Note from the Editor

Dear MES members,

We have to apologize for the delayed publication of this issue of our annual bulletin.

We have had a very successful and enlightening event which was held on Sunday, 15th November 2015 at Pullman Kuala Lumpur City Centre Hotel and Residences. The speakers were Dr Helmut Walsch from Germany, Dr Henry Kim Hyeon-Cheol from Korea and Dr Pairoj Linsuwanont from Thailand. We have an exciting event coming up in this year and I do hope we will all take the time to attend this session to enrich our knowledge in endodontics and to be able to give more value to our patients in our clinical practice.

I wish everyone a fruitful and successful 2016!

Dr Ong Nguk Jean
MES Editor
Dear esteemed colleagues,

Greetings from the Malaysian Endodontic Society.

I am grateful for the opportunity to serve as President of the Malaysian Endodontic Society for the 3rd term. The year 2015 has been a productive year indeed for our society.

In 2015, we were privileged to have had the venerable Dr Helmut Walsch from Germany, Dr Henry Kim Hyeon-Cheol from Korea and Dr Pairoj Linsuwannon from Thailand as our speakers. Dr Henry Kim Hyeon-Cheol had conducted a very interactive workshop on ProTaper Next and Guttcore. We had a very good response to the workshop and conference from MES members as well as traders. This event was a successful collaboration with the MDA.

This year we will be hosting the much anticipated 2016 Annual Scientific Meeting and AGM, at the Pullman Kuala Lumpur City Centre Hotel and Residences on 13th November 2016. We have invited four renowned international speakers namely Dr Mike Gordon of New Zealand, Dr Marino Sutedjo of Indonesia, Dr Jaruma Beau Sakdee of Thailand and Dr Philippe Guettier of France. They will cover a vast variety of interesting clinical and research topics in Endodontics. We also will be organising two pre-congress workshops (ie TF rotary instrumentation workshop by Sybron Endo and Wave One Gold workshop by Dentsply International) at the Universiti Kebangsaan Malaysia (UKM) on 12th November 2016.

I would like to take this opportunity to thank my dedicated and industrious committee members for their efforts and constructive input. I would also like to thank the loyal MES members who continue to support our CPD events year after year. I sincerely hope that the lectures and workshops have benefitted all MES members, including the young graduates as well as the more experienced general practitioners and specialists alike.

I would like to wish the coming committee a wonderful year ahead. I am confident that the MES will grow from strength to strength for many years to come.

Best wishes,
Dr Tan Boon Tik, President
**SCIENTIFIC CONFERENCE**

13th November 2016 (Sunday)

*Venue:* Pullman Kuala Lumpur City Centre Hotel and Residences, No 4 Jalan Conlay, Kuala Lumpur

*Speakers:* Dr Mike Gordon (New Zealand)  
Dr Marino Sutedjo (Indonesia)  
Dr Jaruma Beau Sakdee (Thailand)  
Dr Philippe Guettier (France)

*Topics include:*
- Challenges in treating complex anatomy
- Controversies in endodontics
- Dental trauma 101: The endodontic perspectives
- Current concept for the management of complex endodontic cases

*Lectures:* 6 CPD points (pending)

**HANDS-ON WORKSHOPS**

12th November 2016 (Saturday)

*Venue:* Simulation Lab, Faculty of Dentistry, UKM, Kuala Lumpur

*Workshop 1:* The Golden era of root canal instrumentation (Dr Philippe Guettier)

*Workshop 2:* Modern endodontic concepts and techniques (Dr Mike Gordon)

*Lectures & workshops:* 4 CPD points (pending)

*For further details regarding the meetings and also for registration, please watch out for the flyers cum registration forms, or you could also log on to http://www.mesmalaysia.com/ or email MES Secretariat at mesenquiry@gmail.com*
The 27th Annual General Meeting (AGM) of the Malaysian Endodontic Society was held on Sunday 15th of November 2015 at Pullman Kuala Lumpur City Centre Hotel and Residences, 4, Jalan Conlay, Kuala Lumpur, Malaysia.

The scientific meeting had participation of more than 250 delegates from all over Malaysia. The speakers were Dr Helmut Walsch from Germany, Dr Henry Kim Hyeon-Cheol from Korea and Dr Pairoj Linsuwanont from Thailand.

Dr Helmut Walsch presented on management of calcified root canals and perforation repair. Dr Henry Kim talk about essential and efficient endodontic procedure and share his experiences in characteristic of nickel-titanium in endodontic procedure. While, Dr Pairoj exchange his expertise in management of vital permanent teeth with cariously-exposed pulp; the updated evidence.

The registration started at 9:00 AM followed by the MES/AGM was held at 1:00 PM and Dr Tan Boon Tik was nominated as the MES President for 2015-2016. There were 3 lucky draws.

This one day programme turned out to be an ideal platform for all delegates to come together and also to help each and everyone make a difference in their day to day practice.

A pre-conference hands-on workshop was conducted by Dr Henry Kim at the Simulation Lab, Faculty of Dentistry, UKM on 14th November 2015. It was a half day rotary instrument workshop. The participants were introduced to the theory and hands on training on basic and important knowledge skills about efficient processing of the modern root canal procedures.

Once again, MES has proved to be a very effective organization, conducting more events in the calendar focused purely on evidenced based information in Endodontics at the highest level. This will equip general practitioners to face challenges of the demands of modern endodontic in their day to day practice.

MES Committee Members 2015-2016

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INTRODUCTION:

Endodontics continues to evolve in the field of health science; numerous procedures, techniques and instruments are not the same since we left dental school. We have seen instrumentation change from stainless steel hand files to NiTi rotary files to Reciprocal single file systems, each of which has their advantages and limitations.

Recently, there has been an increasing portion of general dentists who have incorporated rotary endodontics in their daily practice; this report will assist you to compare rotary and reciprocal systems and to determine if you desire to change your instrumentation technique in your practice.

Both rotary and reciprocal systems clean and debride the canals well. Popular reciprocal systems in the Malaysian market are the Wave One Gold (Dentsply Maillefer) and Reciproc (VDW). Either of these systems has to be used in conjunction with hand files for initial scouting, glide path management or recapitulation.1

Is Reciprocation a new revolution?

Reciprocation is defined as any repetitive back-and-forth motion, and it has been used in endodontics to drive stainless steel files since the 1960’s. In the early days, reciprocating files were made of stainless steel and they rotated in large equal angles of 90° clockwise (CW) and counterclockwise (CCW) rotation. This type of symmetric reciprocation can be defined as complete oscillating reciprocation (Fig: 1), resembling the classic atch-winding movement used with manual SS files.

In recent times we have the reciprocal technology that was modified to asymmetric oscillations of CCV 150° and CW 30°, resulting in one complete revolution for every three oscillation cycles (Fig: 2). This modified CW/CCW movement used Ni-Ti files specifically designed to be used in partial reciprocation, such as Wave One (Dentsply Maillefer) and Reciproc (VDW). This kind of partial reciprocation is said to mimic the manual balanced force technique using a Flex R file as described by Roane and colleagues in 1985.3

Performance of Rotary and Reciprocation systems in curved canals

A Clinical survey by Dr Gordon J. Christensen, pointed that general practitioners have high anxiety levels with regards to file separation when using rotary files in calcified and curved canals.6 When Rotary instruments are used to cut dentine in a calcified canal, torsional deformation develops on its axis. If this deformation is within the plastic limit of the metal there is no structural change. However, when you continue to cut dentine, repeated cyclic axial deformation occurs, this leads to instrument fracture due to torsional fatigue and this occurs along with the flexural fatigue that develops within a curved canal, leading to file separation.7

In Reciprocating files, the blades are designed to cut in a counterclockwise direction. The degree of rotation in the clockwise and counterclockwise directions is different. Higher rotation occurs in the CCW direction (150°), which corresponds to the cutting direction, causing advancement of the instrument in the canal and removing dentin. However, the instrument rotates at a smaller angle of rotation in the CW direction (30°), which allows it to unlock and move safely through the root canal, thereby reducing the risk of instrument fracture.9

Is apical debris extrusion- an issue?

When a new file system is in the market, it is first condemned as ridiculous and then dismissed claiming it to be inefficient. With the reciprocating files, apical debris extrusion has been a major area of criticism. But the fact is, all single-file systems both rotation and reciprocation cause apical extrusion of debris. Studies showed that, when coronal flaring was performed prior to shaping, it created less wall contact for the file leading to less friction at the apical third therefore reducing apical debris extrusion.10 Hüseyin Sinan Topcuoğlu et al, have...
also proved that coronal flaring greatly reduced the amount of apically extruded debris. Also, irrigating abundantly and frequently with sodium hypochlorite after removing any given reciprocating file from a canal and cleaning the flutes before entry into the canal can help reduce apical extrusion of debris.

**Misinformation on Root Microcracks**

Several reports have claimed that reciprocating files induced microcracks in root dentin while shaping canals. Rui Liu et al, in his study proved that both rotary and reciprocation can create cracks in the root dentin. Clifford CJ, the founder of Wave one and Wave one gold says that cracks are usually formed due to (a.) failure to follow the directions of use or over preparing canals with small roots, (b.) not emphasizing on glide path management, (c.) forcing files with large tip diameters to full length and most important of all is (d.) using high torque settings for the files. Therefore, it is important to note that dentinal cracks are almost always technique related, and not due to movement or design of a given file.

**Is Reciprocation recommended for me?**

Ruddle 16, the co-inventor of the Wave One file has recommended the reciprocating system for dentists who have any of the following concerns:
- Using stainless steel files for shaping canals
- Breaking rotary files in the canal
- Ledging curved canals
- Transporting the prepared foramen
- Using too many shaping files
- Mastering hybrid techniques
- Spending too much time preparing canals

**Change is inevitable**

The only thing that is constant is change. Endodontics has seen change from an active to passive cutting edge files, a fixed to a variable taper, a traditional to a unique cross sectional design, M-wire to Fire wire NiTi heat treatment alloy and now gold files are turning into blue files. As the world keeps on developing, technology will continue to change, what is working today might not be efficient tomorrow. The only one thing that will stay constant forever is the level of patient comfort that we need to provide for our patient. So it is of utmost importance to stay up-to-date with new emerging technologies and learn how to embrace and use them in our daily practice.

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**References:**

HYPNOSIS IN ENDODONTICS

Dr Afzan Adilah Ayoub,
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Hypnosis came from Greek word ‘hypnos’ mean sleep and combine with osis. However, it relationship as a sleep state is a major misconception (Allison 2015). Hypnosis is a safe and natural state that most people can enter easily and naturally. It is a state of relaxation in which 90% of people experience every day. According to the American Society of Clinical Hypnosis (2012), hypnosis is a state of inner absorption, concentration, and focused attention. It is characterized by relaxation, some degree of suggestibility and when we are focused and concentrating, we are all more able to use our minds effectively. According to the British Medical Association (1935) hypnosis is a valuable medical tool.

The history of hypnosis is lengthy and complex. There is evidence that hypnosis has been practiced, under numerous labels, for centuries. Egyptian soothsayers, tribal medicine men, witch doctors, Greek oracles, Indian yogi and Hindu Fakirs all practiced different forms of hypnotism to heal the sick (Kroger 2008, Facco et al 2014). However, the history of modern hypnosis is believed to start with the Austrian physicist, Franz Anton Mesmer (1734 1815), who practised ‘animal magnetism’ during the late 18th century (Rowley 1986). Mesmer would treat crowds of people by connecting them with cords and ‘magnetising’ the subjects as he touched them with a glass pole, inducing a ‘crisis’, involving convulsions, hysteria, laughing and crying (Kroger 2008, Rowley 1986). The phenomenon became known as mesmerism and, as a result, Mesmer developed a large following until he was exposed by a commission in 1784 stating that the cures were due to the imagination, not magnetism (Kroger 2008). There is still no doubting Mesmer’s significance in the establishment of hypnosis as a therapy.

The title of ‘father of modern hypnotism’, however, belongs to the physicist Dr James Braid, who coined the term ‘hypnosis’. He was born in Scotland and studied medicine at the University of Edinburgh. In his books, Neurohypnology and hypnosis, published in 1843 and 1860, respectively, Dr Braid presented concepts of suggestions and monoideism which focused attention on a sole idea. He recognised that the subject cannot act beyond his/her will, and emphasised the operator/patient relationship (Facco et al 2014).

The use of hypnosis in dentistry or also known as hypodontia was first documented in 1829 to aid a dental extraction (Abdeshahi et al 2013). By late 20th century, hypodontia has become an adjunct of patient management in dentistry (Andrick 2013).

The connection with inhalation analgesia started with a street ‘professors’ who used hypnosis and lectures on the wonders of chemistry as an entertainment. They always demonstrated the effects of laughing gas or also known as nitrous oxide. One night in 1844, Dr Horace Wells, a dentist watched the performance. He witnessed a volunteer tripping around and seriously bruised after he inhaled the laughing gas. Then, he asked the volunteer who claimed that he felt no pain until the gas wore off. The next day, Wells permitted his colleague to extract one of his own tooth under inhalation with nitrous oxide, later published it in the newspaper as the greatest discovery ever made (Kroger 2008).

Hypnosis is an agreement between a person designated as the hypnotherapist and a person designated as the client or patient to participate in a psychotherapeutic technique based on the hypnotist providing suggestions for changes in sensation, perception, cognition, affect, mood, or behaviour (Montgomery et al 2010). While hypnotherapy is the therapy used by a therapist trained in hypnosis, Clinical hypnotherapy or clinical hypnosis is also known as therapeutic or medical hypnosis. This is the use of hypnotherapy within a clinical or medical model and is generally used in the treatment of clinical conditions (Kroger 2008).

In dentistry, hypnosis has both therapeutic and operative uses. Therapeutically, it usage includes inducing patient relaxation, elimination of patient’s tension and anxiety including fear and discomfort, removal of objections to necessary orthodontic or prosthetic appliances after the patient agreed to accept them, maintenance of patient’s comfort during a long arduous of dental work, bruxism (Clarke 1997), accustoming the patient to orthodontic or prosthetic appliances and modification of noxious dental habits (Aaron 2008). Operative application include reduction of anaesthesia or analgesia, amnesia for unpleasant work, substitution for, on in combination with premedication in local anaesthesia, prevention of gagging and nausea (Barsby 1994), control of salivary flow, control of bleeding, postoperative anaesthesia and reduction of postoperative shock (Eli 1992, Aaron 2008).

In hypnosis, there are three depth of trance; light, medium and deep trance. Light trance are as simple as close their eyes, move their eyes rapidly (Rapid eye movement), do not move, breathe more slowly, swallow more frequently and have flattened or relaxed facial features (Kroger 2008). The medium depth trance covers when the patients head sinks towards their chest, their body sinks into the
chairs, jaws slacken, facial features flatten and relax more, eyelids stiffen (catalepsy), skin become flushed or pale, lethargic, experience a heavy feeling in limbs, partial loss of sensation (partial anaesthesia) and reduced awareness of body (Waxman 1989). In the deep trance, patient may experience amnesia, out-of-body feeling (depersonalisation), hallucination, full anaesthesia, slump deeply in the chair, appear to be fully awake, have open eyes, able to talk and talk and take a long time to respond to suggestion (Kroger 2008). Deep hypnosis is longer in time to established and impractical for routine dental practice; however it is needed for analgesia and to tackle the behaviour management (Allison 2015). Establishing a light trance is important to relax an anxious patient for dental treatment.

According to Fross (1966), all dentists have been using a form of hypnosis for years. It is known as ‘chairside manner’, they use it to calm fears and apprehensions”. This recommend that hypnosis does not have to be a trance-state; simply focusing your patients attention and suggesting a calm and pleasant environment can be a considered a form of hypnosis. The hypnotic language, by tapping a positive spin on depressive language, can be used to create a relaxed environment (Holden 2012).

Tackling fear and anxiety is one of the major applications in hypnodontia. Facco (2014) mentioned that both proficiency in behavioural and pharmacological techniques are crucial for anxiety management in modern dentistry. Psychotherapeutic interventions are able to minimize pre-operative anxiety and predicts a better postoperative recovery (Diercke et al 2013).

In every hypnosis session, it is essential that the hypnotherapist obtains consent and discuss about hypnosis, which is critical to its success. The hypnotherapist begins with simple induction exercises and makes it clear that the patient can emerge from the hypnotic state at any time. At the end of a session, the hypnotic state must be reversed (Allison 2015). Conditioning patients to hypnosis can indeed be time consuming; however, this time is regained at subsequent appointments, when induction is faster and efficient; more so than with intravenous sedation (Facco 2014).

The chart described the seven stages of hypnodontic procedure according to Kroger (2008). The first stage which is the mind-set; a stage that needed to accomplish a state of cooperation and building rapport. This is to correct any misconception about hypnosis. Stage two is to test the patient’s susceptibility to hypnosis. Kroger said that all patients should be considered susceptible to hypnosis until proves otherwise.

The goals of induction is simple, to get the patient to close their eyes by asking them or to use with eye fixation technique. Induction may be direct or indirect. Deepening is to help patient achieve a deep enough trance for the work that we plan to do, to heightened their inner focus, and hopefully to promote dissociation. After deepening, most of the dental work can be conducted during this stage. The post-hypnotic suggestions is the stage where we deliver the positive suggestions that will help the patients to achieve the outcome their desire from hypnotherapy based on Specific Measurable Attainable Realistic Timely (SMART)’s goal. We may even suggest at the next session, patient are more susceptible to hypnosis. Lastly, awakening is important that no patient is permitted to leave the clinic unless they are completely and fully coordinated.

Hypnodontics should not be abused by the dental professions. Any dentist whom using hypnosis has the means at his/her disposal of probing into the emotional problems of their patient. Even with narrow experience, hypnosis session may produce other hypnotics phenomena such as age regression, revivification, negative and positive hallucinations and etc. Therefore, dentist has an ethical and moral obligation to their patients to apply all the necessary knowledge to alleviate pain, suffering and discomfort (Kroger 2008). Therefore, judicious judgement is crucial before starting the hypnotherapy.

The limitations in hypnodontia are to avoid to use hypnosis beyond competence, to treat patient as a whole not only a ‘hole’, time consuming, impractical and failure to build rapport.
Hypnosis is an underdog, yet powerful, benevolent tool in dentistry; it provides effective sedation, while leaving the patient in full control. Hypnosis has many expenditures within the dental field, oscillating from simple relaxation of the anxious patient to complete analgesia for surgery. Hypnosis when applied alone or in conjunction with sedation, it is an exclusive management option for many patients struggling with current anaesthetic and sedation methods. With proper training and appropriate patient selection, it can add significance to a professional’s practice and skill set. The current lack of use of hypnosis in general dentistry may be down to a lack of knowledge of the therapy and its applications. Extensive promotion of clinical hypnosis, emphasising its benefits and ease of use, alongside exploring the various types of hypnosis and introducing light hypnosis techniques to relax patients, may encourage practitioners to use it for other applications. The key to hypnodontics is to increase dentists’ knowledge and promote courses in clinical hypnosis. In an era where dentistry is centred on both patient management and surgery, the key is to increase confidence with additional behavioural management skills, of which hypnosis is an excellent example (Allison 2015).

References:

The 10th SES-MES Scientific joint meeting was organized under the general theme of “Endodontics – Where Art and Science Meet”.

The lectures address not only the latest issues but also topics that will affect the field of endodontics for years to come.

Keynote speakers were:

Dr Domenico Riccucci, who spoke on wound healing after root canal treatment and microbial and non-microbial reasons for root canal treatment failure.

Dr Meetu Kohli, spoke on bioceramics in endodontics and endodontics vs implants.

Dr Jeeraphat Jantarat spoke on management of failing root canal treatment: retreatment of endodontic surgery.

Dr Rachel Tan from Hong Kong spoke on Advances in the science of endodontics. Other local speakers include Dr Loh Fun Chee, Dr Tan Shoa Yong, Dr Wu Siwen and Dr Vanessa Chia.

Dr Afzan Adilah Ayoub represented MES to this event and gave a talk on Hypnosis in endodontics.

Over 2 days we were enlightened with a wealth of knowledge and information.

Prepared by
Dr Noor Hayati Azami

Abstract

Bisphosphonates are commonly used in medicine to as an alternative to hormone replacement therapies for osteoporosis and to treat osteolytic tumours. The occasional but devastating adverse effect of these drugs has been described as bisphosphonate-related osteonecrosis of the jaw (BRONJ). As this condition is debilitating and difficult to treat, all efforts should be made to prevent its occurrence in patients at risk. This case report describes the nonsurgical canal treatment of multiple teeth in a patient on bisphosphonate therapy and reviews proposed possible mechanisms of BRONJ and its prevention.

Introduction

Bisphosphonates (BPs) are non-metabolized pyrophosphate analogues that are commonly used in the management of bone diseases, such as osteoporosis, Paget’s disease (Langston & Ralston 2004) and osteogenesis imperfecta of childhood (Letocha et al. 2005). They are also indicated in the treatment of malignant hypercalcemia in patients with multiple myeloma or bone metastases from breast and prostate cancers (Pavlakis et al. 2005, Ruggiero et al. 2009).

BPs maintain skeletal health by reducing excessive bone turnover, resulting in the preservation of structure and mineral content of the bone (Kyrgidis et al. 2010). Their mechanism of action is by inhibiting osteoclastic function, induce apoptosis of osteoclasts, and inhibit osteoclast differentiation from precursors (Lindsay & Cosman 2001). They are also known to inhibit angiogenesis by reducing vessel sprouting (Wood et al. 2002) and cause a significant and lasting decrease in vascular endothelial growth factor (VEGF) levels in patients, and thus may negatively affect angiogenesis (Santini et al. 2002). These drugs are not metabolized well and are slowly released over extended periods of time (Fliefel et al 2015).
Several adverse effects have been reported with the use of BPs. This includes renal toxicity (acute renal insufficiency, deterioration of chronic renal insufficiency), fever, bone pain, hypocalcaemia, and gastrointestinal intolerance (Kühl et al. 2012). BP-related osteonecrosis of the jaw (BRONJ) is also one of the complications associated with these drugs (Marx et al. 2005). BRONJ is defined as an exposure of maxillary and/or mandibular bone that has persisted for more than eight weeks, in patients who have not received radiation therapy in the region and who have been administered with bisphosphonates (Ruggiero et al. 2009). A positive correlation exists between the duration and cumulative dosage of BP treatment and the incidence of BRONJ (Kühl et al. 2012). Based on available data, the risk of BRONJ for patients receiving IV bisphosphonates is significantly greater than that for patients receiving oral bisphosphonates (Ruggiero et al. 2009).

Reducing the risk depends on awareness and avoiding predisposing factors for BRONJ. Several observational studies have shown that dental procedures are one of the risk factors for the development of BRONJ. Mavrokokki et al. (2007) found that the main trigger of BRONJ in patients taking BPs was dental extraction. This was confirmed by several studies, which identified dental extractions or invasive surgical procedures as being one of the risk factors for the development of BRONJ (Marx et al. 2005, Filleul et al. 2010).

Endodontic treatment in patients receiving bisphosphonates is a safe clinical procedure (Kyrgidis et al. 2010). Nonsurgical root canal treatment (NSRCT) specifically, has been recommended as an alternative to extraction to minimize the risk of developing BRONJ (Moinzadeh et al. 2013). A few precautions need to be adhered to ensure no complication arises from the treatment. This paper describes the clinical management of NSRCT in a patient on bisphosphonate therapy, based on the best practice recommended by the published guidelines (AAE 2006).

Case Report

A 36 years-old female was referred to the Universiti Kebangsaan Malaysia (UKM) Endodontic Specialist Clinic for management of root canal treatment of tooth 36. She was initially seen at the outpatient clinic where tooth 36 was diagnosed with irreversible pulpitis and pulp extirpation was performed as an emergency treatment.

Her medical history revealed that she was diagnosed with pituitary adenoma. She was hospitalized due to pituitary adenoma surgeries and avascular necrosis of bilateral hips. Following the pituitary adenoma surgery, she developed panhypopituitarism and chronic gastritis. She was undergoing treatment with intravenous Zolendronate for the second year of a three-year course. Other medications included hydrocortisone, L-thyroxine, Minirin, Calcium and Rocaltrol. She was also known to have allergy to sulphonamides and chloramphenicol. The patient was an irregular dental attendee. Due to her medical condition, the patient was also against the use of amalgam fillings and went to see her dentist to have all the amalgam fillings in her mouth replaced with composite restorations.

Extraoral examination was unremarkable. At the site of complaint, tooth 36 had had intact temporary filling. No abnormality was detected at the periapical area in the radiograph (Figure 1A). There was an occlusal temporary restoration on tooth 37. General examination revealed a dislodged composite restoration (CR) at the distal of tooth 15. Caries was present and tooth was hyper-responsive to electric pulp test. Upon removal of caries, pulp exposure occurred. Widening of periodontal ligament (PDL) space at mesial aspect was noted at the apex of 37 and 15 (Figure 1B and 1C). Teeth 15, 36 and 37 were indicated for NSRCT.

After the completion of root canal treatment of tooth 36 and 15, the patient was not very compliance to her dental appointments and did not turn up for further appointment. She requested for an appointment again a few years later due to the pain she had been experiencing from her lower right side of the jaw. The pain was spontaneous throbbing in nature, and lasted for hours. The pain disturbed her sleep and she had to take medication to relieve the pain. Upon examination, glass ionomer cement (GIC) restoration with deficient margin was observed on disto-occlusal of tooth 45 and mesio-occlusal-distal of tooth 46 (Figure 2). Caries was detected on the distal of tooth 45 and mesial of tooth 46. Both teeth were not tender to percussion and periodontal probing depths were within normal limit of 2-3mm. Pulp sensibility tests were performed. Both teeth showed prolonged and lingering response after stimulus was removed. Radiographic examination revealed carious radiolucency underneath distal restoration and mesial of 46, as well as distal of 45 (Figure 1D). Both teeth were diagnosed as symptomatic irreversible pulpitis and indicated for NSCRT.
Treatment:
All root canal treatment was performed under local anaesthesia 2% Scandonest with 1:100,000 adrenaline, dental dam isolation and magnification with an operating microscope.

Pre-endodontic restoration and access:
The existing restorations and remaining caries were removed. The pulp chambers were accessed and pulp extirpation was carried out. Calcium hydroxide paste was placed as intracanal medication. Teeth 15 and 46 were deemed restorable but post-core crowns were required for the final restoration as the remaining tooth structure was minimal. Molar band was cemented on tooth 46 to retain the temporary filling and facilitate dental dam placement.

Shaping and cleaning:
For all the teeth, Gates Glidden burs size 1, 2, and 3 were used for coronal flaring. A Root ZX mini apex locator was used to determine the working length (WL) and verified with periapical radiograph taken using EndoRay film holder. The canals were prepared using rotary ProTaper Universal files and irrigated with 2.52% Sodium hypochlorite (NaOCl). Calcium hydroxide paste was used as intracanal medication in between appointments. The access cavity was double sealed using Cavit and IRM.

For tooth 36, ultrasonic file tip used for irrigation broke inside the mesio-lingual canal. In an attempt to remove the broken instrument, a strip perforation occurred on the inner wall. The perforation area was cleaned with NaOCl and was immediately repaired with Mineral Trioxide Aggregate after obturation of the mesio-lingual canal.

Obturation:
Master gutta-percha (GP) cone of corresponding apical size of canals were fitted at respective WL and radiograph was taken to confirm the fit. Before obturation, ethylenediaminetetraacetic acid (EDTA) 17% solution was used for 5 minutes to remove the smear layer and rinsed with normal saline. Canals were then irrigated with 2% Chlorhexidine (CHX) for further disinfection. Warm vertical compaction technique was used to obturate all teeth (Figure 3). For teeth 46 and 15, fiber posts were cemented and core build-ups were completed using composite restoration for all teeth. All the teeth were restored with crowns (Figure 4).
Review:
The root treated teeth were reviewed 6 months after all treatment completion. Patient had been symptom-free. Radiographs showed normal apical tissues of all the teeth treated (Figure 5).

Figure 5: Review radiographs

Discussion
Bisphosphonates are used despite some potential complications on patients to improve the life quality of cancer patients (Ruggiero et al. 2009), and it is well established that patients treated with BPs are at higher risk of developing osteonecrosis of the jaw (Mavrokokki et al. 2007). Since the treatment of osteonecrosis is very difficult and unpredictable, protective and preventive interventions must be given priority (Fliefel et al. 2015).

Endodontic therapy has not been identified as a significant risk factor for promoting BRONJ and is therefore considered as the favoured alternative to extraction when possible (Marx et al. 2005, Kyrgidis et al. 2010).

A position paper of the American Association of Endodontics (2006) discusses some of the endodontic implications of BRONJ. Important considerations that are emphasized include:

• the importance of thorough history taking of the patient at risk,
• knowing the risk factors of BRONJ, recognizing patients taking I.V. bisphosphonates are at higher risk for developing BRONJ relative to oral bisphosphonates and
• obtaining informed consent for endodontic procedures that should involve a discussion of risks, benefits and alternative treatments with the patient, as well as communication with the health care team, including the patient’s general dentist, oncologist and oral surgeon, when developing treatment plans for these patients.

The low incidence of BRONJ makes it difficult to conduct clinical trials with high level of evidence to allow the establishment of evidence-based guidelines for nonsurgical endodontic treatment in patients treated with BPs. Moinzadeh et al. (2013) has pointed out the possible role of soft tissue damage and extrusion of micro-organisms during root canal instrumentation in the initiation of BRONJ. Therefore, one should try to be as cautious and atraumatic as possible when placing rubber dam and avoid extrusion of micro-organism during NSRCT procedure. In addition, working under aseptic condition was recommended. This could be achieved with a one-minute mouth rinse with chlorhexidine prior to the start of the treatment that would lower the bacterial load of the oral cavity (Cousido et al. 2010) and disinfection of the working tooth as well as the dam by rubbing a disinfecting solution (Peters et al. 2002). Until more evidence is available, it is necessary to be cautious.
whilst performing nonsurgical endodontic treatment on patients medicated with BPs and at risk of developing BRONJ (Moinzadeh et al. 2013). In this case, all these precautions were taken during the NSCRT of multiple teeth to prevent any complication. The perforation repair in tooth 36 gave favourable result as the repair was carried out immediately under aseptic condition.

The poor condition of teeth in this patient may be attributed to the poor quality of tooth-coloured restorations that were placed in exchange of the amalgam fillings. Although the scientific evidence indicates that no significant risks are involved with the use of dental amalgams, it is not uncommon to find cancer patients who believed that mercury exposure can cause increased production of free radicals as free-radical damage to cellular DNA is a primary cause of cancer. It is prudent for the dentists educate the patient that the risks associated with the use of dental amalgam appear to be limited, and the benefits to patients are known to be large. Dental amalgam is much stronger and more durable than alternative restorative materials, and amalgam restorations can be completed at a more reasonable cost. Recent advances, such as the development of amalgam bonding techniques, have made amalgam even more advantageous as a restorative material. Therefore, it does not make sense to replace amalgam fillings simply on the basis of the current questions being asked about possible amalgam toxicity. Replacement may only be considered for individuals who are sensitive to dental amalgam.

Further treatment for this patient includes preventive measures such as reinforcement of oral hygiene, use of fluoride and chlorhexidine rinse to prevent or reduce the potential for tooth extractions because of caries or periodontal conditions. Regular check-ups are necessary for maintain the oral health condition of the patient.

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**CLINICAL MANAGEMENT OF DENS INVAGINATUS (DENS IN DENTE)**

**Dens invaginatus** is a developmental malformation, in which there is an infolding of enamel into dentine. These infolds represent stagnation sites for bacteria and can predispose to dental caries. The carious infection can spread via enamel and dentine to contaminate the pulp and cause soft tissue necrosis. The altered and sometimes complex anatomy of affected teeth can make endodontic management challenging. Early diagnosis is therefore essential as prophylactic treatment of the dens can prevent degeneration and pulpal necrosis. The aim of this article is to review the aetiology, classification, diagnosis and management of teeth affected with dens invaginatus. Emphasis will be placed on describing the clinical features of this anomaly. Treatment options, management strategies and the challenges faced in managing this condition will be discussed.

**LEARNING POINTS/TAKE HOME MESSAGES**

- Provides an overview of the aetiology and classification of dens invaginatus lesions.
- Discusses the clinical features of this anomaly which can lead to early diagnosis.
- Provides an in depth discussion on the treatment options and management strategies for dens invaginatus.
- Reviews the clinical challenges of treating such lesions

**Dens Invaginatus**

Dens invaginatus (DI) is a malformation of teeth probably resulting from an infolding of the dental papilla during tooth development. The affected teeth radiographically show an infolding of enamel and dentine which may extend deep into the pulp cavity and into the root and sometimes even reach the root apex (Figure 1). Tooth crowns as well as roots may exhibit variations in size and form (Hülsmann, 1997). The teeth most affected are maxillary lateral incisors and bilateral occurrence is not uncommon and occurs in 43% of all cases (Grahnen et al. 1959).

Over the years, Dens Invaginatus has been classified by numerous authors (Ulmansky & Hermel 1964, Vincent-Townsend 1974, Schulze & Brand, 1972), the first being Hallet in 1953 who suggested the existence of four types of invagination based on both clinical and radiographic criteria. However, the system described by

Type I: The invagination is minimal and enamel-lined, it is confined within the crown of the tooth and does not extend beyond the level of the external amelo-cemental junction [Figure 1(a)].

Type II: The invagination is enamel-lined and extends into the pulp chamber but remains within the root canal with no communication with the periodontal ligament [Figure 1(b)].

Type IIIA: The invagination extends through the root and communicates laterally with the periodontal ligament space through a pseudo-foramen. There is usually no communication with the pulp, which lies compressed within the root [Figure 1(c)].

Type IIIB: The invagination extends through the root and communicates with the periodontal ligament at the apical foramen. There is usually no communication with the pulp [Figure 1(d)].

Dens invaginatus is clinically significant, as it allows entry of irritants and hence, possibility of the pulp being affected. Due to the tortuous lingual anatomy, it is possible for caries to develop inside the dens invagination without any clinically detectable lesion. Since the enamel lining is thin and in close proximity to the pulp chamber, a carious lesion could easily perforate the pulp chamber. In some cases the epithelial lining is incomplete and channels may also exist between the invagination and the pulp. As a result the possible sequelae could be pulpal necrosis, abscess and cyst formation, internal resorption. Hence, upon radiographic evidence of a dens invaginatus, the apical periodontium should be examined (Hulsmaan 1997, Mupparapu and Singer, 2004).

Several treatment modalities have been described for dens invaginatus depending upon the degree of complexity of its anatomy. They include nonsurgical endodontic treatment, endodontic surgery, intentional replantation, and finally extraction. In cases in which there is an
immature apex, the use of calcium hydroxide inside the root canal has been proposed to stimulate apexification.

Dens invaginatus is a developmental malformation, in which there is an infolding of enamel into dentine. These infold represent stagnation sites for bacteria and can predispose to dental caries. The carious infection can spread via enamel and dentine to contaminate the pulp and cause soft tissue necrosis. The altered and sometimes complex anatomy of affected teeth can make endodontic management challenging. Early diagnosis is therefore essential as prophylactic treatment of the dens can prevent degeneration and pulpal necrosis. The aim of this article is to review the aetiology, classification, diagnosis and management of teeth affected with dens invaginatus. Emphasis will be placed on describing the clinical features of this anomaly. Treatment options, management strategies and the challenges faced in managing this condition will be discussed.

Case report

22 year old Malay gentlemen presented at the clinic with complain of on and off pain and swelling in upper labial area (Figure 2). Pain & swelling started over a year ago. He went to a dentist and root canal treatment was commenced in late 2012 but symptoms never went away. Patient bought over the counter antibiotics for every swelling episode. He has had at least 6 episodes of swelling and has been self-medicating.

On examination, 22 was a peg shaped lateral incisor with presence of temporary filling on the palatal and tender to percussion. Radiographic examination showed a large periapical radiolucency measuring 3mm x 4mm (Figure 3) and two canals on 22 noted with one canal partially filled with radiopaque intracanal materials. A small FOV CBCT showed loss of buccal plate on the 22 due to the lesion and it also showed that the access cavity coincides with the palatal canal but not the buccal, showing that only one canal has been located, and the periapical lesion has perforated the buccal plate (Figure 4).

From the axial view of the CBCT (Figure 5), it can be confirmed that 22 had malformation Type IIIB dens invaginatus with a C shaped palatal root (Figure 6). The coronal view of the curved slicing of maxillary anterior teeth further confirmed that there is 2 canals noted in 22 and in 12 there is presence of a deep pit on 12 coinciding with dens invaginatus, outline by the red circle (Figure 7) proving that dens invaginatus cases are usually bilateral. However, there is only one canal noted for 12. Sagittal view of 12 showed clearly the invagination of enamel its the palatal surface (Figure 8).
Treatment:

Root canal treatment of 22 was commenced under magnification. After a lengthy discussion with patient, patient opts to not restore the peg shaped maxillary lateral incisors, he preferred to leave it as it is. His only concern was the repetitive infection he had to endure. Upon removal of the temporary filling material on the palatal of the 22, only one canal was located which was the palatal canal. The palatal canal was C-shaped.

The access cavity was refined and magnification was used to locate the buccal canal noted on the pre-operative radiographs. The aid of ultrasonic instrumentation helped in locating the buccal canal. Once the buccal canal was located, working length (WL) determination was done using the RootZX apex locator (Morita, Japan) and the readings were noted. Buccal: 19.0mm, palatal: 18.0mm with the incisal edge as the reference point (Figure 9).

Canals were shaped using Rotary ProTaper up to F2. The C-shaped palatal canal was shaped as two separate canals followed by bucco-lingual brushing using the master apical file (MAF). Copious irrigation with 5.25% sodium hypochlorite followed by each instrumentation. Non setting calcium hydroxide was used as intracanal medicament and IRM was used to seal the canals. Copious irrigation with 5.25% sodium hypochlorite (activated irrigation used with the ultrasonic machine) followed with EDTA irrigation left to stand for one minute. Final activated irrigation with sodium hypochlorite ensued. Canals were obturated using warm vertical technique with customised master cone GP’s. Two GP’s were placed in the C-shaped canal as the canal was shaped as two separate canals [Figure 10(a&b)]. Possibility of internal resorption noted on the buccal canal as irregularities in obturation was noted in the radiographs [Figure 10(b)]. Extrusion of sealer and GP noted. At six month review, periapical lesion has reduced in size and the extruded GP and sealer have migrated apically [Figure 10 (c)].

In this case, the 22 is of dens invaginatus (DI) Type IIIB which means the invagination extends through the root and communicates with the periodontal ligament at the apical foramen. There is usually no communication with the pulp which is shown on the pre-operative radiograph. The c shaped palatal canal is the invagination while the buccal canal is the true canal of the 22. The two canals do not communicate. As to date only two case reports of a similar case has been published which is of Dens Invaginatus type III with C-shaped canal of the maxillary lateral incisors (Boveda et al., 1999, Riley & Dryden, 2012)

Because of the complex and partially unknown anatomic configuration of the dens invaginatus teeth, nonsurgical root canal treatment becomes difficult and problematic. In this case the use of CBCT and operating microscope proved to be of advantage because the CBCT help the operator visualise the true anatomy of the 22 and the dental operating microscope improved visualization and magnification enhancing the operator’s view of the canals.

The tooth is showing good periapical healing and the operator is hopeful the prognosis will get better in time. The patient was informed that the prognosis was guarded due to the complex anatomy of the tooth. But with the help of activated irrigation and warm vertical obturation technique, the operator is very hopeful that the treatment would be a success. Nevertheless, patient will be reviewed continuously for monitoring.
It is documented by Grahnen et al. (1959) that occurrence of bilateral DI is not uncommon, so, the 12 was also observed during the treatment period. It was noted that the 12 has DI Type I, which means the invagination is minimal and enamel-lined; it is confined within the crown of the tooth and does not extend beyond the level of the external amelo-cemental junction. This can be observed in the coronal and sagittal view on the CBCT of 12 (Figure 7 & 8). The tooth will be closely monitored to prevent any periapical pathology.

Extruded GP and sealer were noted during the obturation and at 6 month review the extruded materials were seen to have migrated apically and reduced lightly in size. Observations by clinicians have revealed that material extruded into periapical tissues disappears over time. Langeland (1974) pointed out that since sealers contact vital tissues connected with the circulatory system, they have an avenue of distribution via the blood and lymphatic vessels and that extruded sealer was removed from the site of application via the lymphatic system.

Orstavik and Mjor (1988) implanted polyethylene tubes filled with sealers into rat subcutaneous tissues. In the Procosol samples, sealer particles were found in some vessel walls and in macrophages. These studies provide plausible evidence of a mechanism for removal and distribution of extruded sealer by blood and lymph and by macrophages. Augsburger & Peter (1990) noted that the radiographic disappearance of material extruded beyond the root is a function of time and the amount of material extruded. Extruded material did not prevent radiographic repair of radiolucent lesions which in this case the extrusion of the GP and sealer would not be a major setback in periapical healing of the 22.

Patient is extremely happy with the outcome even though he has refused extracoronal restorations to improve the aesthetics of the peg shaped maxillary lateral incisors. This is because he no longer experience episodes of pain and swelling and to date has been pain free.

Although the endodontic prognosis of the 22 is guarded, the tooth being aesthetic and functional achieves the goals of therapy set by the patient. In conclusion, the patient’s complaint was addressed and his wish to leave the peg shaped laterals alone, which was respected.

References:
My macroscopic view on a few microscopic myths...

About the author

Dr. Reuben Joseph has done his Masters in Endodontics & Restorative Dentistry. He runs a practice in India limited to Micro-Endodontics and Restorative Dentistry.

Do you wonder if you really require a microscope for your day to day endodontic practice and how it can fit into your practice? Let’s bust a few myths.

The eyes don’t see what the mind doesn’t know

True, but the mind can’t perceive what the eyes can’t see. Neither can the hands do anything about what the eyes don’t see. Hence the magnification and the co-axial illumination of a microscope is always a bonus.

Is bigger better?

That is a very untrue statement as most procedures are carried out at lower magnification when the field of view (FOV) is more. Microscopic endodontics is 50% about magnification and 50% ergonomics.

It is really a hard learning curve?

Like mastering any new skill, it will be a bumpy ride initially. With conviction the microscope will eventually become an extension of your vision. So if you decide to take this ride, go all the way. This is where most dentists fall out and become ‘occasional peepers’ than to be ‘absolute users’ of the scope.

Microscope is only for certain endodontic procedures

False again, as a clinician you must train to perform all endodontic procedures from start to stop under the microscope. Learn to use a microscope the right way, trust me it is totally worth it.

Can I buy my microscope straight off the rack?

No, it is not recommended. Everyone’s needs differ and there is a very high chance you will end up with what is inappropriate. Research and always consult with peers and colleagues who have prior experience. A formal course by a reputed trainer will help you decide what is ideal for you.

I use a microscope but I do not use rubber dam isolation for all my routine endo, I think that’s ok.

Rubber dams are standard for endodontic care. Looking at things on a microscopic level and allowing macroscopic contamination in the form of saliva during the procedure is pointless. Additionally, an isolated environment free from interference from the tongue and other associated oral structures including mirror fogging makes things easy.

I have a busy practice. Will using a microscope slow me down?

Once a microscope centred operatory has been set up and the assistants have been trained well, the work flow becomes seamless. In fact, it will be possible to do more in the stipulated time as you do not move more than your elbow to access things. Another way of looking at it is, even if it slows you a bit, the results you can achieve with micro-endodontics is far superior and worth those extra minutes.

Would Dr. Reuben Joseph mind answering another question or two?

Certainly not and it would be my at most pleasure to answer them. Feel free to mail me at thirty2intact@yahoo.com for any professional queries.
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