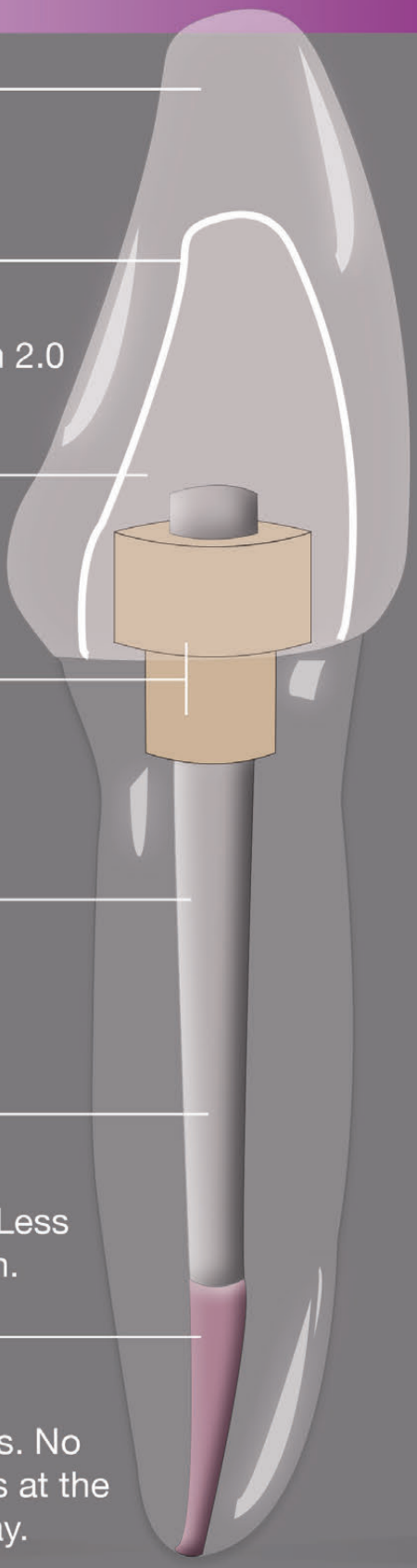

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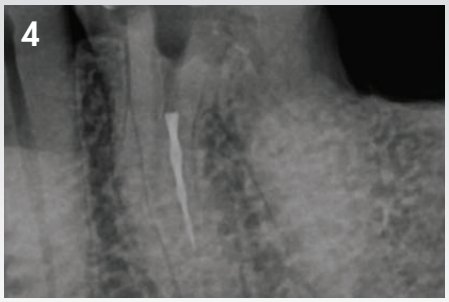

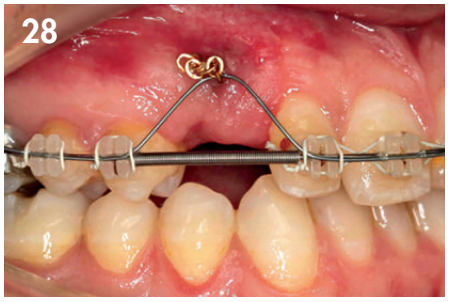

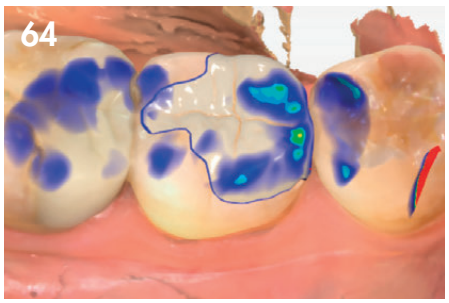

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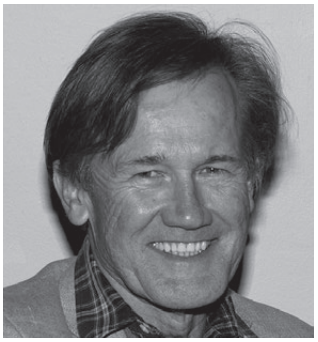

Covid -19: Apocalypse or Awakening?

Professor Andre W van Zyl, *MChD (Oral Medicine & Periodontics)*
Associate Editor

These are extraordinary times, and no-one could have foreseen this in our lifetime. How we react to the COVID - 19 crisis as a profession will perhaps define us for years to come. The fear of the virus has faded slightly as the fear of economic ruin replaced it.

As a profession - can we emerge stronger and with more integrity from this? It is possible!

There are two major challenges for us in this crisis, how we care for patients until we have a vaccine available and how we treat those in our employ. The virus will not disappear once the lockdown is lifted, it will be with us for a long time still and new mutations may appear.

I specialized at the start of the HIV outbreak in South Africa and I remember the fear well. Yet we had to treat patients with dignity, without fear to self and learning everything about infection control to prevent cross-infection of the then deadly HI-virus.

The COVID - 19 virus is not so deadly, but far more infectious and is a wake-up call of things yet to come. Now is the time we should all take a critical look at infection control protocols and communicate this to patients. Practices with excellent, visible protocols in infection control should now distinguish themselves from those who do not follow such standard of care. Those not following such infection control measures - now is the time to change or be left behind. We cannot put our patients at risk by cutting corners in infection control. Stories abound of using one mask a week, one set of gloves per day and not using approved sterilization protocols.

It cannot be easy to provide standard of care at the rates medical aids approve for our profession. Is this not the best opportunity yet to throw off the shackles of medical aid rates? We do charge for infection control - let us then provide it as we are supposed to. Perhaps now is the time to increase the fees a small percentage to provide this, rather than using improper protocols simply to survive at medical aid rates. If this is explained to patients by the use of information brochures in our receptions, a notice displayed where patients can read it and showing pride in this, I for one cannot imagine one patient complaining about the slightly higher cost. This is a challenge to all of us - let us then as a profession rise to this challenge and show our patients we care.

The second issue is how we take care of our extended family - the practice staff. I believe we have to take care of them first, before we take care of ourselves. Many of our staff battle to survive in a country that was in a recession before the virus struck and to lower their income further during the lockdown will be devastating to most. My first thought was how long I could sustain their salaries during a limited or no income scenario. This I then communicated to them so that all uncertainty could be removed immediately. This is the least we owe them. Now is the time to show empathy and sympathy with those less fortunate than us. We are all in this together.

This virus will change forever the way we look at any medical or dental facility as a safe haven, where cross infection should not be a danger. In Italy hospitals and health care workers have unknowingly become vectors for spreading the disease.

It is in our hands whether this be an apocalypse or awakening for our profession. It should be an easy choice.

Minimally invasive endodontics using a new single-file rotary system – Part 2

Peet J van der Vyver[1], Martin Vorster[2] and Ove A Peters[3]

Introduction

Reduced fracture resistance of root canal treated teeth remains a great concern when evaluating the long-term success of endodontic treatment. In fact, structural integrity is one of the main factors impacting the longevity of endodontically treated teeth (Reeh, Messer and Douglas, 1989). Knowledge of root canal morphology, chemomechanical preparation techniques and cavity designs is also important when evaluating the long-term success of root canal treatment (Mauger, Schindler and Walker, 1998, Willershausen, Kasaj, Röhrig et al., 2008).

Access cavities and canal preparations should promote direct access into the root canal system without compromising the conservation of tooth structure (Willershausen, Kasaj, Röhrig et al., 2008). Pericervical dentine and the structural integrity thereof is described in the literature as a key factor in determining the long-term prognosis of endodontically treated teeth, with specific reference to fracture resistance (Tang, Wu and Smales, 2010). The preservation of hard tissue has been shown to significantly reduce stress concentrations, especially in the cervical region, and to increase the resistance to fracture in endodontically treated teeth (Zhang, Liu, She et al., 2019). The term "pericervical dentine", as described by Clark and Khademi in 2010, refers to the 4mm coronal to the crestal bone and 6mm apical of the crestal bone (Clark and Khademi, 2010). Although the loss of tooth structure is not solely responsible for reduced fracture resistance in endodontically treated teeth, clinicians should adapt a minimally invasive approach when performing endodontic treatment and deciding on a choice of preparation instruments in order to preserve dentine adequately.

This article reviews the use of the TruNatomy system (Dentsply Sirona) in conventional root canal treatment and illustrates the use of the instruments in complex and challenging endodontic cases.

Case Report 1 – Conventional root canal treatment

A main goal of root canal treatment is the elimination of peri-apical inflammation (Berutti, Negro, Lendini et al., 2004). It is well established that ingress of micro-organisms is the cause of pulpal and consequentially periapical disease (Kakehashi, Stanley and Fitzgerald, 1965). Biomechanical cleaning and shaping in order to facilitate irrigation, disinfection and ultimately canal obturation are crucial elements in eliminating apical periodontitis (Berutti, Negro, Lendini et al., 2004).

Preservation of the original canal anatomy and position and size of the apical foramen are also important when performing contemporary root canal treatment (Schilder, 1974). Van der Vyver et al. describe some of the benefits and design features of a novel system, TruNatomy, in a recent paper (Van der Vyver, Vorster and Peters, 2019). The TruNatomy preparation system was designed specifically with

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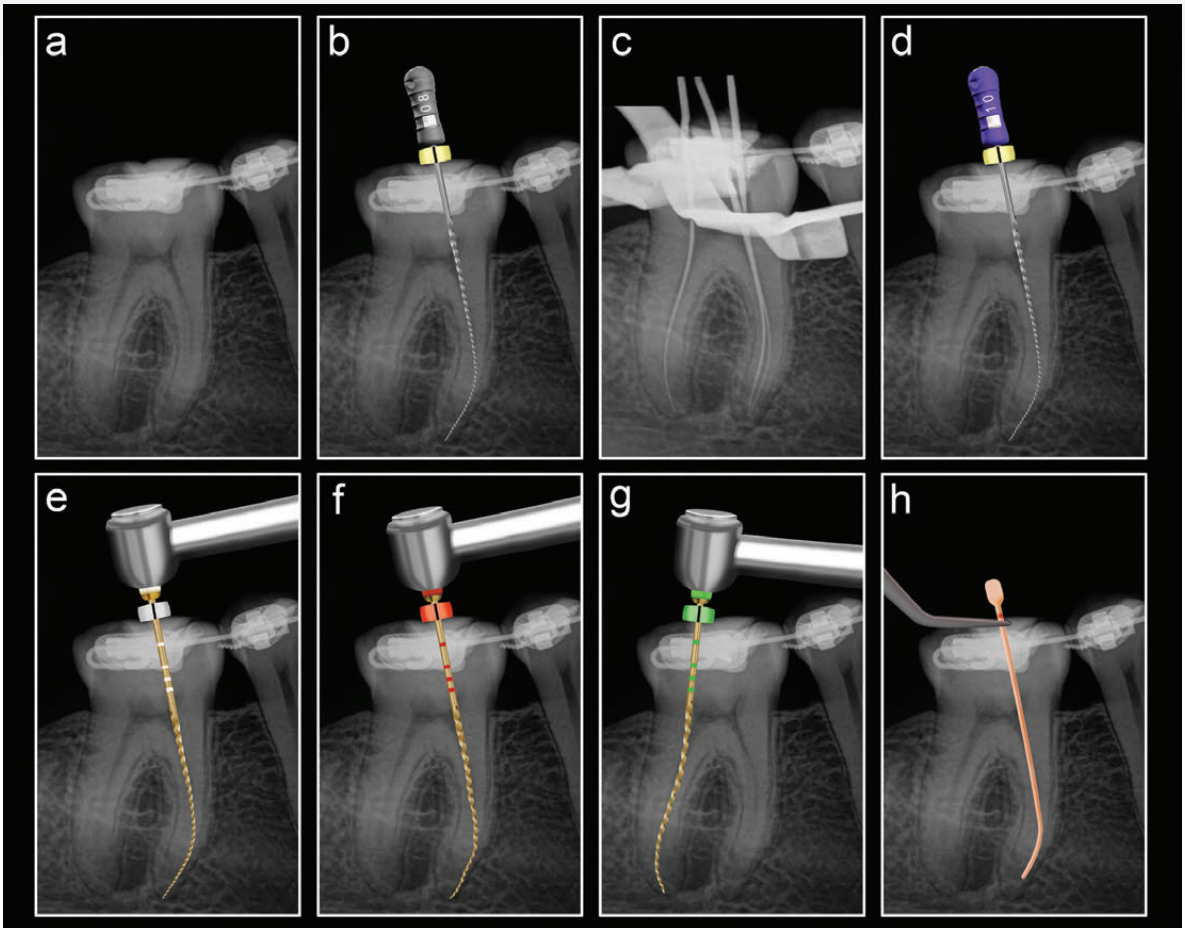

Figure 1. (a) Pre-operative peri-apical radiograph of mandibular first molar; (b) Canals were located and negotiated to patency with a size 08 K-File; (c) Working length was determined with an electronic apex locator and confirmed radiographically; (d) Reproducible micro glide paths were prepared with a 10 K-File; (e) Glide paths were expanded using the TruNatomy Glider; (f) Mesial root canals systems were prepared with a TruNatomy Prime instrument; (g) Distal root canal system was prepared with a TruNatomy Medium instrument; (h) 17% EDTA was activated using the manual dynamic agitation technique with a gutta percha point

dentine preservation and the overall strategy of minimally invasive endodontics in mind.

The patient, a 27-year-old female, reported severe pain on her mandibular first molar after orthodontic treatment (Figure 1a). A diagnosis of irreversible pulpitis with an acute apical periodontitis was made after clinical examination. The tooth was anaesthetised and an access cavity prepared. Three root canal systems were located and the canals negotiated to patency with a size 08 K-File (Figure 1b). Working length was determined with the Propex IQ apex locator (Dentsply Sirona) and confirmed radiographically (Figure 1c). A reproducible micro glide path was prepared with size 08 and 10 K-Files (Figure 1d) and verified before the glide path was expanded using the TruNatomy Glider (Figure 1e). The root canal systems were prepared with the TruNatomy Prime instrument (Figure 1f). It was noted that the Prime instrument passively progressed to full working length in the distal root canal system, and it was decided to complete canal preparation with the TruNatomy Medium instrument (Figure 1g).

The irrigation protocol that the authors recommend is to remove the smear layer with 17% EDTA solution by activating it with either (1) the EDDY irrigating tip driven by a sonic air scaler or (2) using the manual dynamic agitation technique where the tip of a matching gutta percha point is trimmed 1.5mm and pumped 30–40 times up and down in the root canal system (Figure 1h). This is followed with 20–40ml of warmed 3.5% sodium hypochlorite dispensed continuously into the pulp chamber, while activating the solution with the EDDY irrigating tip driven by a sonic air scaler (Figure 1i). A

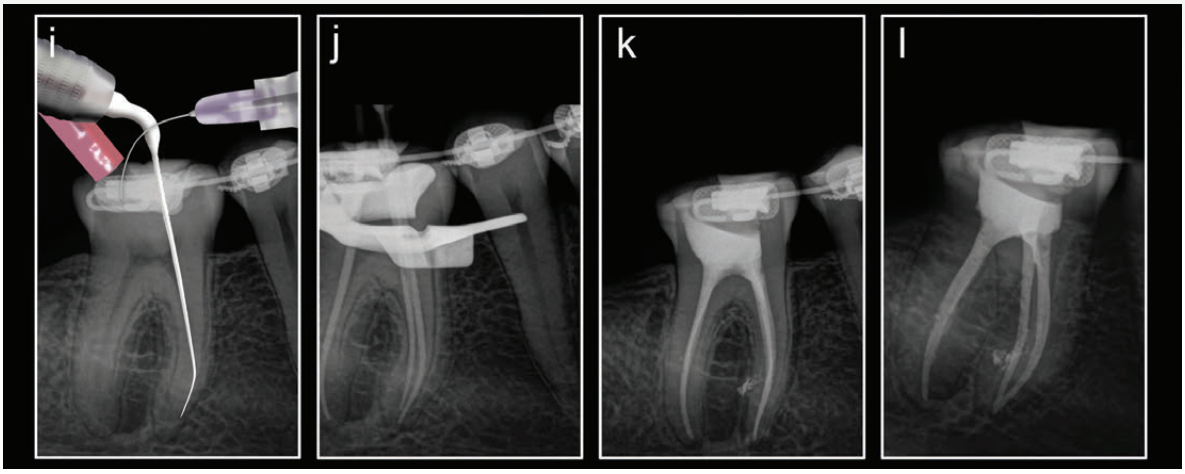

Figure 1. (i) Heated 3.5% sodium hypochlorite was dispensed continuously into the pulp chamber, and activated with the EDDY irrigating tip driven by a sonic air scaler. A suction tip was held next to the tooth to collect the excess spray and overflow from the pulp chamber; (j) Fit of TruNatomy gutta percha points confirmed radiographically; (k) Postoperative peri-apical radiograph after root canal obturation (parallel view). Note the maximum preservation of pericervical dentine; (l) Postoperative peri-apical radiograph after root canal obturation (mesial angulated view). Note the obturation of a midroot lateral canal

suction tip is held next to the tooth to collect the excess spray and overflow from the pulp chamber.

TruNatomy Prime gutta percha points were fitted in the mesial root canals and a TruNatomy Medium cone in the distal root canal, and the fit confirmed radiographically (Figure 1j). The root canal systems were dried with matching TruNatomy paper points. The root canal systems were obturated (Figures 1k and l) with the TruNatomy gutta percha points and Pulp Canal Sealer (Kerr), using warm vertical condensation with the Gutta Smart Obturation System (Dentsply Sirona).

Case Report 2 – Root canal treatment with unusual anatomy (Radix Entomolaris)

The number of roots in the mandibular first molar teeth may vary; Carabelli et al. was the first to report on mandibular first molars with supernumerary roots. The third root was located on the disto-lingual side and was called radix entomolaris (RE) (Carabelli, Carabellivon, Lunkaszprie et al., 1844). In very rare cases, the mandibular first molar can also present with an additional root on the mesio-buccal side, known as radix paramolaris (Calberson, De Moor and Deroose, 2007, Sperber and Moreau, 1998).

The presence of RE in the mandibular first molar is more frequently associated with certain ethnic groups. In populations with Mongoloid traits (for example Chinese, Inuit and Native Americans) the frequency can range from 5–30% (Turner, 1971, Curzon and Curzon, 1971, Yew and Chan, 1993, Reichart and Metah, 1981, Walker, 1985, Curzon, 1973). However, in Eurasian and Indian populations it is less than 5% and in African populations less than 3% (Ferraz and Pécora, 1992). RE can be found on first, second and third mandibular molar teeth, occurring least frequently on second molars (Visser, 1948). Studies have also reported a bilateral occurrence with a frequency of 50–67% (Steelman, 1986).

According to Calberson, De Moor and Deroose (2007) the etiology behind the formation is still unclear, but it could be related to external factors during odontogenesis. Racial genetic factors can also influence profound expression of a particular gene, which can result in the more pronounced phenotypic manifestation.

The coronal third of the disto-lingual root of RE can be fixed partially or completely to the distal root. Based on the curvature in a buccal-lingual orientation, the separate RE variants can be classified into three types according to De Moor, Deroose and Calberson (2004). Type I refers to a straight root/root canal. Type II refers to an initially curved entrance, which continues as a straight root/root canal. Type III refers to an initial curve in the coronal third of the root canal and a second curve beginning in the middle and continuing to the apical third.

The patient, a 45-year-old male, presented with pain and discomfort in his mandibular left first molar, previously restored with a direct pulp-capping procedure and a composite resin restoration. A pre-operative radiograph revealed evidence

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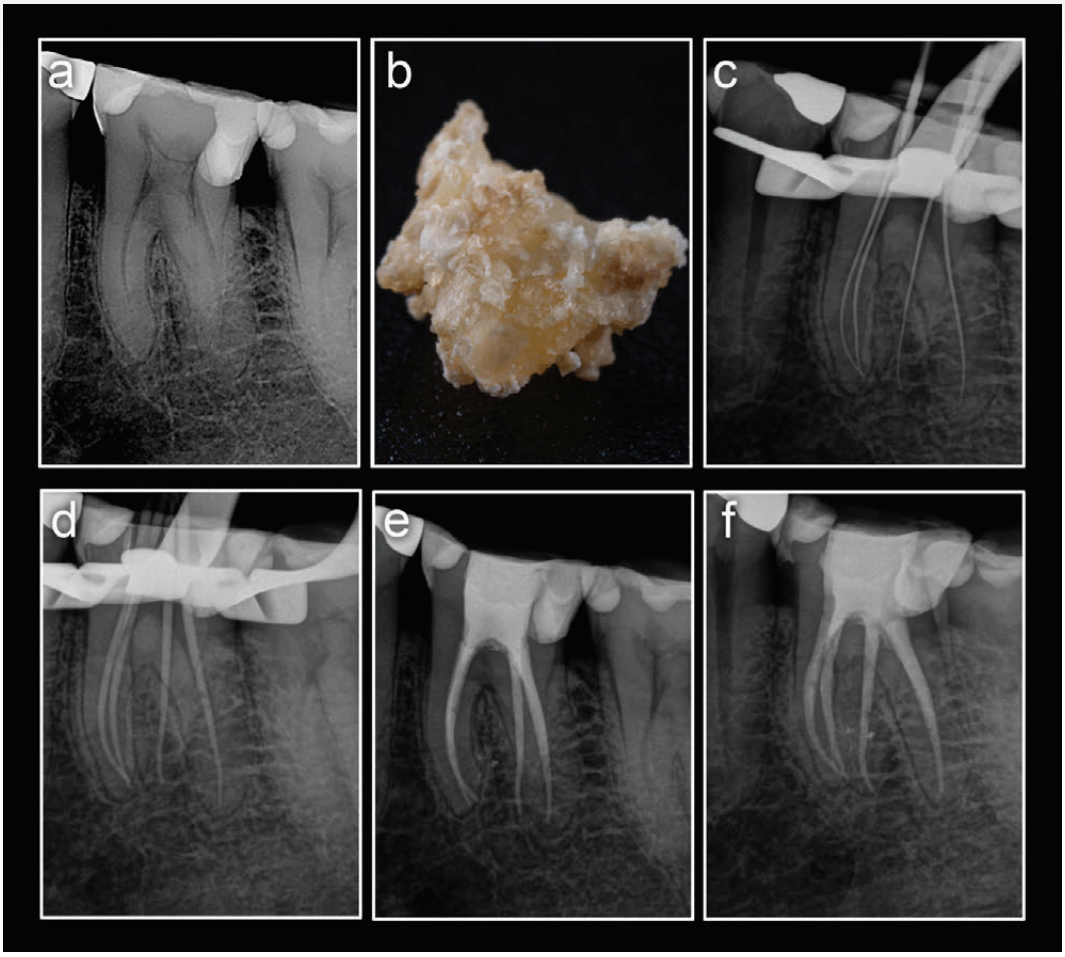

Figure 2. (a) Pre-operative peri-apical radiograph of a mandibular left first molar, previously restored with a direct pulp capping procedure and a composite resin restoration. Note the evidence of a large pulp stone in the pulp chamber as well as unusual root morphology; (b) Large pulp stone removed with a Start-X no. 3 ultrasonic tip; (c) Peri-apical radiograph confirming working length. Note the presence of an additional disto-buccal root; (d) Fit of TruNatomy gutta percha points confirmed radiographically; (e) Postoperative peri-apical radiograph after root canal obturation (parallel view). Note the maximum preservation of pericervical dentine; (f) Postoperative peri-apical radiograph after root canal obturation (mesial angulated view)

of a large pulp stone in the pulp chamber as well as unusual root morphology (Figure 2a). The tooth was accessed and the pulp stone (Figure 2b) removed with a Start-X no. 3 ultrasonic tip (Dentsply Sirona). Four root canal orifices were located and enlarged with the TruNatomy Orifice Modifier (Dentsply Sirona).

The canals were negotiated with size 08 C+ and K-Files to patency and a length determination was made with an electronic apex locator (Propex IQ Apex Locator, Dentsply Sirona) and confirmed radiographically (Figure 2c). The peri-apical radiograph also confirmed the presence of an additional disto-buccal root, and a diagnosis of Radix Entomolaris Type I was made.

Reproducible glide paths were prepared with hand files and the TruNatomy Glider (Dentsply Sirona). Root canal preparation was completed using the TruNatomy Prime instrument.

The root canal systems were irrigated with the modified EDDY technique and dried with paper points. Four Prime TruNatomy gutta percha points were placed and the fit confirmed radiographically (Figure 2d). The canals were obturated using the gutta percha points and Pulp Canal Sealer (Kerr) using the continuous wave of condensation technique with the Gutta Smart Obturation System (Dentsply Sirona). Figures 2e and 2f show the postoperative obturation results.

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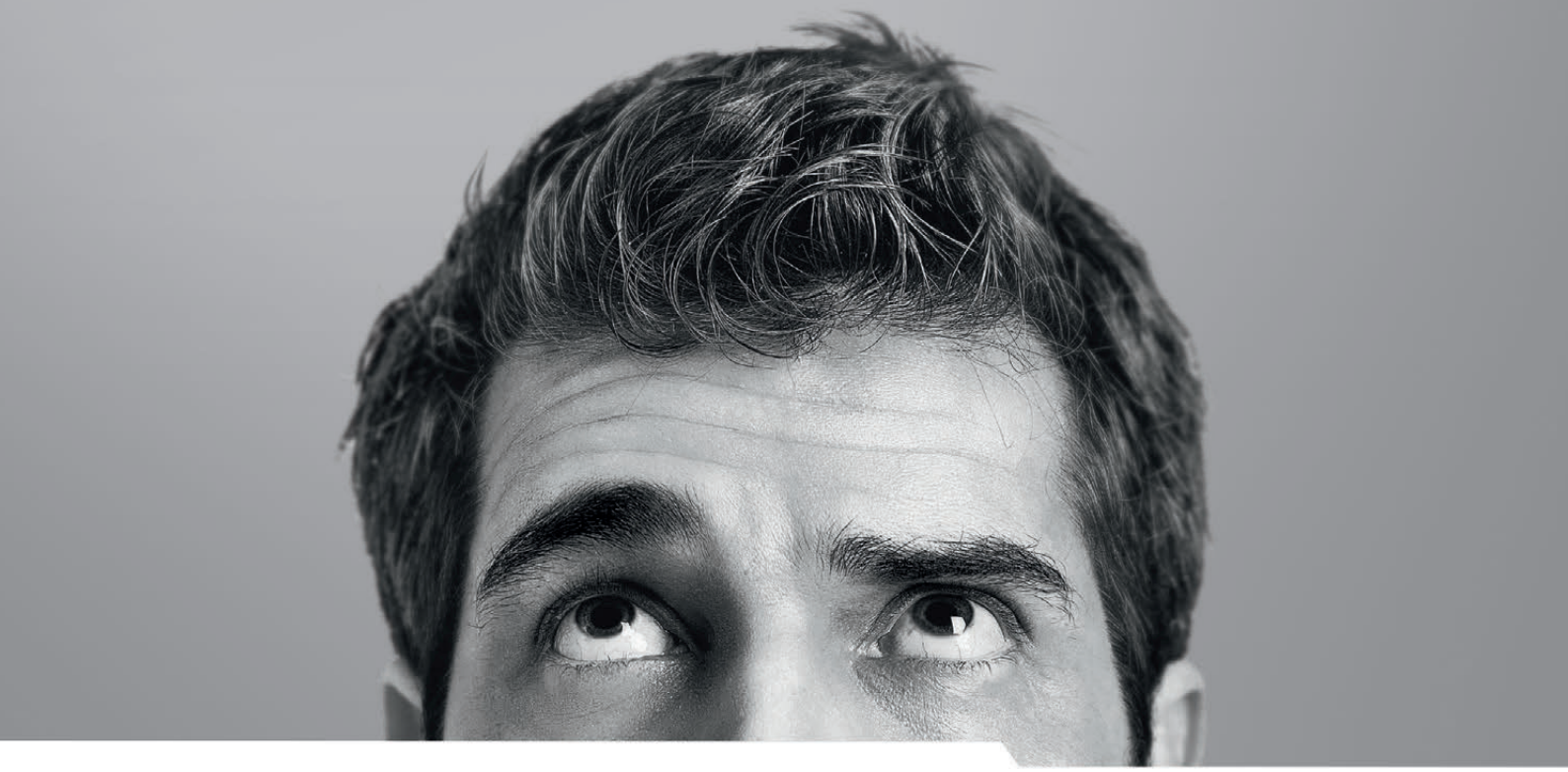

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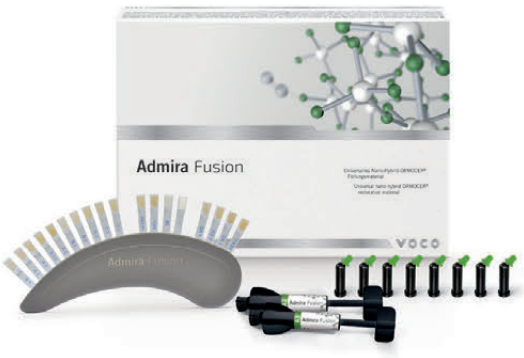

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the fracture of an endodontic instrument. Even with highly skilled operators, the incidence of fracture is about 5% for NiTi instruments (Parashos and Messer, 2006). Leaving the fractured fragment in situ, bypassing the fragment or removing it are the options available to the clinician.

Leaving the fragment in situ involves incorporating the fragment into the final obturation (Saunders, Eleazer, Zhang et al., 2004). This can be risky in cases with apical lesions as the chance of healing may be reduced, (Sjögren, Hägglund, Sundqvist et al., 1990, de Chevigny, Dao, Basrani et al., 2008), but in selected vital cases or cases where chemical disinfection was complete before fracture of the instrument, the prognosis is considered favourable and this treatment option can be considered (Parashos and Messer, 2006, Torabinejad and Lemon, 2002).

Bypassing the instrument with small hand files between the fragment and the root canal is another option. Although it is a time-consuming and labour-intensive exercise, full working length negotiation can be achieved. The fragment is left in situ to form an integrated part of the final obturation (Saunders, Eleazer, Zhang et al., 2004).

The last option is to remove the fractured fragment. This procedure can be a very challenging exercise (Frota, Aguiar, Aragão et al., 2016) and proper vision, illumination and magnification play a crucial role (Gencoglu and Helvacioglu, 2009). According to Hulsmann (1994) there is no standard method for removing fractured instruments and a number of approaches can be followed.

Case Report 3 – Bypass of a fractured instrument

A 45-year-old female presented with a fractured file in the mesio-buccal root canal of her mandibular right second molar (Figure 3a). It was a fragment of approximately 7mm, located in the apical third of the root canal system. After an unsuccessful attempt by her general dentist to remove the fractured instrument with ultrasonic instruments, she was referred for further management.

At the time of treatment it was decided to attempt to bypass the file for the following reasons: (1) examination of a CBCT scan revealed that the fragment was located beyond the maximum curvature of the root canal system; (2) under high microscope magnification the coronal aspect of the fractured fragment was not visible even after coronal enlargement of the root canal system by her general dentist.

A size 08 C+ and 08 K-File were precurved and used alternately to bypass the fractured fragment (Figure 3b). The new glide path next to the fractured instrument was carefully enlarged with a size 10 K-File, followed by a size 12 Profinder (Dentsply Sirona) and a ProGlider (Dentsply Sirona) rotary glide path instrument used in a manual motion.

Canal preparation was completed with the TruNatomy Prime file in the mesial root canal systems and the TruNatomy Medium file in the distal root canal system. The fit of two Prime and one Medium TruNatomy gutta percha cones was verified radiographically (Figure 3c) before the canals were obturated with AH Plus root canal cement (Dentsply Sirona) using the Gutta Smart Obturation System (Dentsply Sirona) (Figure 3d).

Case Report 4 – Removal of a fractured instrument

A 58-year-old male presented with a history of a fractured instrument in the mesio-buccal root canal of his mandibular left first molar. A peri-apical radiograph confirmed a fractured

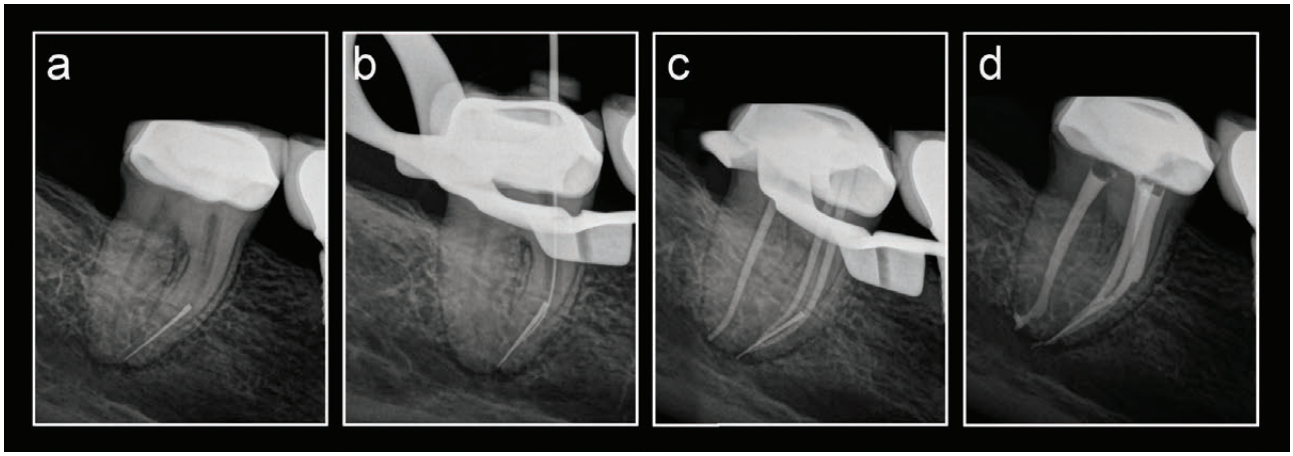

Figure 3 (a) Pre-operative peri-apical radiograph of a mandibular right second molar with a fractured instrument in the mesio-buccal root canal system; (b) Fractured file bypassed with a size 08 K-File; (c) TruNatomy Prime gutta percha points fitted after preparation with the TruNatomy Prime and Medium files; (d) Postoperative peri-apical radiograph after obturation

file located in the midroot region (Figure 4a). A sagittal view of a CBCT confirmed the location, but demonstrated that the fragment was located at the point of maximum curvature of the root canal system (Figure 4b). The mesio-lingual and mesio- and disto-buccal root canal systems were patent and could be negotiated to full working length (Figure 4c). It was decided to use the EndoCowboy (Köhrer Medical Engineering) (Figure 4d) to attempt removal of the fractured instrument.

Figure 4e depicts the coronal aspect of fractured fragment in the mesio-buccal root canal system under 12X magnification. A size 15 Endosonare file (Dentsply Sirona) mounted on a U-File holder (Endo Kit E12, NSK) driven

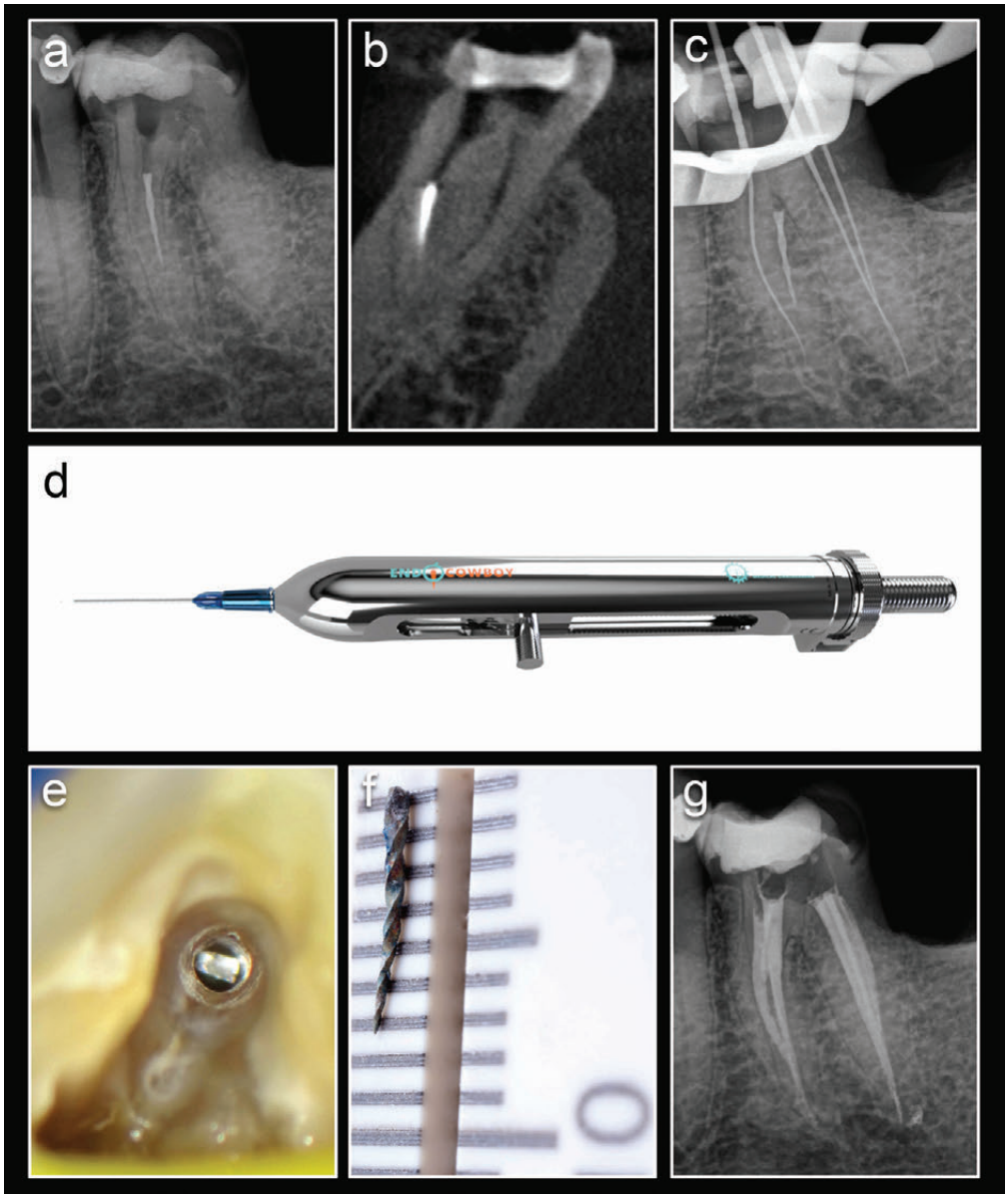

Figure 4: (a) Peri-apical radiograph showing a fractured instrument in the midroot area of the mesio-buccal root canal of a mandibular left first molar; (b) Sagittal view of a CBCT confirmed that the fragment was located at the point of maximum curvature of the root canal system; (c) Length determination peri-apical radiograph confirming that the mesio-lingual and mesio- and disto-buccal root canal systems were patent and could be negotiated to full working length; (d) EndoCowboy (Köhrer Medical Engineering), preloaded with the standard 0.12mm wire in a 0.5mm cannula; (e) Coronal aspect of the fractured fragment in the mesio-buccal root canal system under 12X magnification; (f) Extracted fractured fragment measuring 6mm on a ruler; (g) Postoperative peri-apical radiograph after root canal preparation and obturation of all the root canal systems

by a Satelec P-5 ultrasonic scaler (Satelec) was used to trough around and to expose the coronal aspect of the fragment. The EndoCowboy, preloaded with the standard 0.12mm wire in a 0.5mm cannula, was introduced into the root canal, the preformed lasso was positioned around the separated instrument, the lasso closed and the fractured fragment (Figure 3f) extracted from the root canal using a pulling action. Figure 3g shows the final obturation result after treatment of all the root canal systems.

Case Report 5 – Orthograde endodontic retreatment

Orthograde endodontic retreatment of previously treated teeth is a fairly common clinical procedure and is usually attempted before surgical endondontics, especially in teeth restored without posts (Gorni and Gagliani, 2004).

Salehrabi and Rotstein (2010) evaluated the outcome of orthograde endodontic retreatment of 4744 teeth over a period of five years. The results of the study indicated that 89% of the teeth were retained in the oral cavity five years after endodontic retreatment; only 4% of the teeth required apical surgery within two years of completion of the orthograde retreatment, and only 11% of the teeth were extracted over the five-year period.

The patient, a 49-year-old female, presented with discomfort in her maxillary left first molar, which had previously had root canal treatment. Radiographic examination revealed that all three obturated root canal systems was treated short of full working length (Figure 5a). After access cavity preparation, the previous gutta percha was removed from the canals using Endosolv E (Septodont) and a size 15 Hedstrom file. Under magnification, a second mesio-buccal root canal system was detected before all the root canal systems were negotiated to full working length using size 08 C+ and K-Files (Figure 5b). Reproducible micro glide paths were established using a size 10 K-File and enlarged with a TruNatomy Glider (Dentsply Sirona). The root canal systems were prepared to working length with the TruNatomy Prime file followed by the TruNatomy Medium file. TruNatomy medium gutta percha points were placed and the fit confirmed radiographically (Figure c). Figure 5d depicts the final result after obturation.

Case Report 6 – S-shaped root canals

The extent of root canal curvature is one of the most important variables that determine the difficulty of root canal shaping procedures. The curvature in the root canals varies depending on the location or severity; it may be apical or gradual or S-shaped (Ruddle, 2001). In clinical conditions, when two curves are present in the same root canal trajectory, this is called an "S-shaped" canal (Machado, Chaniottis, Vera et al., 2014). S-shaped canals are found most often in maxillary lateral incisors, maxillary canines, maxillary second premolars and mandibular second molars (Gutmann and Lovdahl, 2010, Michetti, Maret, Mallet et al., 2010).

These S-shaped root canal systems often pose clinical challenges during root canal instrumentation, disinfection and obturation (Sakkir,Thaha,Nair et al., 2014). Common causes of failure in these canal systems are primarily related to procedural errors such as ledges, fractured instruments,

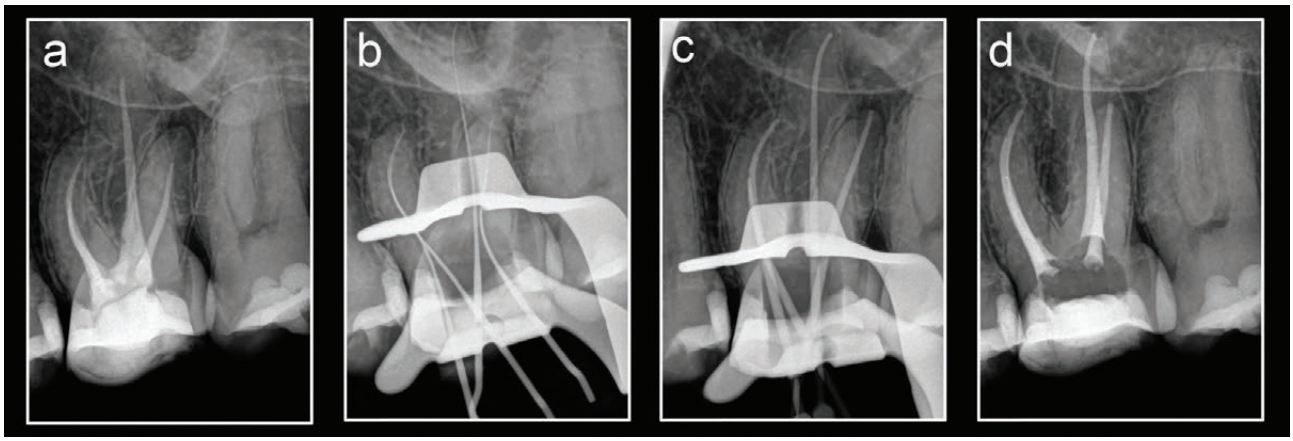

Figure 5. (a) Preoperative peri-apical radiograph of maxillary left first molar with previous root canal treatment. Note that all three obturated root canal systems were treated short of full working length; (b) Length determination peri-apical radiograph; (C) Conefit peri-apical radiograph; (d) Postoperative peri-apical radiograph after obturation

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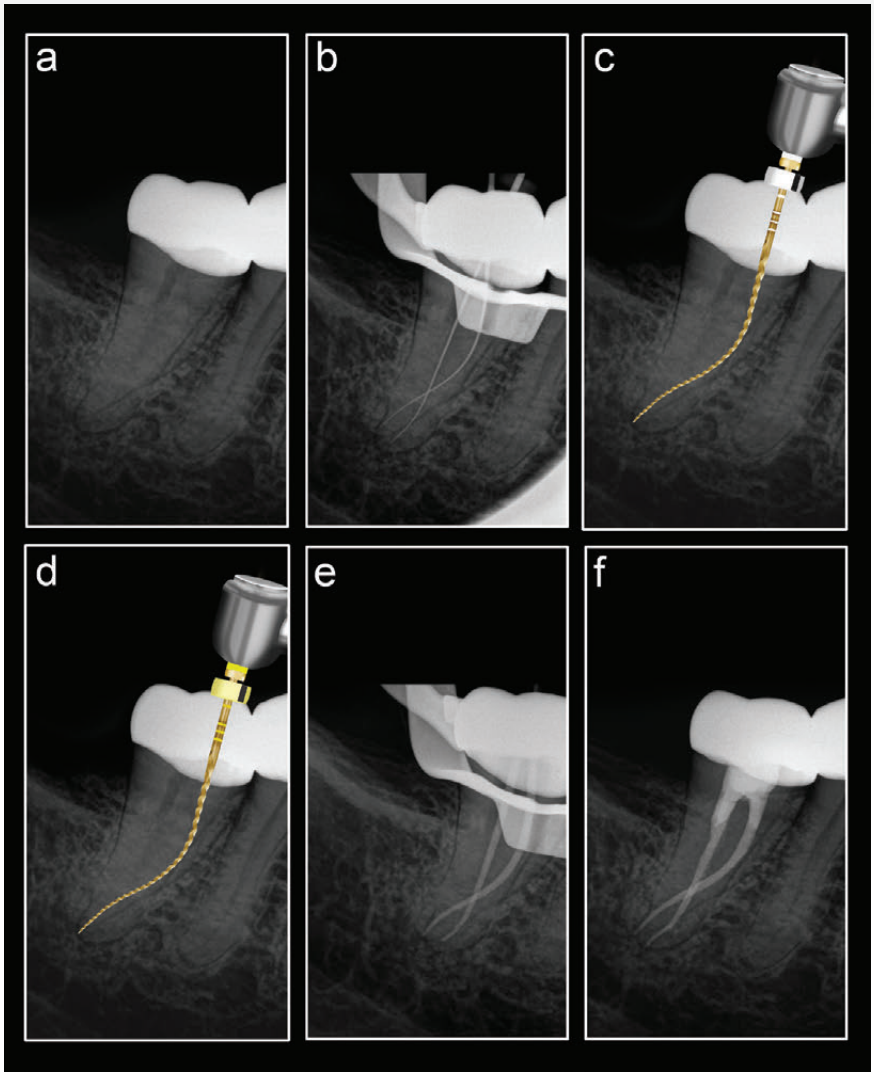

Figure 6. (a) Pre-operative peri-apical radiograph of non-vital mandibular right second molar; (b) Length determination peri-apical radiograph; (C) Glide path enlargement with the TruNatomy Glider; (d) Root canal preparation with the TruNatomy Small file; (e) Conefit peri-apical radiograph; (d) Postoperative peri-apical radiograph after obturation

canal blockages and canal transportation (Hamasha,Al-Khateeb and Darwazeh, 2002). Root canal preparation of S-shaped canal systems depends on the flexibility of the instruments, the technique of biomechanical preparation, the location of the apical foramen and the presence of calcification in the root canal system (Ye and Gao, 2012). In general, problems can occur primarily in four distinct anatomical situations during root canal preparation with rotary instruments: i) canals that join as they traverse from the orifice to the apical foramen; ii) S-shaped canals; iii) canals with abrupt deviations coronally, usually 2–4mm below the canal orifice; iv) canals with sudden deviations, usually 90 degrees or more in the apical one-third of the root (Gutmann and Lovdahl, 2010).

The patient, a 58-year-old female, presented with a symptomatic non-vital mandibular second molar (Figure 6a). The patient reported that the tooth had been crowned approximately two years before but had never felt comfortable. After access cavity preparation and examination of a pre-operative CBCT scan, only two root canal systems were located. It was very difficult to negotiate the S-shaped canals with pre-curved size 08 C+ and K-Files and it took several attempts to achieve patency and to determine working length (Figure 6b). A

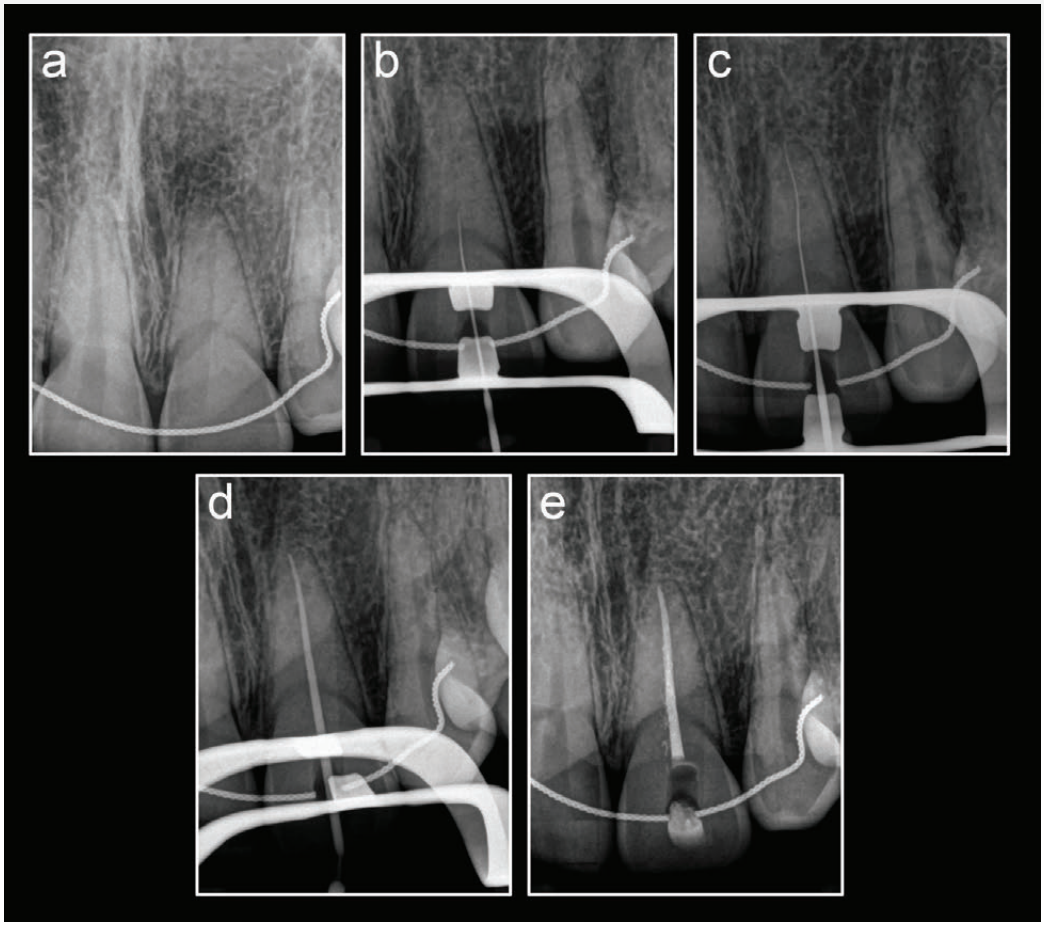

Figure 7. (a) Pre-operative peri-apical radiograph of maxillary left central incisor with obliterated root canal system; (b) Coronal aspect of the root canal negotiated with a 08 C+ File; (c) Length determination peri-apical radiograph; (d) Conefit peri-apical radiograph confirming the fit of a TruNatomy Prime gutta percha point; (e) Postoperative peri-apical radiograph after root canal obturation

reproducible micro glide path was prepared in both root canal systems using a size 10 K-File before the glide paths were carefully enlarged with a TruNatomy Glider (Dentsply Sirona) (Figure 6c). Several cutting cycles were made with the TruNatomy Glider, followed by irrigation, recapitulation and re-irrigation before the TruNatomy glider reached full working length. Taking into account the difficulty of canal negotiation, glide path preparation and the S-shape of the root canals, it was decided to only enlarge the root canal systems with the TruNatomy Small file (Figure 6d). After irrigation, TruNatomy Small gutta percha points were placed and the fit confirmed radiographically (Figure 6e). Figure 6f depicts the final result after obturation using the Gutta Smart Obturation Sytem (Dentsply Sirona) to perform warm vertical condensation.

Case Report 7 – Calcific Metamorphosis

Calcific metamorphosis (CM) or pulp canal obliteration (Andreasen, Andreasen and Andersson, 2013) is a common occurrence following concussion and subluxation injuries (Oginni, Adekoya-Sofowora and Kolawole, 2009). Although the exact mechanism by which the canal is obliterated is unknown, it is believed to be related to neurovascular damage and deposition of hard tissue within the canal (Yaacob and Hamid, 1985, Robertson, 1998). This calcification of the pulp canal space results in a loss of translucency and leaves the crown with a yellow discolouration (Patterson and Mitchell, 1965). CM can be clinically detected as early as three months after injury, but in most cases remains undetected for up to a year after trauma (Andreasen, 1970, Rock and Grundy, 1981, Torneck, 1990).

Most teeth showing canal obliteration are asymptomatic (McCabe and Dummer, 2012, Robertson et al., 1996, Oginni, Adekoya-Sofowora and Kolawole, 2009) including the absence of sensitivity to percussion (Malhotra and Mala, 2013). CM is therefore often an incidental finding during clinical or radiographic investigations (Oginni, Adekoya-Sofowora and Kolawole, 2009, McCabe and Dummer, 2012). Asymptomatic teeth presenting with CM do not initially require treatment other than annual follow-ups (McCabe and Dummer, 2012, Oginni, Adekoya-Sofowora and Kolawole, 2009), but the pulp status within partially obliterated canals may eventually lead to apical pathology requiring treatment (Malhotra and Mala, 2013, de Cleen, 2002, Feiglin, 1996, Gopikrishna, Parameswaran and Kandaswamy, 2004, Amir, Gutmann and E Witherspoon, 2001).

The absence of a root canal on conventional radiographs does not necessarily mean the total absence of a canal (McCabe and Dummer, 2012, Patterson and Mitchell, 1965, Schindler and Gullickson, 1988, Torneck, 1990). Histologic evaluation of pulp canals, radiographically diagnosed as being obliterated, almost always confirms the existence of a narrow pulp canal with pulpal tissue (Feiglin, 1996, Abbott and Yu, 2007, Amir, Gutmann and Witherspoon, 2001, Malhotra and Mala, 2013). "Canal mineralisation" has therefore been suggested as a more accurate term than canal obliteration (Malhotra and Mala, 2013, Abbott and Yu, 2007, Levin, Law, Holland et al., 2009).

The patient, a 27-year-old female, presented with percussion sensitivity on her maxillary left central incisor. A peri-apical radiograph and CBCT scan revealed that the canal was almost completely obliterated. After access cavity preparation, the darker dentine discoloration of the pulp floor was followed with small long-shank burrs (Dentsply Sirona) and a Start.X no. 3 ultrasonic tip (Dentsply Sirona) until a very calcified canal orifice was located. The coronal aspect of the canal was negotiated with a 08 C+ File followed by a 08 K-File. This sequence was repeated until canal patency and full working length were achieved. A size 10 K-File was used to create a reproducible micro glide path before the macro glide path was completed using the TruNatomy Glider in 8–12 back-stroke brushing motions. Canal preparation was done with the TruNatomy Prime file followed by canal irrigation with EDTA and sodium hypochlorite. The root canal system was obturated with a TruNatomy Prime gutta percha point (Dentsply Sirona), AH Plus Root Canal Sealer (Dentsply Sirona) and the Gutta Smart Obturation System (Dentsply Sirona).

Conclusion

Endodontic treatment, even in routine cases is often challenging and indeed stressful (Dahlström, Lindwall, Rystedt et al., 2017). More challenging and complex cases may be seen as not predictable even in expert hands. The presented case studies illustrate how clinicians can approach a variety of challenging endodontic scenarios using the TruNatomy endodontic shaping system. It is evident from each case that the TruNatomy system not only preserves dentine, ensuring minimally invasive root canal preparation, but is also a versatile system with many clinical benefits and advantages when used in these challenging cases.

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Innovative resin-modified glass-ionomer cement for zirconia restorations: a case report

Roberto Sorrentino[1]

Due to the increasing patients' demand for aesthetics and its optimal biomechanical and optical properties, zirconia is widely used in prosthodontics as a material of choice for indirect ceramic restorations [1-4]. Recently, cubic translucent zirconia has been introduced in the market to improve the optical characteristics and reduce material ageing [3,5,6].

Due to the absence of any glassy matrix, zirconia is free from silica and, consequently, cannot be conditioned with conventional acid etching techniques [1,7,8]. Several surface treatments were suggested in the literature but to date data are still controversial [9,10]. On the basis of the physical-chemical properties of zirconia, in the presence of retentive preparation geometries and full coverage prostheses, conventional water-based luting agents (i.e. glass ionomer and zinc phosphate cements) and hybrid cements (i.e. resin-modified glass ionomer cements) should be considered the first choice materials for cementation [9,11,12].

Case history

A 43-year-old male patient treated and stabilised for a previous severe chronic periodontitis asked for the aesthetic rehabilitation of both dental arches, complaining about aesthetic as well as functional problems (Figs. 1-2). After achieving good occlusal stability and proper vertical dimension of occlusion by means of implant-supported metal-ceramics single crowns in the posterior regions, a careful evaluation of the maxillary front teeth was performed, in order to formulate a proper biomechanical and aesthetic treatment plan. Particularly, the patient presented with the following problem list: diastema, tooth wear, high caries activity, moderate staining, unsatisfactory composite restorations, altered interdental proportions, gingival recessions and moderate bone resorption (Fig. 3).

Figure 1: Extraoral pre-operative view.

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Figure 2: Intraoral pre-operative view.

Figure 3: Pre-operative detail of the maxillary front teeth.

Treatment

According to the patient's requests and taking the aesthetic needs and biomechanical drawbacks of the case (i.e. deep bite, long lever arms) into consideration, 6 cubic translucent zirconia single crowns were planned, in order to achieve a natural tooth-like appearance of the restorations and optimal mechanical resistance during function.

Minimally invasive vertical tooth preparations were performed on the maxillary front teeth, removing the previous composite restorations and secondary decays and keeping satisfactory total occlusal convergence. The prosthetic margins were iuxtagingivally placed and all the teeth were kept vital (Figs. 4-6). Temporary acrylic resin restorations were used for 3 weeks to allow the soft tissues to recover from preparation and impression procedures.

Subsequently, 6 cubic translucent zirconia single crowns were fabricated (Fig. 7). The buccal surfaces were layered with a dedicated veneering ceramics, so as to extol the aesthetic appearance, whereas the palatal functional aspects were left in the monolithic configuration and glazed, in order to avoid any risk of chipping. Because of the excellent biocompatibility of zirconia, the prosthetic iuxtagingival margins were manually polished and left unglazed to promote the formation of an epithelial attachment and optimise the biological integration of the restorations.

The inner zirconia surface of each crown was conditioned with mild sandblasting using 110 µm alumina particles at 0.2 MPa. An innovative paste-paste resin-modified glass ionomer luting agent (FujiCEM Evolve) was used to cement the restorations (Fig. 8). As this type of luting agent does not require complete field isolation and allows to perform a conventional cementation procedure, PTFE tapes were used to protect the adjacent teeth (Fig. 9). After seating the restorations, cement gelification was achieved by means of light-curing; this passage is not mandatory but allows for a faster setting of the luting agent. Then, cement excess was removed with a urethane dimethacrylate curette, in order not to damage the glazed surface of the ceramic crowns (Fig. 10), and dental floss was used to clean the interproximal

Figure 4: Maxillary front teeth preparations for single crowns.

Figure 5: Detail of the right side tooth preparations.

Figure 6: Detail of the left side tooth preparations.

Figure 7: Layered cubic zirconia anterior single crowns. A: internal view; B: buccal view.

Figure 8: Maxillary central incisor zirconia crowns filled with resin-modified glass-ionomer cement.

spaces (Fig. 11). The same approach was used to cement the zirconia crowns onto lateral incisors (Fig. 12) and canines (Fig. 13). Finally, post-curing was performed after applying an oxygen barrier so as to achieve complete setting of the cement at marginal level (Fig. 14).

Thanks to the excellent biocompatibility of zirconia, to the precision of the prosthetic margins and to the optimal performance of FujiCEM Evolve, 2 weeks after cementation the aesthetic and biological integration of the zirconia crowns was ideal, with good recovery of the gingival health and proper periodontal maturation (Figs. 15-17).

Due to economic reasons, the patient decided to have the severely worn and malpositioned mandibular front teeth (Fig. 18) restored with composite restorations. Consequently, the

Figure 9: PTFE- assisted cementation of the maxillary central incisors.

Figure 10: Cervical cement excess removal from central incisors.

Figure 11: Interproximal cement excess removal from central incisors.

Figure 12: PTFE- assisted cementation of the maxillary lateral incisors.

Figure 13: PTFE- assisted cementation of the maxillary canines.

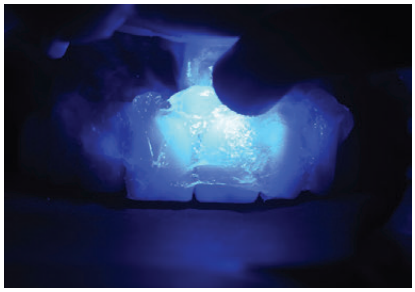

Figure 14: Light-curing of the prosthetic margins of the zirconia crowns through the oxygen barrier.

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Figure 15: 2-week soft tissues healing after cementation: front view of the cubic zirconia single crowns.

Figure 16: Post-operative right side detail of the cubic zirconia single crowns.

Figure 17: Post-operative left side detail of the cubic zirconia single crowns.

Figure 18: Pre-operative view of the mandibular front teeth.

Figure 19: Restoration of the mandibular front teeth by means of the composite injection technique with G-ænial Universal Flo.

Figure 20: Post-operative view of the mandibular from teeth restored with injected direct composites.

Figure 21: Post-operative view: layered cubic zirconia single crowns at the maxillary arch and injected direct composite restorations at the mandibular arch.

Figure 22: Functional occlusal check at the maxillary arch.

Figure 23: Functional occlusal check at the mandibular arch.

area was restored by means of direct restorations applied using the flowable composite (G-ænial Universal Flo) injection technique (Figs. 19-20).

Proper dynamic and occlusal functions were restored and carefully checked (Figs. 21-23). Moreover, the final outcome showed a good aesthetic restoration of the patient's smile line (Fig. 24).

Outcome

Different advantages were noticed using FujiCEM Evolve, like ease of use (the possibility to use the automixing dispenser makes cement application very slightly dependent on the operator's skill), moisture tolerance (ideal in the presence of iuxta- or sub-gingival margins and requiring no isolation) and versatility (suitable for different restorative materials).

Figure 24: Extraoral post-operative view.

Particularly, in the present case this luting agent was used to cement both zirconia crowns in anterior areas and metal-ceramics crowns onto posterior implants, showing the same flowability and easiness in cement excess removal, due to its user-friendly rubbery consistency, very useful to avoid the entanglement of any particle within the soft tissues.

Furthermore, no ceramic pre-treatment is mandatory before the application of the cement and the dual-curing technology allows for a faster setting using light-polymerisation.

Thanks to its innovative features, FujiCEM Evolve allowed to avoid any post-operative sensitivity and its radiopacity makes the identification of possible sub-gingival excess very easy.

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Exploring orthodontic options in complex adult cases

Shivani Patel[1]

A 40-year-old male at the start of treatment presented with a mild class III incisor relationship on a skeletal I dental base with average vertical facial proportions.

There was severe crowding in the upper arch and mild crowding in the lower arch. He had a reduced overjet and increased overbite with bimaxillary retroclination. The treatment took exactly two years.

The molar relationship was class III on the right and class I on the left side. The case was complicated, with retained upper right and left deciduous canine teeth, along with unerupted and impacted upper right and left canine teeth.

Treatment carried out was with bilateral closed surgical exposure of the upper right and left canine teeth, combined with upper and lower preadjusted Edgewise appliance therapy.

Preoperative assessment

The patient complained of having baby teeth that were now mobile and also made his smile immature. He was now applying for the chief executive officer post in his firm and wanted to be taken seriously, and for his smile to look mature and fit his face and age.

He was undecided and came to see us initially four years ago and was re-exploring his orthodontic options again.

Relevant medical history suggested the patient was fit and healthy.

Extraoral assessment

Skeletal assessment

- Skeletal I pattern
- Average vertical skeletal relations
- No asymmetries.

Soft tissue assessment

Lips

- Lips were incompetent at rest
- The soft tissue profile looked good. It was felt that the patient was bimaxillary retroclined, which meant his upper and lower lips were set back and less supported.

Nose

- Average nasolabial angle.

Tongue

- Nothing abnormal detected.

Speech

- Nothing abnormal detected.

Temporomandibular (TMJ) assessment

- Nothing abnormal was detected
- Maximum mouth opening: 42mm.

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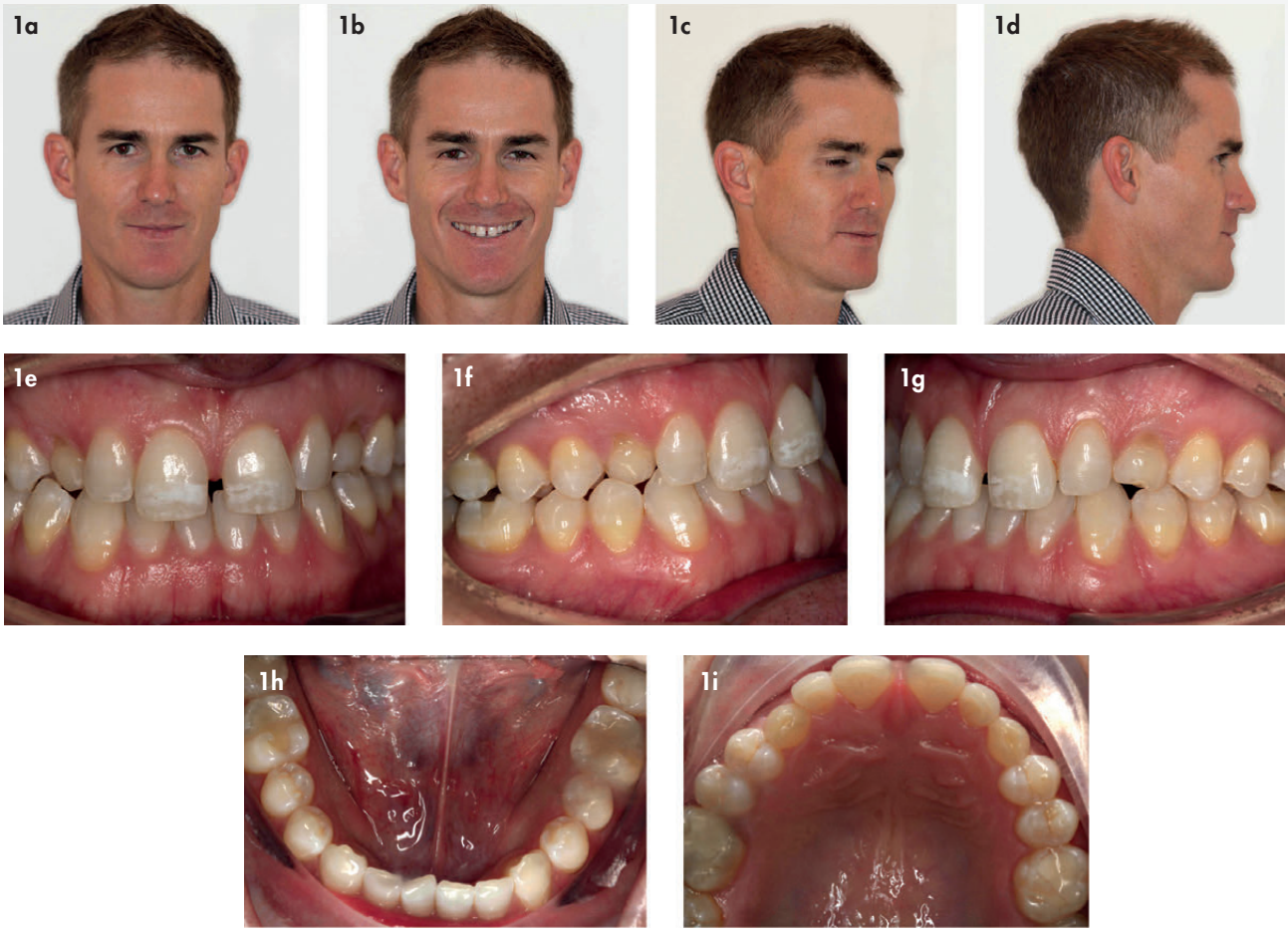


Figures 1A-I: Preoperative photographs

Intraoral assessment

Oral hygiene and dental health

- Oral hygiene was good
- Restorations present on some posterior teeth. All sound and with no other pathology detected.

Soft tissue assessment

- Gingivea and mucosa were healthy.

Unerupted teeth

- All teeth had erupted apart from UR3 and UL3.

Arch alignment and space assessment

Maxillary arch

- Upper labial segment was severely crowded and retroclined
- The upper right and left deciduous canine teeth were retained and mobile. Mobility grade II
- The buccal segments showed mild crowding, primarily confined to the first premolars
- Median diastema of 2.5mm with a low frenal attachment.

Mandibular arch

- The lower labial segment was mildly crowded and retroclined
- The buccal segments were well aligned.

Bolton Analysis

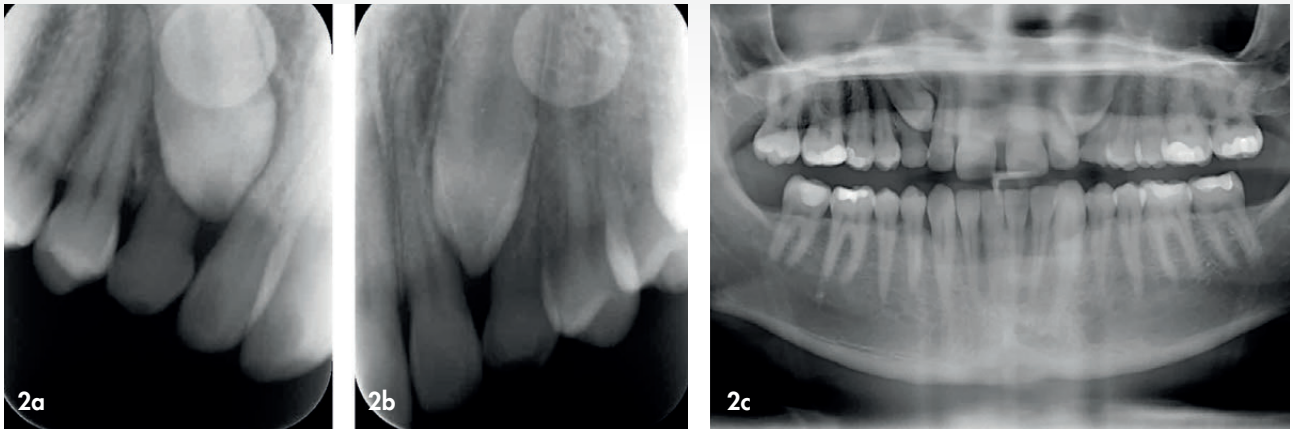
3(9mm) 2(6mm) 1(9mm)	1(9mm) 2(6mm) 3(9mm)
3(8mm) 2(6mm) 1(6mm)	1(6mm) 2(6mm) 3(8mm)

Total 83.33 (ideal ratio 77.2 +/- 1.65).

A Bolton discrepancy is evident. This is due to the upper lateral teeth being smaller than average

Occlusal relationships

- Incisor classification: class III
- Overjet: 1.5mm
- Overbite: increased, complete to tooth
- Centre line: coincident dentally and facially.



Figures 2A-C: Preoperative radiographs

Buccal segment relationship

Molars:
- Left: full unit class I
- Right: full unit class III.

Canines:
- Left: class I
- Right: class I.

Crossbites:
- Nil.

Displacements:
- Nil.

Other features to note:
- Mottling on the upper incisor edges
- History of childhood trauma.

Intercanine width
- Upper: 33mm
- Lower: 27mm.

Intermolar width
- Upper: 58mm
- Lower: 51mm.

Special investigations

1. Initial extra and intraoral photographs (Figures 1a-1l)

2. Preoperative radiographs
- Views taken
- Dental panoramic tomogram
- Long cone periapicals
- Unerupted UR3 and UL3
- Absent teeth: none
- Pathology: none.

Other relevant radiographic findings:

roots of the upper right and left deciduous canine teeth have been resorbed.

3. Study models

Unfortunately, these were sent to the laboratory a few years ago for digitising and were misplaced/lost.

Summary of radiographic findings

An orthopantomogram (OPG) was taken of grade I quality to assess position, presence and pathology.

The OPG revealed normal TMJ and surrounding structures. Radiographic assessment revealed normal and healthy periodontal status; however, the upper canine teeth were impacted and the roots of the deciduous canines were resorbed.

It appears that both the upper canine teeth are aligned favourably close to their ideal axis in the arch and the apices are well positioned for potential movement into the arch.

Horizontal parallax views were taken to localise the position of the teeth (Southall and Gravely, 1987). This was done with two long cone periapical views. Horizontal parallax views are more accurate; 83% of 3s were correctly located with horizontal parallax compared with 68% with vertical parallax (Armstrong et al, 2003).

When localising canines and determining the prognosis, there are a number of factors to consider:
- The bucco-palatal position
- The position of the apex – very important
- Height of the crown to the occlusal plane
- Obliquity to the long axis
- Proximity to the midline.

Bearing all these factors in mind when assessing the radiographs, the UL3 is placed in the line of the arch as its crown shows no movement with respect to the lateral incisor tooth root between the two views.

The UR3 has its crown slightly towards the palatal aspect. Both of these teeth would be accessible buccally for the

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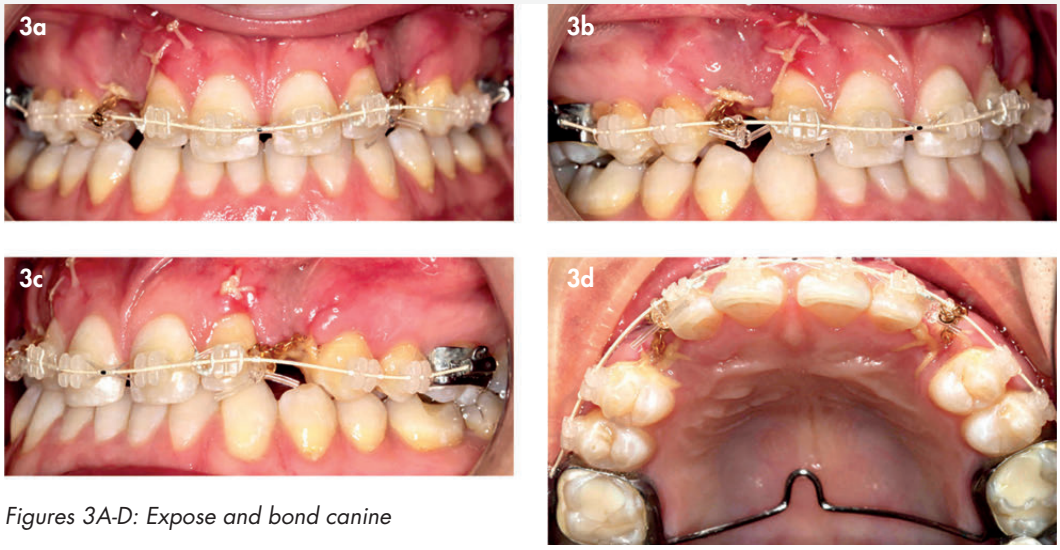
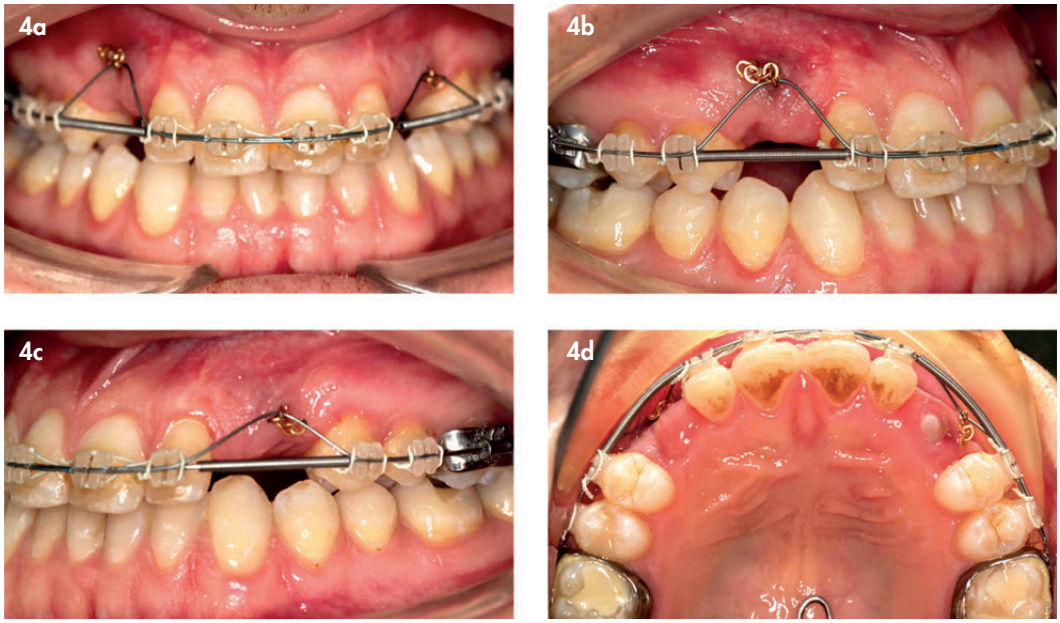


Figures 3A-D: Expose and bond canine



Figures 4A-D: Piggyback mechanics

approached of expose and bond.

There is no evidence on any of the X-rays of any cyst formation or root resorption; however, this is a 2D X-ray of a 3D person. Twelve per cent of cases of impacted 3s cause root resorption of the lateral incisor teeth (Ericson and Kurol, 1987).

Computed tomography (CT) scans demonstrated that 48% of lateral incisor teeth demonstrate a degree of resorption. (Ericson and Kurol, 2000). Risk factors for the root resorption of lateral incisor teeth are:

- Female
- Under 14 years of age
- Horizontally impacted canine teeth
- Canine crown medial to the midline of the lateral incisor (Ericson and Kurol, 1988).

It was not deemed necessary in this case to take a routine CT scan and expose the patient to unnecessary radiation.

Aetiology of presenting malocclusion – dentoalveolar

- Severe crowding in the upper arch and mild crowding in the lower arches due to dentoalveolar disproportion
- Failure of resorption of the deciduous canine
- Pathology impeding the canine eruption – alveolar bone/fibrous tissue/cyst

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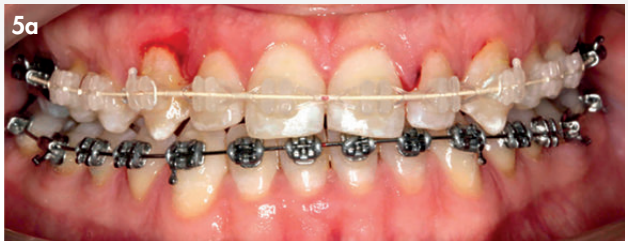
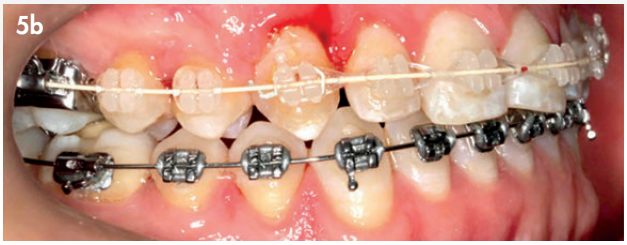
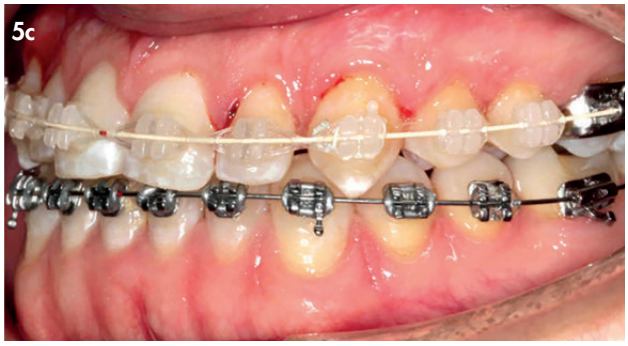
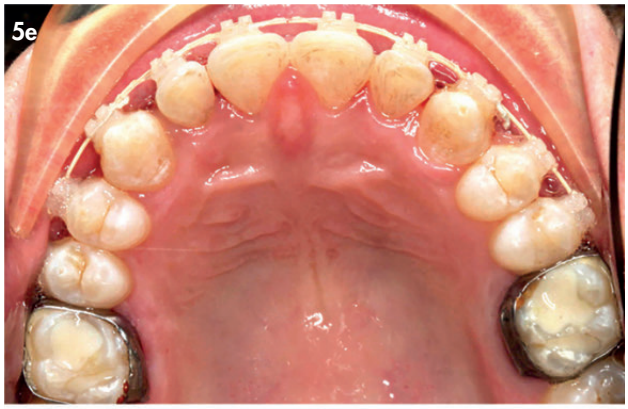








Figures 5A-E: Transpalatal arch removed

- Lateral incisor teeth are slightly small – guidance theory
- Genetics?

Aims of treatment

Facial

- Improve facial profile (up righting the upper and lower anterior teeth giving better soft tissue support).

Dental

- Maintain good oral hygiene and general dental condition
- Create sufficient space for the alignment of the upper canine teeth
- Relief of crowding and align the arches
- Correct the molar relationship
- Correct the overbite and over jet
- Retain.

Treatment plan

1. Stabilisation and prevention

This involved a comprehensive check-up and bitewings, along with two sessions of oral hygiene sessions to reverse the mild gingivitis and prepare the patient for high standards of oral hygiene required during orthodontic therapy.

2. Orthodontic options

i) No active treatment

ii) Surgical exposure of the canine teeth and traction with fixed appliances – comprehensive care
- Extractions patterns: ULC and URC
- Expose and bond: UL3 and UR3
- Transpalatal arch for additional vertical anchorage
- Placement of upper and lower buccal fixed braces and align the exposed upper 3s.

iii) Surgical extraction of the impacted canine teeth, orthodontics and replacement with implants/resin bonded bridges-orthodontics with limited objectives. Under general anaesthesia, surgically extract the upper canine teeth. The upper deciduous canines are also very mobile and, hence, would be lost in the process. Placement of fixed appliances to align the teeth, improve the over jet and overbite, and create sufficient space for the future restoration of the canine teeth with implants or resin bonded bridges.

iv) Extraction of the deciduous canines, impacted canines and close the extraction spaces with fixed appliances. Camouflage the upper first premolar teeth to look like canines – orthodontics with limited objectives

Figures 6A-K: Debond

v) Transalveolar transplant and surgical repositioning.

3. Indefinite retention

Upper and lower vacuum formed retainers to be worn initially full time, then, after one year, part time at night for an indefinite period of time.

Bonded upper and lower lingual retainers from the UR3 to UL3 and LR3 to LL3 using 0.0175" braided stainless steel (co-axial).

Retention regime: full-time wear for 12 months, followed by nocturnal wear for 12 months, and then long-term wear of the upper retainer for a minimum of four nights a week.

4. Frenectomy

5. Restorative phase

Whitening and bonding to mask the mottling on the upper central incisor teeth.

Consent and treatment

Standard benefits and risks pertaining to orthodontic treatment were discussed with the patient, including those related to poor oral hygiene, caries, periodontal issues, root resorption, loss of vitality, ankylosis and TMJ dysfunction TM disorders.

More specific to this case was the risk of ankylosis of the upper canines, the risk of a second surgical procedure to remove the ankylosed canines, and additional costs possibly involved to restore the spaces created by the missing canine teeth, along with possible formation of postoperative black triangles, which is highly likely in adults.

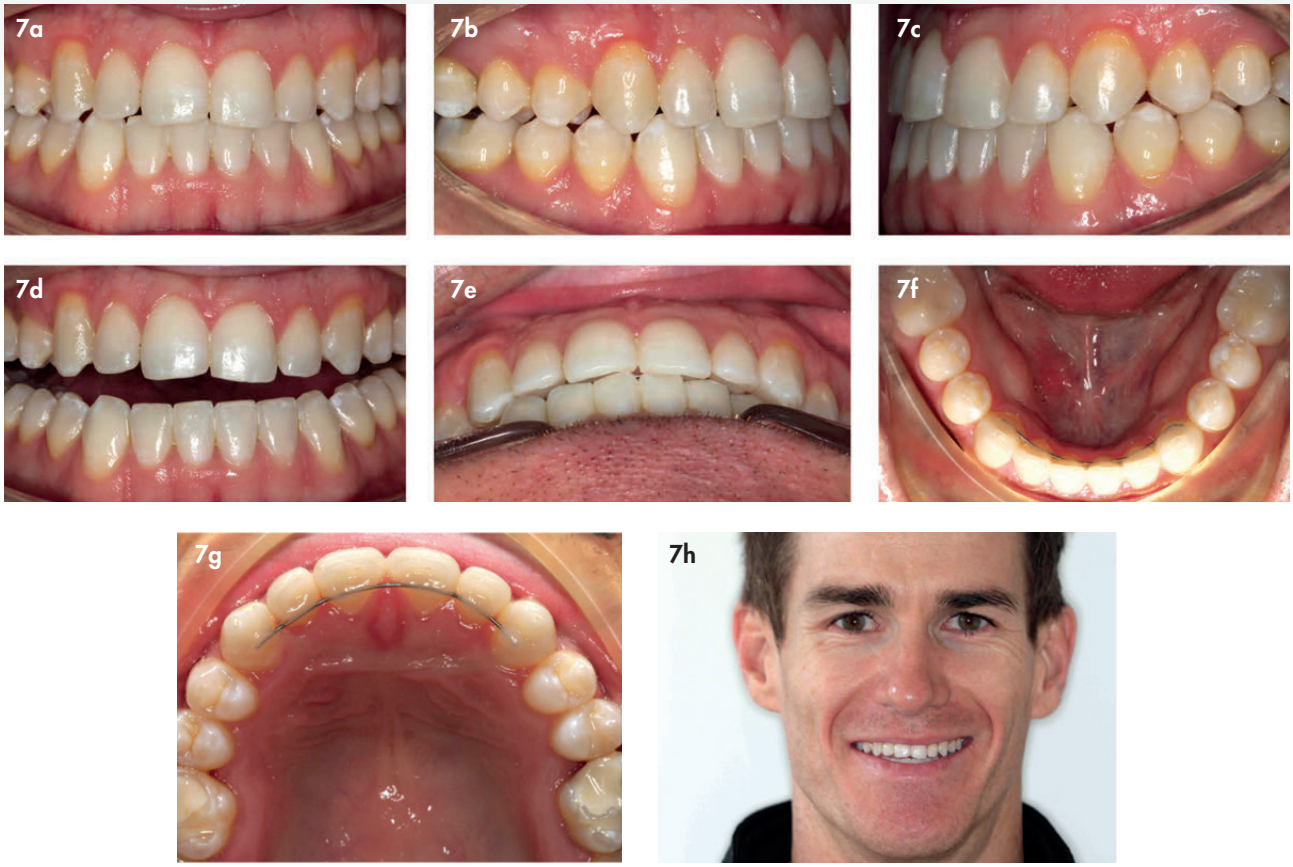
The treatment option selected was extraction of the Cs, surgical expose and bond of the upper 3s and orthodontic traction – comprehensive care.

The patient, as front-face worker, was keen for lingual braces, extractions of the 3s and Cs and placement of two implants. After three reviews to ensure we got the right ethical plan for this patient, the above option was chosen, which was one-third of the cost of the patient's ideal plan.

Fixed appliance design

Orthodontic traction is required to pull an unerupted tooth toward the line of the arch. This can be done with removable appliances or fixed appliances. In this instance, as it involved an adult patient, we deemed it predictable and acceptable to align the upper canine teeth with buccal fixed appliances.

- Bracket prescription and variation



Figures 7A-H: Three-month review

- Placement of upper and lower preadjusted Edgewise fixed appliances
- Upper ceramic and lower metal (due to the deep bite)
- MBT prescription brackets using 0.022" x0.028" slot size.

An MBT bracket of +7º was used to give sufficient labial root torque. The upper canine teeth are in the line of the arch and hence root torquing shouldn't be much of an issue.

The lower incisor MBT brackets have a -6º torque, which in this case is not ideal, as the teeth are already retroclined and up righting them would have been better achieved with -1º from an Andrews or Roth bracket.

Aligning the canine teeth

The upper fixed appliances were placed before the procedure on exposure and bond was carried out so that sufficient space could be created before traction was applied.

Up-righting the retroclined anterior teeth and closing off the diastema created enough space.

Traction was initially applied using zing string. This was renewed every two weeks.

Then we used piggy back mechanics using 0.019x0.025" SS as a base arch/stabilising wire and using 0.014" nickel titanium as an initial aligning arch wire running on top of the base arch wire, and ligated with ligatures to reduce the amount of friction.

After six months of aligning, we took a progress OPG X-ray to look for movement of the canine teeth and rule out any ankylosis.

Anchorage

A transpalatal arch (TPA) was constructed with 0.9mm stainless steel wires soldered to slightly oversized bands on the upper first molar teeth. The TPA has several clinical applications, but, in this instance, was used to provided vertical anchorage when extruding the canines into the line of the arch (Wise et al, 1994).

Surgical procedure (surgeon's account)

Extraction of the Cs and closed exposure and a gold chain was bonded under sedation. The patient did not want a

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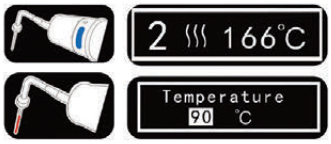

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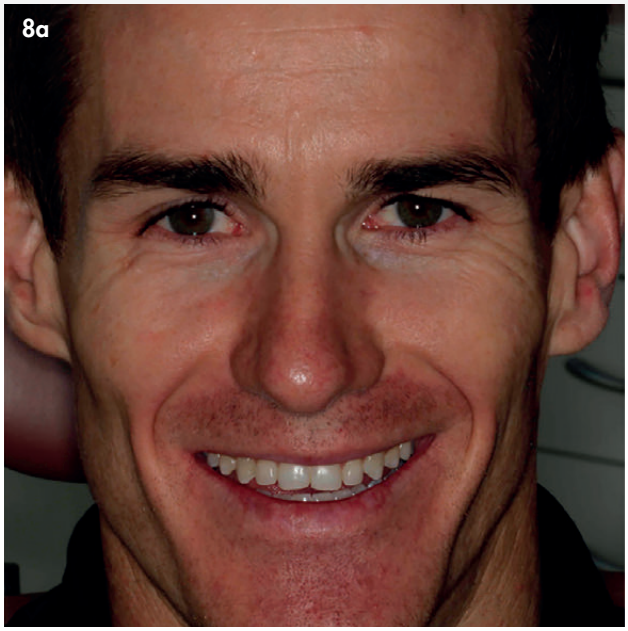


Figures 8A-D: Before and after bonding

general anaesthetic and, due to the favourable position of the teeth, sedation was a viable option.

The first stage of this procedure is to achieve effective anaesthesia. Local anaesthetic with adrenaline was injected both palatally and bucally as an infiltration.

A full thickness palatal mucoperiosteal flap must be raised. The incision needed to extend to at least two teeth either side of impacted canine. Often the canine is partially visible, or there is a bulbosity of bone under which the canine lies.

Once the position is identified, overlying bone around the crown of the canine is removed to expose the tip of the tooth up to the cemento-enamel junction. Finally, any follicular tissue is curetted away.

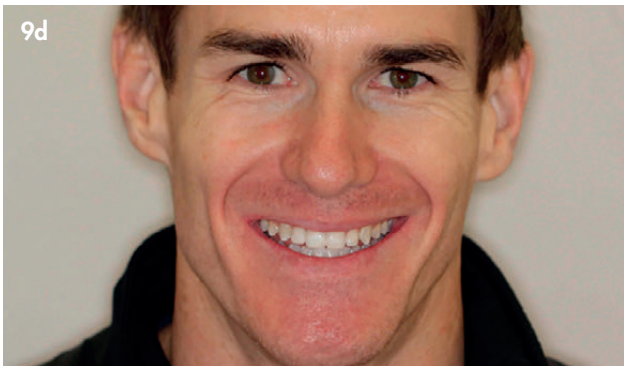
The next step is to bond the chain to the canine. The surgical field was kept completely moisture free during the bonding process; local anaesthetic and highspeed suction can help achieve haemostasis and a favourable bonding environment.

Either a single or two-staged etch and bond technique can be used.

We applied composite to the orthodontic bracket and bond to the exposed canine surface. The chain should be attached closer to the canine tip than the cement-enamel junction.

Once secure, a hole is pierced for the chain into the palatal tissue with a 15 blade, and thread the chain through the tissue. Suture the palatal flap into place with resorbable sutures and attach the chain to archwire (if present) or into the buccal sulcus so it is free from the occlusion using non-resorbable sutures.

Analgesics and warm saline rinse postoperatively was



Figures 9A-D: One-year review

recommended. A two-week review to monitor healing was advised. Following successful healing the patient is ready for continuation of orthodontic treatment and traction.

Retention regime

Bonded upper and lower lingual retainers from the UR3 to UL3 and LR3 to LL3 using 0.0175" braided stainless steel (co-axial). An upper bonded retainer was essential to prevent the diastema from opening up.

Full-time wear of the VFRs for 12 months, followed by nocturnal wear for 12 months, then long-term wear of the upper retainer for a minimum of four nights a week.

Frenectomy

This was carried out under local anaesthesia by the oral surgeon. The ideal time for the frenectomy is once the teeth are aligned, the diastema is completely closed, hence when healing occurs with the teeth together inevitably the post-surgical scar stabilises the teeth in their correct position, instead of creating obstacles to final space closure. The key to success is the removal of the interdental fibrous tissue.

The diastema will recur no matter how carefully the space is managed initially. The critical area keeping the teeth in contact is missing, so a bonded fixed retainer is essential (Edward, 1993).

Whitening process

Custom trays where made for day whitening using 6% Pola following upper and lower alginate impressions. The technician also made a wax up on a duplicate model for the upper four incisors. SO whitened for a period of 15 days to achieve a B1 status.

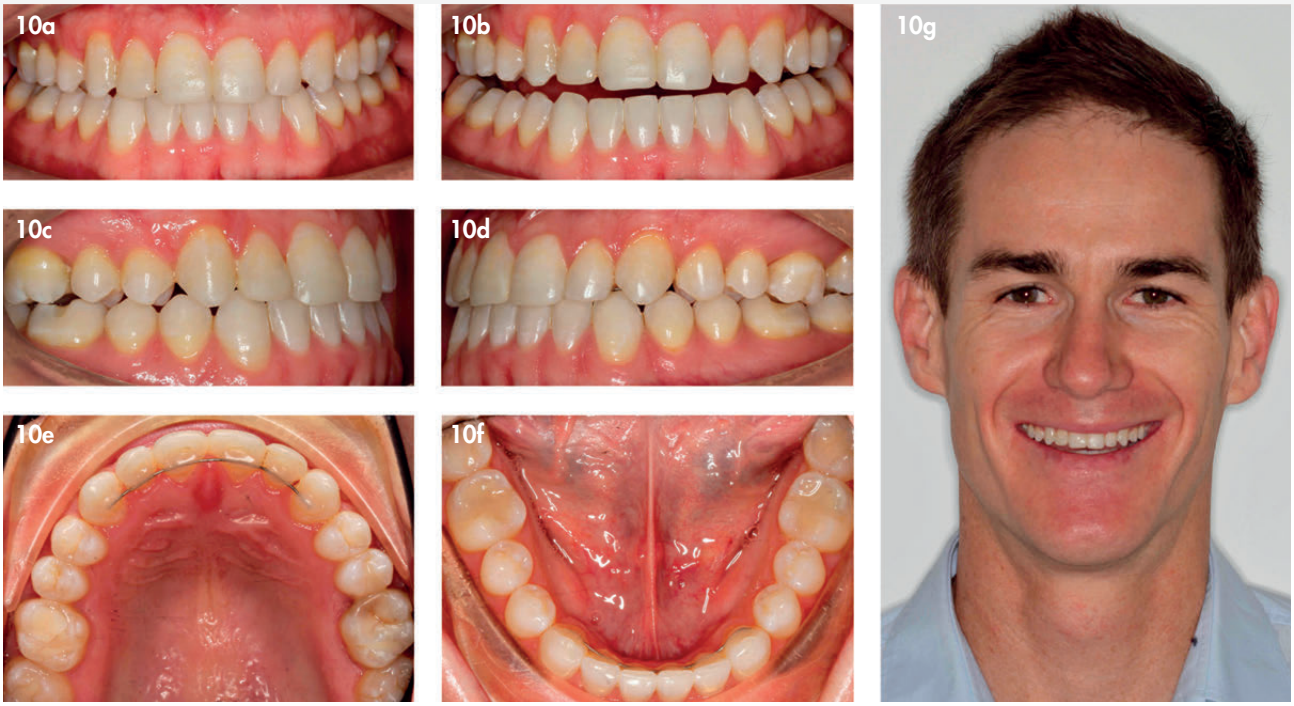
After four weeks post whitening, we commenced the bonding phase. Studies have shown the residual oxygen within enamel and dentine prevent optimal resin infiltration and complete resin polymerisation if the adhesive procedures are performed too soon after bleaching. Delayed bonding also allows for the whitening shade to settle at a hue that the patient can maintain in the long term without having to continually whiten.

Bonding

A silicone stent, with incisal and palatal shelves where fabricated to aid the process. A shade between Vita A1 and B1 was measured.

Rubber dam was applied and a chamfer was created of 0.5mm to 1.0mm buccally. Air abrasion with 27 micromillimetre aluminium oxide particles was used to remove the pellicle layer, aprismatic enamel and topi cal stains.

Phosphoric acid (35%) was placed, washed and rinsed. Next, a layer of single bottle etch and rinse bonding agent



Figures 10A-G: Two-year review

(Optibond Solo) was applied and air thinned to evaporate the solvent, then cured for 20 seconds.

Venus Pearl (Kulzer) was placed. Varying amounts of A1 and B1 using a layering technique, cured for 60 seconds, then again with glycerine applied and cured for another 60 seconds to cure the top oxidised layer.

The bite was adjusted and polished with soflex discs and enhanced. A new upper Essix retainer was made following the placement of a bonded retainer immediately after my bonding.

Prognosis for stability

The stability of the corrected malocclusion was dependent on (Woloshyn et al, 1994):

- Age
- Viability of the canine-ankylosis is a possibility
- Good interdigitation of the buccal segments
- Good interincisal angle
- Availability of space
- Good root paralleling
- Dental health and periodontal status of the dentition
- Compliance with the proposed treatment and retention regime
- Prolonged retention to prevent late lower incisor crowding, diastema opening up.

Assessment of treatment outcome

- Preoperative peer assessment rating (PAR) score: 27
- Postoperative PAR score: 2
- Percentage reduction in PAR score: 93%.

Postoperative evaluation

The patient has had a favourable improvement from his presenting malocclusion. He proved to be cooperative and treatment progressed well.

Occlusal features:

- Incisor relationship: class I
- Overjet (mm): 2 mm
- Overbite: average and complete to tooth
- Centrelines: dentally coincident and coincident with the facial midline
- Molar relationship right: class I
- Molar relationship left: class I
- Crossbites: none
- Displacements: none.

Functional occlusal features:

- Right and left canine guidance, no non-working side interferences
- Posterior disclusion on anterior guidance

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  Distributes weight from seat to feet allowing proper circulation.
- **Contoured Backrest**
  Cradles the spine, while encouraging blood flow. Contoured backrest is standard on the A-dec 521 dentist's stool and optional on the A-dec 522 assistant's stool.
- **Upholstery**
  Minimal seams make clean up easy.
- **Standard Foot Ring**
  (A-dec 522 Assistant's Stool)
  Helps practitioner maintain correct posture.

Optional Swing-out Armrests

Three adjustments—width, height and rotation — give you greater support and mobility.

- Rest your arms while working in the oral cavity
- Slide armrests out of the way with ease
- Adjust armrest height

Features

Whisper Quiet Casters
New design provides smooth, ultra-quiet movement on both carpet and hard flooring.

Adjustment Controls
Numbered paddles are easy to access for quick adjustments and easy cleaning.

Backrest Height Control
A push button makes access and one-handed adjustments easy.

Testimonial by:
Dr. Rob Soicher

The Adec doctors stool has been life changing for me in my practice. In addition to the seat taking the pressure on the buttocks like a saddle and alleviating pain in the perineum, the swivel on the backrest allows a great range of motion and provides the necessary lumbar support needed. The greatest advantage of this chair are the swiveling armrests which create such an ergonomically superior position to work from. By resting on the arm rests the operator takes off all the tension from the muscles in the neck, reducing headaches and allows the hands total freedom, minimizing wrist and hand strain. From someone who has cervical disc replacement, this chair is a winner.

Pictures used may be for representation only. E&OE.

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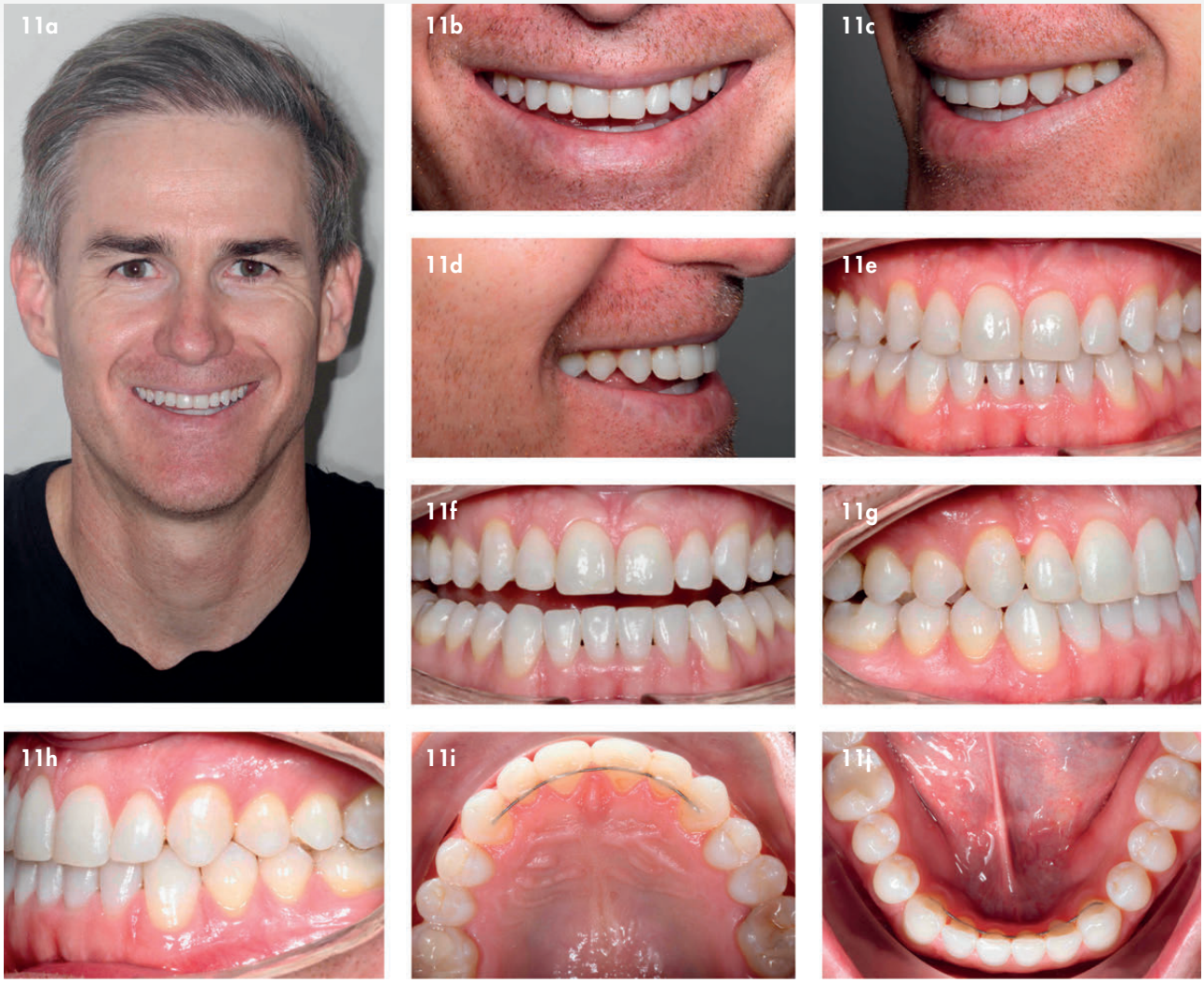

Figures 11A-J: Three-year review

Intercanine width preoperative:
- Upper: 33mm
- Lower: 27mm.

Intercanine width postoperative:
- Upper: 37mm
- Lower: 28mm.

Intermolar width preoperative:
- Upper: 58mm
- Lower: 51mm.

Intermolar width postoperative:
- Upper: 59 mm
- Lower: 51 mm.

Difficulties encountered during treatment

Oral hygiene

Even though the patient's oral hygiene was satisfactory before orthodontic treatment commenced, he struggled at times to maintain a high standard consistently throughout his orthodontics. This is evident from the photographs where the gingivae look inflamed, especially around the upper canine teeth.

We ensured that he saw the hygienist every three months, along with reinforcing the importance of good hygiene at each appointment and evaluating his methods of cleaning and stressing the importance of maintaining a good level, which would reduce the risk of dental decay, periodontal disease; and, also, unaesthetic gum margins, especially around the surgically exposed canine teeth.

Anterior tooth size

The Bolton discrepancy was discovered by Wayne A Bolton to determine the discrepancy between the upper and lower anterior teeth. The analysis helps determine the optimum inter arch relationship.

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Bolton analysis

3(9mm) 2(6mm) 1(9mm)	1(9mm) 2(6mm) 3(9mm)
3(8mm) 2(6mm) 1(6mm)	1(6mm) 2(6mm) 3(8mm)

Total 83.33 (ideal ratio 77.2 +/- 1.65)

There was a Bolton discrepancy that exceeded the 77.2% +/- 1.65, which showed that the upper lateral incisor teeth were only 6mm and smaller than the average upper lateral incisor tooth.

The patient did not initially want his lateral incisors bonded and sized up to the ideal size, which would have then allowed us to upright the upper anterior segment further, in turn creating sufficient space for the lower incisors to be up righted, which would have aided further in the overbite correction.

Deep bite

In non-growing patient deep bites are difficult to correct. In this case we couldn't intrude the lower incisors, but had to rely on proclining them to open up the bite/improve it. However, the amount of proclination would be dependent on the space available from the upper anterior segment being up righted.

In this case, without building up the lateral incisors to their ideal shape and size meant the full correction of the overbite was limited.

White spots

There was a history of trauma to the upper anterior teeth when the patient was growing up. The history was vague, as it occurred prior to the age of four years. This may have accounted for the light white spot lesions on his central incisor teeth. These can sometime be difficult to fully mask.

Risk benefit

Benefits in orthodontic treatment are:

- Psychological
- Dental
- Functional.

The smile is an important component of the face and the malocclusion can affect selfesteem and social interaction. Correcting this young man's malocclusion has led to better psychological health and definitely self-confidence.

Some of the main risk factors in this case would be:

- Decalcification – however, we ensured we started treatment after good oral hygiene sessions and continued oral hygiene care
- Space opening after closure of the median diastema and also rotation of the canine teeth. Hence, prolonged fixed bonded retention is necessary.

If the canines had not been exposed and aligned, then the patient would have been subjected to annual radiographs to assess the canines for the development of cysts or and adjacent lateral incisors for developing any root resorption from the impacted teeth.

The overall the benefits of having the treatment outweighed the risks.

Conclusion

Adult orthodontic treatment has become increasingly popular over the years as patients become more discerning about the beauty of their smile.

The above patient is a typical young adult who desired, but did not receive, orthodontic treatment in his youth and now seeks it as he is financially independent and wants to improve the quality of his life. He was seeking comprehensive treatment and the maximum improvement that would be possible.

Despite all the alternative treatment options and risks laid out to him from the outset of treatment, he had taken his time over a few years to gain all the information regarding the complexity of his case and had finally decided the best option was to choose the comprehensive care. This was difficult and technically demanding and required great communication and planning among the multidisciplinary team involved.

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Dental malpractice and its liabilities: Ethical and legal considerations every dentist should know

Johan Hartshorne[1] and Andre van Zyl[2]

Executive Summary

Rationale

Dental malpractice claims are extremely expensive, emotionally stressful and time-consuming. Understanding the ethical and legal concepts related to dental malpractice and negligence, common causes of malpractice, application of ethical decision-making and risk management principles is important. It will better equip dental practitioners to avoid ethical minefields, malpractice claims and dental litigation.

Key points

- Patients rely on trust, their dentist's expertise and a professional diagnosis, to assess their treatment needs.
- Maintain caution, skill, and prudence at all time.
- Clinical decision-making should be based on the fundamental ethical questions: (i) what is in the patients best interest; (ii) will it do harm; (iii) have I informed the patient appropriately; and (iv) is it fair to the patient?
- The over-riding criteria for standard of care – is it in the best interest of the patient?
- The treatment recommended should be safe, predictable, cost-effective, respectful of patient preferences, aimed at preserving normal tissue and function and based upon current scientific evidence.
- Treatment should always address the patient's main complaint.
- Applying ethical decision-making and good risk management protocols will not only reduce risk exposure, patient dissatisfaction, avoid malpractice claims and litigation, but will also improve the standard of patient care.
- Communicate with passion and compassion.

Essential practice implications

- The standard of care applies to all dental practitioners and specialists.
- Never ignore patient expectations and never raise unrealistic expectations.
- Note the patients' main complaint in the file.
- Always be on the alert for risk factors.
- Provide the patient with a written treatment plan and cost assessment.
- Obtain the patients' written informed consent before starting treatment.
- Recall and maintenance care is of critical importance, especially with periodontitis patients, implant dentistry and restorative rehabilitations.
- Deal immediately and appropriately with dissatisfied patients.

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Introduction

The dental profession holds a special trust relationship with its patients. To uphold this mutual trust the dental profession makes a commitment to the patient that they will adhere to a high ethical standard of care and conduct.[1] The relationship between dentists and patients has changed in recent times and some of the major causes are: [2]

1. An increase in patient awareness of their rights.
2. High expectations and demands where aesthetic procedures are involved.
3. Competition between practitioners in a highly competitive market.
4. A change in the patient-dentist relationship from a personal/professional relationship to a more business/ commercial relationship.
5. Increase in scientific and technological development creating a society founded on capitalism and consumption.

The dental profession has in recent times come under increasing attack by disgruntled patients dissatisfied with their treatment.[3] Dissatisfaction between patient and dentist can often be resolved or managed properly and early, but sometimes patients turn to courts to get matters resolved. Such litigation cases against a dentist can result in severe consequences frequently causing loss of income, loss of reputation, harassment, mental agony, stress, sleeplessness, and embarrassment in society.[3] Furthermore, dental malpractice claims are expensive, emotionally stressful and time-consuming. It is therefore in the patient's as well as the clinicians' best interest to prevent dental malpractice claims. To avoid malpractice claims, dentists should know the rules/ regulations guiding the profession, the law and litigation pertaining to their practice and standard of care practice protocols.

Prevalence/ incidence of dental malpractice

Not many descriptive studies are available describing the prevalence, causes, impact and outcomes of dental malpractice claims. A recent study analysing malpractice cases finalized between 2007 and 2016 in South Africa, showed that most cases constituted fraud (66.7%), clinical malpractice (23.2%) and professional misconduct (10.1%).[4] Clinical malpractice complaints mainly involved oral surgery (27.3%), endodontic therapy (22.7%), prosthodontic therapy ((22.7%), operative dentistry (9.1%), periodontics (6.8%) and orthodontics (4.5%).[4]

A survey of dental malpractice claims in Rome, Italy showed that most litigious activities were related to prosthetic, dental implant and endodontic procedures.[5] Most insured convicted dentists (52.3%) were not fully covered by their insurance due to the presence of unmet contract clauses. An analysis of malpractice claims in implant dentistry in Italy from Insurance Company Technical Reports between 2006 to 2010 revealed that most of the surgical errors were committed during implant insertion (82.6%). Halve of these cases involved surgical errors due to inadequate treatment planning and execution, resulting in damage of the inferior alveolar nerve (32.2%), lingual nerve (2.5%), invasion of the maxillary sinus (9.1%), and damage to adjacent teeth (6.6%).[6]

A retrospective study conducted in Tehran, Iran between 2002 and 2008 showed that the majority of complaints were in fixed prosthodontics and oral surgery. Most of the cases were against general dentists. In 56.7% of clinical and 40% of misconduct (non-clinical) dental malpractice claims, dentists were found at fault.[7] A survey of dental malpractice claims in Brazil reported that endodontics was the most involved dental speciality with the highest prevalence of litigation.[2] Maxillofacial and oral surgery, endodontics and fixed prosthodontics are the dental specialities most often involved in litigation.[2,4,7,8,9]

What are dentists' ethical duties and obligations to a patient?

Dentists assume unique moral duties in presenting themselves to society as being uniquely qualified to care for oral health. Ethics is used as a generic term for various ways of understanding and examining moral behaviour.[10] The application of fundamental ethical principles provides various ways of understanding and examining moral behaviour,[11] inquiring why an individual action is right or wrong, or establishing the reasons why a person is good or bad.[12] Many ethical dilemmas don't have clear answers and sometimes it is truly a matter of choosing the most right or least wrong choice. Ethical decision-making is finding the middle ground on an ethics continuum where on the one extreme is 'right' or 'good' and the other extreme is 'wrong' or 'bad'.

Dentistry has historically been a caring profession with core ethical obligations that center on the duty to treat and prevent disease and ultimately to promote well-being.[13] Our clinical decision-making, behaviour or conduct, and

standard of care is guided by a professional or ethical code of conduct, which is based on four fundamental ethical principles (described in detail below): (1) autonomy (patients' right to make or participate in decision-making and make their own choices); (2) non-maleficence (preventing harm); (3) beneficence (promoting or doing good); and (4) justice (fairness in treating each other justly).[11] General guidelines on duties and obligations and conduct for expressing these fundamental ethical principles is provided in detail by the Health Professions Council of South Africa.[14] A duty is an obligation to do or refrain from doing something. Our duties to act in the best interest of the patient, doing good, preventing harm, truthfulness and fairness reflect the underlying nature of the dentist-patient relationship. Ethical guidelines help clarify the path of what's appropriate and what's not.

1. Autonomy (Right to self-determination)

Autonomy is defined as the patient's right to make or participate in decision-making and make their own choices. The principle of autonomy expresses the concept that dental clinicians have a duty to respect the patients' right to select or refuse treatment according to their desires, within the bounds of accepted treatment. Dental clinicians' primary obligations include involving patients in treatment decisions in a meaningful way with due consideration being given to their needs, desires and abilities, facilitated by the process of informed consent.[15]

Patients should be educated to fully comprehend the treatment plan, treatment sequencing and ultimate restoration possibilities, expected treatment outcomes, and the patient's responsibilities towards achieving and maintaining a successful outcome.[16] Signed informed consent is of little value if given by a patient who is unable to comprehend what was signed or the implications of treatment.

Complex treatment plans require more detailed descriptions and discussions. It is essential that the patient understands this and is given the opportunity to ask questions to clarify any matters. Dental clinicians should elaborate on different treatment options available, the advantages, risks, costs involved of each alternative, their prognosis and long-term consequences, and allow patients the opportunity to participate in treatment planning discussions rather than focusing on promoting the most profitable treatment option. It is the authors experience that often patients are given treatment options based on the particular skills of a clinician, rather than what is in the best interest of the patient. To refer a patient to another practitioner who is more capable to assist with a certain treatment option is certainly not an indication of incompetence by the referring clinician. Most patients will readily accept such a referral if it is explained that as being in their best interest. By listening to the desires and wants of patients and communicating relevant information openly and truthfully, dental practitioners assist patients in making informed choices about the treatment options available and also empowers the patient to participate in achieving and maintaining optimum oral health. Patients who are fully informed will better understand the treatment and implications thereof and how to maintain optimum oral health to ensure a predictable and successful outcome. In addition, a patient that demands and accepts a complex and costly treatment plan will then also accept more responsibility for their treatment. The final choice of treatment is largely dependent upon the patient's expectations, desires, financial budget and willingness to undergo treatment.[17]

• *Informed consent*

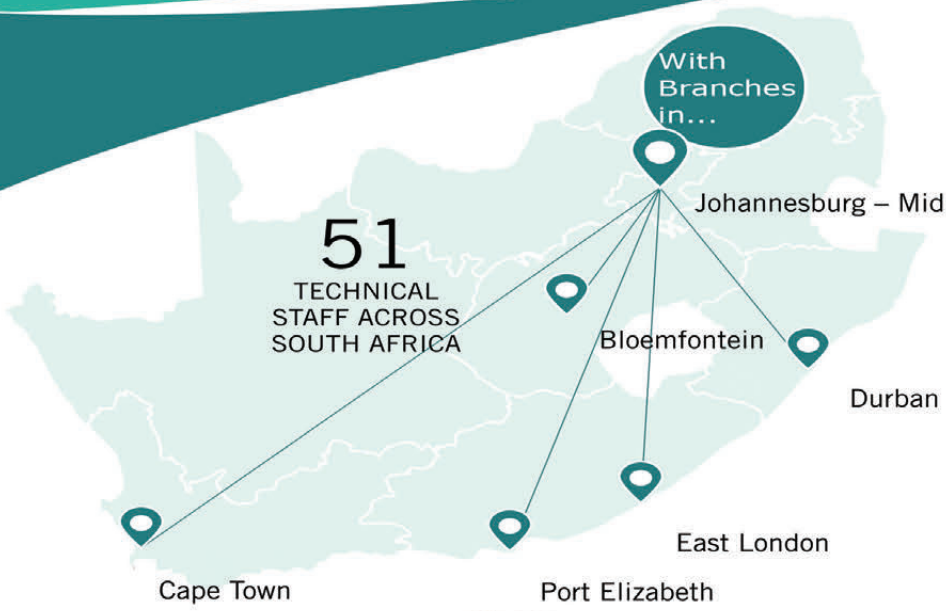
Before subjecting a patient to any proposed treatment, their tacit agreement, or informed consent is essential. This is both an ethical and a legal requirement. A competent patient will be able to make a choice based on an understanding of the information given to him/her, an appreciation of the diagnosis, the procedure proposed and its consequences, and will be able to reason and weigh up the various treatment options.

Informed consent is obtained by conducting a structured, formal consultation with a patient to explain the goals of treatment. It should include alternative options, the probable benefits (advantages) and actual or potential risks (disadvantages) of treatment, costs of each treatment, and the risks of non-treatment prior to performing procedures.[10,18,19]

• *Conditions of consent*

Consent must be voluntary – that is – the patient must not be manipulated or coerced into consenting. According to the National Health Act of No 61 of 2003, Chapter 2 Section 6 the following information must be given to the patient:

- Range of diagnostic procedures and treatment options available.
- Benefits, risks, costs and consequences associated with each option.
- User's right to refuse care and explain implications, risks and obligations of such refusal.
- Furthermore, this information must be provided in a



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language that the patient understands and in a manner that takes into account the patient's literacy level.

The dentist's recommendation is important, but in advising patients, it is essential that the patient's best interests are paramount. The "best interest" of patients means that professional decisions of proposed treatments and any reasonable alternatives proposed by the dentist must consider the fundamental ethical principles, as well as the values and personal preferences of the patient. This must be done in a manner that allows the patient to become involved in the decision-making process. Consent forms cannot replace an informed treatment discussion and thorough documentation in the dental chart before any work begins.

- *Material risks*

Dentists are obligated to warn patients of "material risks" inherent in the proposed treatment or procedure. Risks are regarded as "material" if:

(i) a reasonable person in the position of the patient, if warned of the risk, would attach significance to it, and

(ii) the practitioner concerned should be reasonably aware that the patient, if warned of the risk, would attach significance to it.

- *Confidentiality*

Dental health care providers are obligated to tell the truth, protect confidentiality and respect privacy.[12]

2. Non-Maleficence (Do no harm)

The ethical principle of "first, do no harm," is a fundamental feature of the foundation of health practice since Hippocratic times and is considered to be a moral imperative of health practitioners' behaviour. This principle expresses the concept that dental clinicians have a duty to exercise care, and to refrain from harming the patient e.g. doing irreversible harm or placing teeth at risk by selecting inappropriate therapies and not informing patients of unavoidable risks.[20,21] Under this principle the dentists' primary obligations include keeping knowledge and skills current, knowing one's own limitations and limiting and managing risks with the ultimate aim of minimizing harms and maximizing benefits for the patient.

No treatment comes without risks or failures. There are actual and potential risks in each treatment that may result in varying consequences, complications, and harm either physically, emotionally or financially. Harm from overuse, misuse, errors, failures, technology and material flaws, accidents, complications, and known risks are all consequences of treatment that must be avoided wherever possible.[22]

Quality and safe dentistry can only be provided when both the clinician and the patient make treatment-planning decisions based on the patient's general health status, oral health, functional and aesthetic needs. The treatment recommended should be scientifically proven (evidence-based), safe, predictable, cost-effective, and respectful of patient preferences, and should be aimed at preserving normal tissue and function.[23]

3. Beneficence (To promote or to do good)

The principle of beneficence expresses the concept that professionals have a duty to care for and to act in the patient's best interest. Under this principle the dentist's primary obligation is service to the patient with the aim of benefiting or improving the patient's oral health. The most important aspect of this obligation is the competent and timely delivery of appropriate and safe dental care within the bounds of clinical circumstances presented by the patient.[20] Patients rely on trust, the dentist's expertise and a professional diagnosis to assess their treatment needs.

Dental care is only a small part of the whole system of healthcare and quality of life. Beneficence could be applied for medical reasons, preventive purposes, health promotion, or it could be structural, functional or aesthetic in nature. In addition to the patient's main complaint and/or requests, the overall treatment plan should include and manage the periodontal health, tooth structure and occlusal health to ensure a successful treatment outcome with long-term stability. The dentist is responsible to do what is best for the patient, on a physical and emotional level. Every patient should be presented with an ideal treatment plan that has been developed to take into consideration the patient's clinical, functional, and aesthetic needs, before a compromise or alternative plan is provided. Dentists are responsible to provide a high standard of professional care, are accountable for the intended benefit and outcome of any treatment and should not harm patients while delivering such comprehensive oral health treatment.

4. Justice (fairness)

The fourth fundamental ethical principle is justice. Justice expresses the concept of fairness in treatment, respect for patient's rights and demands consideration of fair distribution of scarce resources.[12] Justice requires that dental healthcare

providers ensure patients are given the same treatment options as anyone would receive in a similar position, regardless of financial status.

What is the difference between dental malpractice, negligence and misconduct?

• *Dental malpractice*

Dental malpractice is defined as the failure of a dental professional to follow the accepted standards of care of his/her profession resulting in harm, injury or loss.[24,25] Malpractice is a type of negligence, and is often referred to as professional negligence.

• *Negligence*

Negligence refers to a breach of duty of care where professional conduct falls below the standard of care,[25] failure of the clinician to use reasonable care and skills in rendering services to a patient,[24] or failure to protect a patient against unreasonable risk of harm, injury, loss or damage.[25] Harm through negligence caused by carelessness (not intentional harm), is known as tort law.

Proof of negligence is based on comparing the actions with those that a reasonable clinician, under the same circumstances would have performed.[25]

Disgruntled or dissatisfied patients often present to a different practitioner for a second opinion when they feel they have been mistreated. This puts the second clinician in a difficult position of trying to establish whether the actions were negligent or severe enough to constitute malpractice. Questions to ask include: was the aim to provide a therapeutic benefit, to protect the patient, to prevent harm, to remove conditions that could lead to future harm and was the treatment aimed at promoting the patients best interests.[25]

• *Misconduct*

Professional misconduct is defined as inappropriate, abusive, or illegal behaviour by a professional and implies an intentional compromise of ethical standards with the intent of benefitting the clinician.[24]

Examples of professional misconduct include: claiming for services not rendered, over-servicing, violating regulations governing the dental profession,[1] inappropriate relationship with a patient, issuing fraudulent medical certificates, breach of confidentiality and failure to obtain valid informed consent.

It is not within the scope of this review to cover the complex subject of misconduct.

What does 'Standard of Care' in dentistry mean?

Standard of care is what a reasonable, prudent dentist would do under the same or similar circumstances while applying scientific evidence-based care.[26] Standard of care is the same for all clinicians, whether general practitioners or specialists.[26] Whilst clinical training, educational and continuing education levels vary widely, the general practitioner is expected to perform dental services with the caution, skill and prudence of a specialist.[26,27] The over-riding criteria for standard of care is whether it is in the best interest of the patient.

Standard of care means practicing clinical and evidence-based dentistry as per relevant and current-based literature,[27] and should reflect changing and evolving new technologies, dental materials, and methodologies.[26] Every speciality and aspect of dentistry has optimal technology and methodologies that are indicated to uphold the current standard of care.[27]

In endodontics this would include the use of cone beam computed tomography (CBCT) for three dimensional radiographs to facilitate diagnostic interpretations, and a surgical microscope or loupes to allow for high power magnification and visualization. The above is not to say that practicing without these or similar technologies is below the standard of care, but it is suggested that the further the clinician is from such utilization, the closer to negligence they may be, especially in the event of a harm or injury.[27] Negative clinical outcomes and complications happen every day, but are not a proof of a deviation of the standard of care.[27]

Dental malpractice claims – legal considerations that dentists should keep in mind

• *Proving negligence or malpractice*

Standard of care exists within the definition of 'malpractice' or 'negligence' which has four elements, and all must be met if it is to be used as grounds in a malpractice suit. The four elements required for proving negligence or malpractice are: [25,26]

Duty: *The clinician (defendant) had a duty or an obligation to the patient (plaintiff).*

The patient will need to show that he or she had a professional relationship at the time of the incident. A person

cannot claim, for instance, if an off-duty dentist gave bad advice at a cocktail party.

Breach: *The clinician breached or did not follow this duty, or failed to conform to the required standard of care.*

Patient dissatisfaction is not a ground for a malpractice lawsuit. Dental malpractice suits can be brought against practitioners only when they fail to uphold the acceptable standard of care, or when a practitioner provides treatment that exceeds the patients informed consent. The patient will have to prove that the dentist either unintentionally failed to provide the acceptable standard of care, or the dentist intentionally committed an act that no other qualified and reasonable dentist would have committed when dealing with a similar situation.

The patient will need to show that the dentist breached his/her duties of care according to parameters of the professional relationship.

Causation: *The harm suffered by the patient was as a direct result of this breach of duty or sub-standard conduct.*

The patient must prove that the dental practitioners' incompetence or negligence caused the injury.

Damages: *Damages sought have a direct relation to the harm caused.*

The patient must prove that the actions or non-actions of the dentists caused real and compensable damages or harms, such as medical bills, personal injuries, lost wages, pain or suffering.

• *Reasonable person rule*

One of the most important arguments used in negligence law is that of the "reasonable person" which provides the standard by which conduct is measured.

By definition a dentist has acted in a negligent manner if they have departed from the conduct expected of a reasonable, prudent dentist acting under similar circumstances.

It considers many factors including the dentists' knowledge, experience, and perceptions, the activity they are engaging in and the circumstances surrounding their actions.[24]

• *Specials skills and reasonable care*

In the dental/medical context, when a clinician engages in a procedure requiring special skills, education, training, or experience, the standard by which their conduct is measured is the conduct of a reasonable, skilled, competent, and experienced person who is a qualified member of the group authorized to engage in that activity or procedure. A dentist cannot deny personal knowledge of basic aspects of a specific activity or procedure that are known and practiced by their peers. This is important for those dentists performing implant treatment, especially the surgical part thereof, where ignorance of anatomy and/or surgical skills may lead to harm.

The law does not a have a special allowance for beginners with regard to special skills, and holds everyone to the standard of conduct of persons who are reasonable, skilled and experienced in the activity or procedure.[24]

• *Impairment, mental capacity and intoxication*

A dentists' physical characteristics or other impairments, including mental capacity, does not excuse them from acting according to the reasonable person standard.

• *Emergencies*

In the case of emergencies, the law recognizes that "even a reasonable person can make errors of judgement in such situations, and their conduct will be evaluated in light of whether it was a reasonable response under the circumstances, even though, in hindsight, another course of action might have avoided the injury".[24] In other circumstances, failure to anticipate the emergency could constitute negligence, as a reasonable person would have anticipated, and taken precautions against, the foreseeable emergency.[24]

• *Patient conduct*

A clinician could also be held negligent by virtue of the patient's conduct. The law may consider that a trained professional should have taken into account the possible conduct of the patient, and regulated their own conduct accordingly.[25] For example, administering a double mandibular block to a child without anticipating that they would not understand the implications and damage they may inflict on themselves if they chewed while their mouth was still anaesthetized, is negligent.[25] Even adults given bilateral inferior alveolar nerve blocks experience loss of control of the tongue, collection of fluid in the oral cavity, weak bolus propulsion during swallowing and possible aspiration.[28]

• *Proof of negligence and expert witnesses*

Proof of negligence is based on comparing the actions with those that a reasonable clinician, under the same circumstances, would have performed.[25] Expert witnesses (colleagues) are often called upon to provide

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information beyond the common knowledge of the legal representatives, such as scientific evidence, interpretation of special investigations and test results, diagnosis and clinical procedures performed. They will also be asked to report on the extent of the damage caused by the accused colleague, and ascertain whether the accepted standard of care was given and provide a report on their findings. A report from an expert witness should not include personal allegations, accusations or assumptions of guilt.[25] The expert witnesses' report could be presented in a court of law, and all observations, opinions and deductions should be defensible and justifiable. Also consider that one never knows the exact circumstances, or issues that may have been beyond the clinician's control which could account for their actions.[25]

• Patient negligence and dual responsibilities

There are times when the patient could have acted in a negligent manner, by not following the clinicians instructions and thus adding to their own injury or damage. This is called "contributory negligence", and often results in their being unable to claim for damages caused by the clinician.[25] To this end, clinicians can protect themselves by always giving written instructions to patients, preferably via email before the procedures. This may include all aspects regarding the post-operative home care, i.e. "As you will receive a double lower jaw block injection, you should not chew or eat anything until such time as the injection has worn off. This is to prevent you from damaging the tongue, cheek or lips"

What are the common causes/reasons for dental malpractice?

Several common scenarios are associated with dental malpractice.

• Limited or inadequate diagnostic testing

A dental record should include, but not be limited to: medical history (updated periodically), charting of restorations, tooth decay, missing teeth, occlusion, temporomandibular joint status, cancer screening, periodontal screening, presence of diseases and pathology in all forms, and radiographic records where indicated.[27]

• Inadequate treatment planning

Inadequate or no treatment planning is a frequent cause for dental malpractice.[7] Deviations of the initial treatment plan should be clearly indicated. Dental records should at all times be adequate and contain exact and comprehensive descriptions of every procedure, event or interaction.[27]

With inadequate records the dentist will be at risk for being asked the following valid question by an attorney: "How can you testify as to what happened if your dental record does not detail the event and/or refresh your memory?"[27] Written records should be in black ink if possible.

• Lack of informed consent and poor record keeping

When a patient initiates a relationship with a general practice, there should be a written general informed consent covering the common areas of the doctor patient relationship and practice policies.

When a patient is engaging in a specific activity or procedure, there should be much more specific written informed consent detailing the procedure, alternatives, risk of the procedure and show that all the patient's questions were answered in advance of the treatment.[27]

• Clinical / treatment errors

Clinical and technical errors during treatment are common causes in malpractice cases.[7,9,29]

• Unfavourable and unsuccessful clinical outcomes not normally expected from the procedure

Some procedures do end with unsuccessful or unfavourable results even if the patient signed a consent document. The patient may need money to enable emotional and physical recovery. If the harm was caused by a lack of or inadequate procedure done by the dentist, this is usually part of the damages owed to the patient.

Although negative clinical outcomes happen every day, they are not proof of a deviation of the standard of care. In the case of malpractice claims, plaintiff (patient) attorneys are looking for why a routine procedure caused the patient injury or harm and where the dentist went wrong or failed.[27] For example, if a tooth is abscessed, the patient is visibly swollen (has pus surrounding the tooth), the appropriate care is to open the tooth to gain access to the pulp chamber, perform drainage, place medication inside the canals and prescribe appropriate medication (e.g. antibiotics and anti-inflammatory medication) and bring the patient back for completion of the root canal treatment once the swelling and pain has resolved. To finish the root canal treatment in one visit under these clinical conditions, could easily exacerbate the infection and land the patient in hospital with a potential life-threatening condition. Such an action

taken by a clinician is below the standard of care for the given clinical circumstance.

• Lack of communication and adequate patient management

It is almost universal that the patient who has lost trust in his/her dentist, and where the dentist did not respond in a communicative, compassionate empathetic manner, is much more likely to bring some kind of action or claim against a dentist.[27] Lack of communication between the dentist and patient can help an attorney to establish the causal link between the injury and the deviation of the standard of care by showing the dentist was distracted, had poor organizational skills, or was not keeping up with the standards expected of a clinician doing specialist procedures.[27]

Patients who relocate to a different geographical area often change dentist. Practitioners then get to see their predecessors work. If a practitioner is faced with such a situation, make objective and observational statements. Think very careful about what you want to say and do not try to impress the patient by making negative comments about your colleague. Instead of saying: "Man, he really did a shoddy job in placing this implant", rather say " Your implant is showing because there is no bone to support the soft tissue".

Transgressions and common forms of dental malpractice

Analyses of malpractice claims in South Africa revealed the following common forms of dental malpractice:[4]

- Oral surgical malpractice claims mainly comprised of poor presurgical planning and implants being placed in the incorrect position, thereby compromising the final prosthodontic rehabilitation of the patient. Following these complications, dentists also failed to adequately manage and to appropriately refer these patients. Exodontia malpractice claims included broken or fractured roots, lingual nerve damage and oro-antral opening, and failure to diagnose surgical emphysema.
- Endodontic transgressions included failure to diagnose root perforations during the performance of a root canal, and omitting to inform the patient of a fractured endodontic file.
- Prosthodontic malpractice claims mainly comprised delivery of poorly fitting dentures and failure to achieve proper occlusion.
- Periodontics – failed surgical procedures.
- Orthodontics – refusal by the clinician to remove orthodontic appliance.

Other transgressions and common reasons for dental malpractice include the following:

• Inadequate diagnostic testing

Failure to:

- make a correct diagnosis or treatment without a diagnosis
- notice/diagnose oral health problems (e.g. periodontitis, oral cancer)
- take into account a patients relevant medical history (i.e. prosthetic joint replacement)

• Inadequate treatment and clinical errors due to improper treatment

- Unnecessary extraction of teeth or extraction of the wrong tooth
- Inserting poorly fitting fixed prostheses ultimately resulting in permanent damage to teeth or periodontium
- Improper usage of dental tools, equipment or technology (e.g. Laser resulting in permanent tissue damage, pain and suffering).
- Permanent or temporary structural injuries or damage to the tongue, jaw, chin, lips or teeth

• Unfavourable outcomes

- Fracture of jaw due to a dental procedure
- Improper or negligent administration of local anaesthesia resulting in broken needles, nerve injuries resulting in permanent or temporary numbness or loss of taste or sensation
- Adverse reactions to dental drugs
- Infections following treatment
- Temporomandibular joint disorders

Practical guidelines on how to prevent and avoid malpractice claims and litigation

1. Ethical decision-making

In our treatment discussions and planning we must attempt a systematic and reasoned approach to the question: "What is the right thing to do?" This will help dental professionals to conduct a safer and more ethically-based practice.

Dental clinicians who provide evidence- based services, based on beneficence, non-maleficence, truthfulness and

respect for patient autonomy and in keeping with professional standards of care, are fulfilling their professional and ethical obligations. The ethical principles are the moral rules, foundations and justification for our treatment decisions and behaviour.

Asking the following fundamental ethical questions can help to navigate ethical minefields and assist the clinician in avoiding malpractice claims and subsequent litigation:

- Beneficence – what is in the patient's best interest?
- Non-maleficence – Will it do harm?
- Autonomy - Informed consent – Have I informed the patient appropriately
- Justice – Is it fair to the patient?

2. Balancing benefits versus risks

Balancing the benefits and risks of treatment plays a role in nearly every medical and dental decision. For every treatment option the dental clinician has to weigh and balance competing values of the patient and the service provider; searching for consistency, longevity, predictability and success in treatment outcome as well as considering the impact of our actions on patients. All treatments have potential risks. Dental clinicians have an obligation to minimize potential harms and maximize benefits of therapy. It is therefore always important to ensure that the benefits of treatment are greater than the potential harms. This fundamental ethical principle of balancing benefits against risk is critical to ensure the treatment that the patient will receive is in his/her best interest. Beneficence and non-maleficence are complementary principles because both rest on the fundamental ground rule of treatment outcome that is in the patient's best interest.

By providing informed consent, dental clinicians give patients the information necessary to understand the scope and nature of various treatment modalities and their potential risks and benefits. This empowers patients to make informed choices about the treatment they need or desire. Ultimately, the potential benefits of any therapy must always outweigh the potential risks in order for it to meet the requirement of "being in the best interest of the patient".

3. Risk management – minimizing risk exposure

Appropriate risk management protocols will not only reduce risk exposure but also improve patient care.[30]

Following are some important considerations and practical guidelines for the clinician to minimize risk exposure and to avoid malpractice claims:

• Patient assessment

Do a proper evaluation of the patient's medical, dental and personal history. Assess and understand the patient's needs, desires, expectations and suitability for dental treatment. Never ignore the patient's expectations otherwise the case is destined to fail. Always note the main complaint in the file.

• Treatment planning and record-keeping

Ensure that study models, radiographs, photographs and a diagnostic wax-up are available for the treatment work-up. Document everything - it is still your best defence in case of a complaint.

• Treatment discussion and patient education

Educate patients so that they fully comprehend all treatment possibilities, sequencing of treatment, limitations and risks. A diagnostic wax-up communicates the treatment plan to be used throughout the entire restorative process. Use photographs to illustrate the proposed treatment(s) and to document progress of treatment. Limit the act of creating false expectations and guarantees and inform patients in advance about potential risks and complications.

• Always be on the alert for medical risk factors

Be alert for risk factors such as diabetes, immunosuppressed patients, smoking, medications that may influence the outcome of treatment or have the potential to cause complications.

• Explain benefits, risks and alternatives (including no treatment)

Explain the benefits, risks and alternatives to patients as part of the consent process and record the discussion on the patient's record and in the final treatment plan. Never raise unrealistic expectations of what can be achieved.

• Obtain informed consent

Identify and disclose all positive (benefits) and negative (risks) aspects of treatment options to the patient. Obtain informed consent from the patient prior to commencing treatment and ensure that it is part of the treatment record. Never provide additional services that are beyond the patients informed consent, unless the patient signs written acceptance to such changes.

• Cost implications

Provide the patient with an estimate cost of the various treatment options before the final decision is made in terms of

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a treatment plan. Let the patient know beforehand what the potential additional cost is for of treating complications (e.g. root canal treatment), re-treatments, and managing failures. This is important when a patient is to receive conscious sedation as the patient cannot consent to changes under those conditions. In the event that changes are necessary, the patient is neither surprised nor angered by incurring the additional expense.

• Recognise the limitations of your skills

Offer referral to specialists in complex cases if you lack necessary training, experience or technical competence.

• Utilizing evidence-based technologies and methodologies

Utilizing current evidence-based technology (e.g. CBCT) and methodologies in a clinical acceptable manner or prescribed protocol will vastly increase the chances for clinical success and reduce morbidity or complications.

• Continuing professional development

Ensure that you are knowledgeable in the latest dental procedures and products.

Acquire the necessary knowledge and develop the prerequisite clinical skills before attempting advanced aesthetic treatment modalities.

• Never deviate from the acceptable standard of care

Perform your duty to perfection, always provide the best possible and conservative care, always act in the patients best interest, and never place the patient's health at risk for personal gain. Allow adequate time in your schedule for excellence, quality care and artistry.

• Dental materials

Use the best evidence-based materials available that are effective, safe, predictable and affordable.

• Team effort

Work in a team if at all possible. An ideal treatment plan can often be achieved only by a team effort involving various specialists, oral hygienists and laboratory technicians.

Ensure good communication with all colleagues (inclusive of the dental technician) involved in the patient's care to ensure they understand what is expected of them.

• Dental laboratory

Choose your laboratory technician with care. Find an "artist" who understands your work, shares your work ethic and aesthetic goals and who does not mind reworking a prosthesis until it is perfect. Take advantage of the dental laboratory technician's knowledge regarding diverse restorative options offered by modern dental products. Establishing a team relationship with your laboratory technician helps build confidence and ensures consistent and successful treatment outcomes, especially in complex cases. Involve your dental technician from the start of the planning process, it will prevent disappointments later on. The dental technician is an essential member of the team.

• Treatment selection and staging

Proceed with prosthodontic, orthodontic or implant treatment only when periodontal disease and caries is under control. Always select the most conservative treatment option, especially in younger patients with un-restored healthy teeth. Less invasive or more conservative options such as bleaching, orthodontics, and resin-bonded composites should be offered to the patient as alternative options to ceramic veneers/crowns. Always give the patient an opportunity to observe the appearance and shade of veneers, crowns or bridges prior to final cementation.

• Maintenance care

Explain to patients how to care for any new implant/conventional prosthesis and stress the importance of rigorous oral hygiene and regular dental check-ups. Secure patient commitment to regular dental check-ups and oral hygiene maintenance program in order to maintain implant, periodontal and rehabilitation work performed. This is essential to long-term success. Consider a log of rehabilitation, periodontal and implant patients at your practice to ensure that appropriate recall intervals are maintained.

• Communication

Listen to your patient, be open and honest about treatment options and explain all options, not just those that you are interested or experienced in performing. If it is in the patient's best interest to be referred, then do that. In the long run it will benefit your practice and you will be seen to act with integrity.

• Deal appropriately with dissatisfied patients

Never rebuff a patient when he/she has expressed dissatisfaction with treatment at an early stage and make

a request for remediation, e.g., retreatment, referral for a second opinion or a refund. To avoid litigation in cases where dentists have been threatened or dissatisfaction expressed by the patient, the optimal course of action by the dentist is to simply refund the fees paid by the patient, refer the patient for a second opinion and/or retreat the patient at no charge.[27]

Conclusions

Dental malpractice claims are extremely expensive, emotionally stressful and time-consuming. It is therefore in the patient's as well as the clinicians' best interest to prevent dental malpractice claims. Dentists have an ethical duty and obligation towards their patients to observe ethical principles and code of conduct in practice, as well as to adhere to acceptable evidence-based standards and protocols of diagnosis and treatment. Clinicians who fail to adhere to the fundamental ethical principles not only violates the trust placed in them, but may also expose themselves to malpractice and litigation.

To provide cautious, skilful and prudent care, clinicians need adequate training and experience. Clinicians should also follow evidence-based science to advance their skills, stay up-to-date with technology, equipment and methodologies, and ensure that they have adequately trained support staff.

Every effort should be made to identify and avoid situations and procedures that may lead to potential harm. Applying ethical decision-making principles and good risk management protocols in dental practice will not only reduce dissatisfaction and risk exposure, but will also improve the standard of patient care.

To best serve the patient, dental clinicians need to act with empathy, integrity, competence and they have to communicate effectively with patients and team members. The better the communication, the less the risk and the more successful the treatment outcome. Empathy and sympathy in treating our patients may go a long way to avoid unpleasant outcomes.

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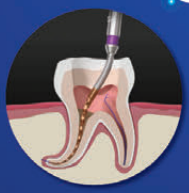
Flexibility:	 Super flexible. Excess force transferred to spring.	
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A simple chairside digital workflow

Linda Greenwall[1] and Benedict Harrison[2]

Intraoral scanning equipment has been rapidly introduced in dental practices as there are improvements to the technology in the last decade.

Computer-aided design (CAD) and computer-aided manufacture (CAM) is available to dental practitioners for the production of in-surgery restorations and devices using milling and printing technology.

This article will outline an overview of 3D scanning, its uses in general practice and discuss a simple chairside digital workflow of an indirect restoration.

A brief historical background

Dental biomaterials have been used in general dentistry for many years. Fillings inserted into crowns have been reported as early as the Neolithic period 6,500 years ago, with beeswax being the material of choice.

Historically a dental impression was needed for a technician to cast and construct a prosthesis.

Recent innovations in intraoral scanning have drastically improved their ability to acquire precise and accurate information with speed and ease. This enables dentists and technicians alike to view and design in an accurate virtual environment (Bernardini et al, 2012).

In recent years, computer technology and the development of CAD/CAM has allowed dentists and technicians to manufacture prosthesis using a digital workflow, and enabled them to make restorations out of millable materials such as composite, ceramic and zirconia and polymethyl methacrylate (PMMA) (Russo et al, 2019; Kilhara et al, 2019).

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[2] Dr Benedict Harrison BDS, Private Practitioner, London, UK

Figure 1: Preoperative photo of the clinical situation showing the distal fracture that had developed.

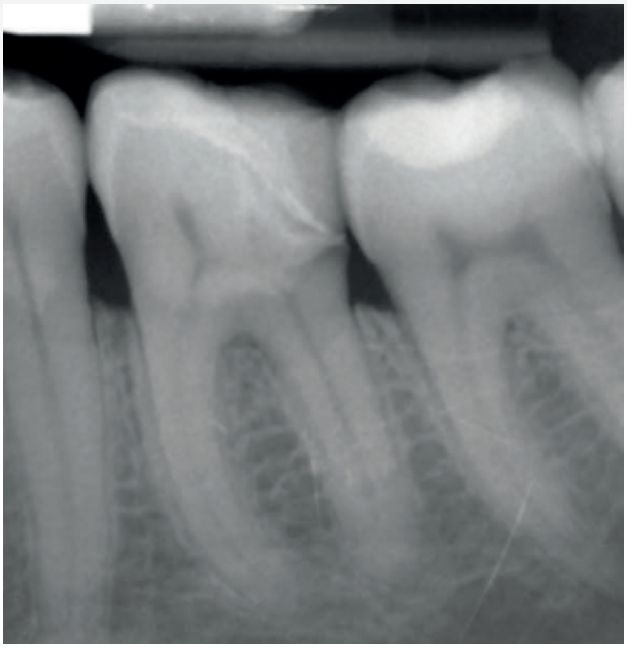

Figure 2: Preoperative radiograph showing significant crack in the distal marginal ridge of LL7.

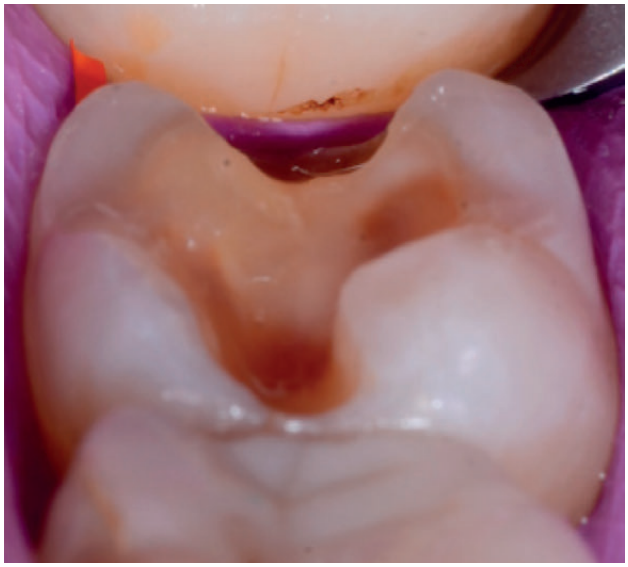

Figure 3: After removal of composite and reduction in cusp height to remove fractured cusps. Once the caries is removed and fracture chased out we can decide on the most appropriate material for the restoration.

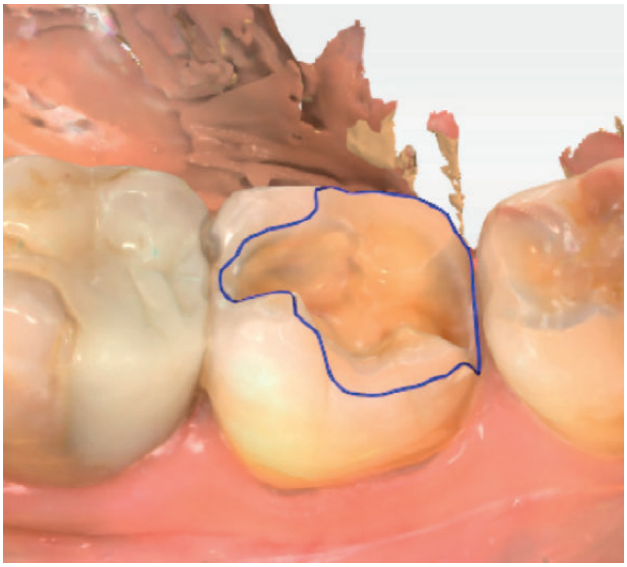

Figure 4: Scan of preparation and automatic margin detector. This margin is adjusted to the clinician's specification.

Types of CAD/CAM systems

There are three different CAD/CAM production concepts in dentistry described in the literature:

1. Chairside production – all components in the CAD/CAM system are located in the dental surgery
2. Laboratory production – a traditional working sequence

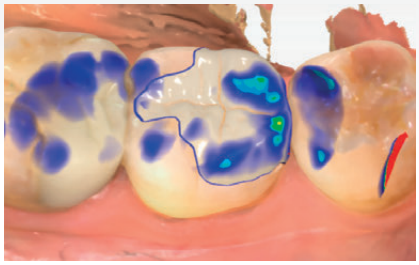

Figure 5: Restoration is designed using Cerec. Patients occlusion can be visualised with colour pressure areas. Restoration contacts can be turned on and off.

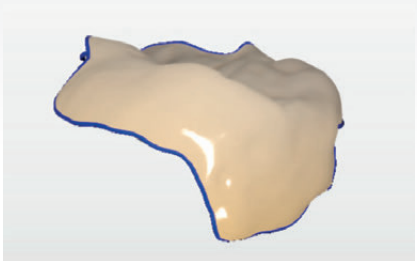

Figure 6: Lower model can be removed from the design to help add and remove from the virtual wax up. This is particularly useful when designing the restoration contact point.

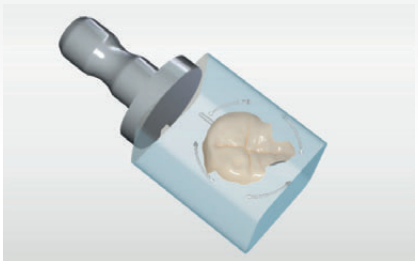

Figure 7: Once happy with your design, position the sprue on your restoration to a favourable position.

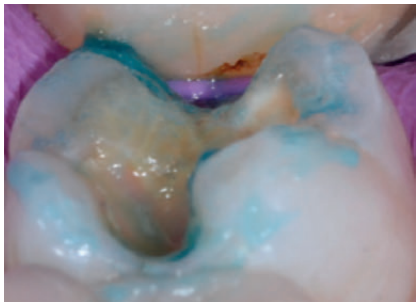

Figure 8: Cementation process – etch 20 seconds (Super Etch 37% phosphoric acid).

Figure 9: Washed and dried.

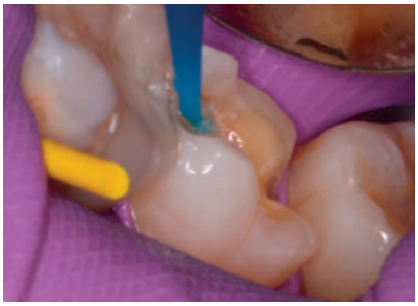

Figure 10: Application of Stae bond after Hurriseal application.

between a dentist and a laboratory. Once a laboratory receives impressions, these are cast then the CAD/CAM production starts by scanning the models. This enables the laboratory to digitally design and manufacture the prosthesis

3. Centralised production – laboratories send a design to a centralised production centre for milling, printing or pressing, this avoids the need for laboratories to purchase expensive production equipment (Baroudi and Ibraheem, 2015; Beuer et al, 2008).

The CAD/CAM in surgery system in dentistry comprises of four major components (Baroudi and Ibraheem, 2015; Beuer et al, 2008):

1. Digital scanner – a tool to convert physical geometry to digital information (such as Primescan, Trios 4, Emerald S, Itero Element 5D)
2. Software component – computer aided design software (Cerec, Trios, Planmeca)
3. Milling machine (Cerec MC-XL, Roland DWX-4W, Planmill 40/E4D Mill)
4. Millable block – ceramic, composite, PMMA and zirconia.

Scanning

Intraoral scanning devices have been around for many years, but have recently taken huge steps to make them a viable and effective tool for the general practitioner.

Historically, powder had to be used in conjunction with the scanner to provide an optical efficient environment to collect data. Scanners available on the market today are powderless and colour accurate. Many have adjunctive tools, such as shade analysing and caries detection.

Accuracy of scanning

There is not an exhaustive amount of research on the accuracy of digital scanning when compared to conventional analogue impression techniques.

The pace at which technology is improving makes it hard for research to stay up to date and relevant as digital scanning is constantly changing.

Some studies have reported better accuracy of scanned preparations using optical scanning (Abduo and Elseyoufi, 2018). However, a review by Abduo et al (2018) showed that intraoral scanning was just as accurate as conventional impressions in short spans, but during full arch scanning

Figure 11: Application of D/E resin.

Figure 12: Application of Relyx Unicem.

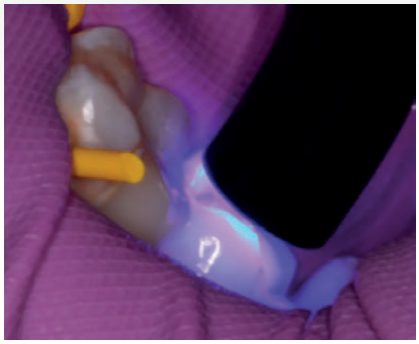

Figure 13: Seating and curing of the restoration.

there was more perceptibility to inaccuracies.

Ultimately, for diagnostic and short span scanning, digital impressions are comparable to conventional impressions (Abduo and Elseyoufi, 2018).

Acquisition of a good quality virtual model

1. Dry field – the use of a three in one and a vigilant nurse with a saliva ejector can make obtaining the scan much easier. A device such as an Optragate (Ivoclar Vivadent) that deflects the lips is also beneficial to clear the scanning field
2. Dark environment – the dental light, as well as surgery lights, should be switched off to enable the scanner to work more effectively
3. Good preparation design – clear, smooth margins, ideally supragingival. Use of retraction cord essential for margins sub or juxtagingival
4. Half arch impression – this reduces inaccuracies in the impression and also makes designing the restoration easier when moving the virtual model on the software program
5. Obtain the bite registration and opposing arch before preparation – this reduces the scanning time after preparation. Ideally, the bite registration should be taken in an upright position with the patient biting together, but not clenching.

A simple case is highlighted step by step to show the digital work flow.

Case: Preparation of a ceramic combination inlay/onlay

This patient, due to a clenching habit, developed a deep distal crack on the lower left second molar. The crack was situated on the distal marginal ridge of the tooth and had developed a fracture on the occlusal surface where decay had penetrated into the crack.

Table 1: (Mangano et al, 2017)

Advantages and disadvantages of chairside scanning	
Advantages	**Disadvantages**
More time efficient	Deeper margins more difficult to scan
Less patient discomfort	Learning curve
Better communication between dentist and technician	Cost of purchasing equipment
Better communication between dentist and patient	Ensuring good isolation to record accurate details
Less waste	Dry field is essential to pick up accurate details of the prep
Accurate fit of restorations due to better identification of margins	Initial learning curve can take more time to do
	More time needed to learn the software and design software

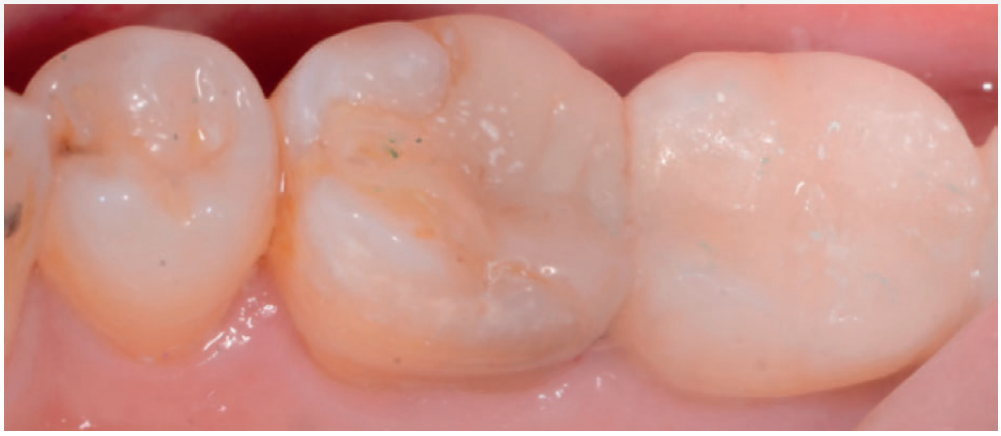

Figure 14: Final restoration LL7.

To preserve and protect the tooth from further fracture, it was decided the best and most conservative options would be to design an inlay/onlay combination, overlaying the distobuccal and distolingual cusps and keeping the inlay design/occlusal design (Figures 1 to 14).

Treatment time was 90 minutes from start to finish. This helped to save the patient a second appointment and patient did not have to have a temporary restoration.

The overall outcome was a conservative onlay made to protect the tooth from further breakdown and preserve the remaining tooth structure.

Conclusions

Using the digital scanner and Cerec digital design software, an onlay was created chairside using a milling machine and ceramic block.

It was an effective way to undertake restorative and aesthetic dentistry. More research is needed and more training is needed, as further materials and software are introduced onto the dental market.

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Article: Minimally invasive endodontics using a new single-file rotary system – Part 2. Van der Vyver et al, page 4

1. *Peri cervical dentine refers to the following:*
a 6mm coronal to the crestal bone and 4mm apical to the crestal bone
b 3mm coronal to the crestal bone and 6mm apical to the crestal bone
c 4mm coronal to the crestal bone and 6mm apical to the crestal bone
d 6mm coronal to the crestal bone and 2mm apical to the crestal bone

2. *Which of the following is considered paramount considering its effect on the longevity of endodontically treated teeth:*
a Dentine preservation
b Structural integrity
c Chemomechanical preparation techniques
d All of the above
e None of the above

3. *According to Parashos and Messer (2006), what is the incidence of NiTi instrument separation during canal preparation?*
a 8%
b 2%
c 5%
d >10%

4. *Which of the following options are considered acceptable treatment options for the clinical management of fractured root canal instruments?*
a Bypassing the fractured instrument
b Removing the fractured instrument
c Leaving the fractured instrument in situ
d All of the above

5. *True or False: Leaving a fractured instrument in situ reduces the chance of healing in cases where an apical lesion is present.*
a True
b False

Article: Minimally invasive endodontics using a new single-file rotary system – Part 2. Van der Vyver et al, page 4

6. *True or False: Preparing a micro glide path prior to shaping with the TruNatomy Prime file is not indicated when using the TruNatomy preparation system*
a True
b False

7. *S-shaped canals are most often found in which of the following teeth:*
a Mandibular incisors
b Maxillary lateral incisors
c Maxillary first premolars
d Mandibular canines

8. *Radix Entomolaris refers to a third root located on which side of a mandibular molar*
a Buccal
b Lingual
c Both buccal and lingual
d None of the above

9. *True or False: Calcific metamorphosis is a possible complication after dental trauma. The absence of a root canal on conventional radiographs in these cases indicates the total absence of a root canal.*
a True
b False

10. *According to the authors, the new TruNatomy system has the following advantages*
a Dentine preservation
b Minimally invasive preparations
c Versatile with many clinical applications and advantages
d All of the above

Article: Dental malpractice and its liabilities: Ethical and legal considerations every dentist should know.
Hartshorne & van Zyl, page 46

11. Which of the following general statements are true? (More than one answer may be correct, select one)
a The dental profession holds a special trust relationship with its patients
b Business/economic factors has impacted on the dentist-patient relationship
c Aesthetic procedures require low patient expectations and demands
d Dental malpractice claims are emotionally stressful, expensive and time consuming
e Patient rights have no impact on the dentist-patient relationship

12. Which of the following statements regarding the principle of 'Autonomy' are true? (More than one answer may be correct, select one)
a The patient has a right to participate in decision-making and treatment choices
b The principle of autonomy expresses the clinicians right to select treatment
c The final choice of treatment is dependent on the dentist skills and most profitable procedure
d Due consideration must be given to the patients needs, desires and financial abilities
e Complex treatment plans require more detailed descriptions and discussions

13. Which of the following statements regarding informed consent are true? (More than one answer may be correct, select one)
a Informed consent is an ethical and legal requirement
b Consent must be voluntary
c Consent must be in written format and signed by the patient
d The patient has a right to ask questions
e The dentists' best interests are always paramount

14. The fundamental ethical principle of 'Non-maleficence' means the dentist has a duty to:
a To do good
b To do no harm
c To exercise care
d To refrain from placing the patient at risk
e Non-disclosure of unavoidable risks

15. The fundamental ethical principle of 'Beneficence' means the dentist has a duty to:
a To promote or to do good
b To act in the patients' best interest
c To improve the patients' oral health
d To treat the patient fairly
e To respect the patients' rights

Article: Dental malpractice and its liabilities: Ethical and legal considerations every dentist should know.
Hartshorne & van Zyl, page 46

16. Dental malpractice is defined as the failure of a clinician to follow the accepted standards of care of his/her profession resulting in harm injury or loss. (True or False?)
a True
b False

17. Which of the following statements regarding standard of care are true? (More than one answer may be correct, select one)
a What a reasonable dentist should be doing under similar circumstances while applying evidence-based care
b The standard of care differs between general practitioners and specialists
c The overall criteria for standard of care is whether it is in the patients' best interest
d Standard of care means practicing anecdotal-based dentistry
e Negative clinical outcomes and complications are proof of deviation from the standard of care

18. Which of the following elements are required for proving negligence or malpractice?
a The clinician had a duty or an obligation to the patient
b Patient dissatisfaction
c The clinician failed to conform to the required standard of care
d The harm suffered by the patient was a direct result of sub-standard care
e Damages sought are directly related to the harm caused

19. Dental malpractice is commonly caused by:
a Inadequate diagnostic testing
b Inadequate treatment planning
c Lack of informed consent
d Treatment errors
e All of above

20. Malpractice claims and dental litigation can be prevented by:
a Systematic and reasoned ethical decision-making
b Ensure that benefits always outweigh potential risks
c Inadequate documentation and record keeping
d Providing additional services beyond the patients' informed consent
e Referral to a specialist if you lack necessary training, training, experience or technical competence

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