Clinical Guidelines for Endodontics

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Health Policies and Standards Department

Health Regulation Sector (2025)

ACKNOWLEDGMENT

This document was developed by Dental Services Department, Primary Healthcare Services Sector (PHCSS). It has further been reviewed by the Health Policy and Standards Department (HPSD), HRS. HRS would like to acknowledge and thank all parties that participated and worked toward developing these guidelines to ensure improving the quality and safety of healthcare services.

Health Regulation Sector

Dubai Health Authority

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INTRODUCTION

Health Regulation Sector (HRS) forms an integral part of Dubai Health Authority (DHA) and is mandated by DHA Law No. (6) of 2018 to undertake several functions including but not limited to:

- Developing regulations, policies, standards and guidelines to improve quality and patient safety and promote the growth and development of the health sector;
- Licensure and inspection of health facilities as well as healthcare professionals and ensuring compliance to best practice.
- Managing patient complaints and assuring patient and physician rights are upheld.
- Governing the use of narcotics, controlled and semi-controlled medications.
- Strengthening health tourism and assuring ongoing growth.
- Assuring management of health informatics, e-health and promoting innovation.

The Clinical Guidelines for Endodontics aims to fulfil the following overarching DHA Strategic Priorities (2022-2026):

- Pioneering Human-centered health system to promote trust, safety, quality and care for patients and their families.
- Make Dubai a lighthouse for healthcare governance, integration and regulation.
- Foster healthcare education, research and innovation.
- Strengthening the economic contribution of the health sector, including health tourism to support Dubai economy.

EXECUTIVE SUMMARY

Clinical guidelines to enhance the standard of care in health facilities are increasingly becoming part of current practice and will become more common over the next decade. These Clinical Guidelines aim to improve the quality and the level of healthcare provided to the clients. Healthcare providers can use these guidelines to answer specific questions in day-to-day practice and as an information source for continuing professional education.

This document presents a framework for Endodontists:

- To increase the awareness among the dental practitioners regarding the importance of case documentation and obtaining an informed consent prior to Endodontic/dental treatment.
- To assist General Dentists and Dental Specialists to facilitate proper antibiotic prescription in DHA licensed Health Facilities and give them an overview of the topic of antibiotic prescription in endodontics, in order to achieve successful results.
- To assist dentists to facilitate successful use of Cone Beam Computed Tomography (CBCT) in endodontics in order to achieve effective results.
- To assist dentists to effectively facilitate and successfully assess difficult cases
- To assist dentists to facilitate successful and efficient management in relation to Root Canal Treatment (RCT) with the use of Rubber Dam isolation ensuring consistent, as well as more effective dental care.

- To provide an overview on which instruments are to be used and when during Root Canal Treatment, to ensure improved success rate and treatment outcome.
- To present a framework to dentists to adopt current international best practice in root canal irrigation, in the best interest of the patient.
- To assist dentists to facilitate successful obturation in Root Canal Treatment (RCT).
- To assist dentists to facilitate the management of immature teeth.
- To assist dentists to facilitate a successful management of immediate and urgent care of Traumatic Dental Injuries (TDIs).
- To assist dentists to facilitate successful Non-Surgical Endodontic Re-Treatment.
- To assist dentists to facilitate a successful management of endodontic mishaps.
- To provide dentists an overview of the topic of endodontic surgery, to assist them make informed choices in root canal preparation, in order to achieve successful results.
- To assist dentists to facilitate successful management of root resorption.
- To assist in making informed choices in management of tooth discoloration, in order to achieve successful bleaching results.
- To assist dentists to facilitate a successful Endodontic Temporization.
- To facilitate a successful management of a treated wrong tooth.
- To assist dentists to facilitate successful management of ingested instruments.

The Clinical Guidelines for Endodontics aims to fulfil the following overarching DHA Strategic Priorities (2022-2026):

- Pioneering Human-centered health system to promote trust, safety, quality and care for patients and their families.
- Make Dubai a lighthouse for healthcare governance, integration and regulation.
- Pioneering prevention efforts against non-communicable diseases.
- Strengthening the economic contribution of the health sector, including health tourism to support Dubai economy.

DEFINITIONS

Acute apical abscess: is an inflammatory reaction to pulpal infection and necrosis characterized by rapid onset, spontaneous pain, tenderness of the tooth to pressure, pus formation and swelling of associated tissues There may be no radiographic signs and the patient often experiences fever, malaise, and lymphadenopathy.

Asymptomatic apical periodontitis: is inflammation and destruction of apical periodontium that is of pulpal origin, appears as an apical radiolucent area, and does not produce clinical symptoms; i.e. no pain on percussion or palpation.

Asymptomatic irreversible pulpitis: is a clinical diagnosis based on subjective and objective findings indicating that the vital inflamed pulp is incapable of healing. Additional descriptors: No clinical symptoms but inflammation produced by caries, caries excavation, trauma, etc.

Case assessment: is to assign a level of endodontic case difficulty to a particular case by the dental practitioner with the help of an assessment form.

Chronic apical abscess: is an inflammatory reaction to pulpal infection and necrosis characterized by gradual onset, little or no discomfort, and the intermittent discharge of pus through an associated sinus tract. Radiographically, typical signs of osseous destruction such as a radiolucency. A gutta percha cone is carefully placed through the opening of the sinus tract until it stops, then a radiograph is taken, in order to identify exactly the source.

Condensing Osteitis: is a diffuse radiopaque lesion representing a localized bony reaction to a low-grade inflammatory stimulus, usually seen at apex of tooth.

Double Seal: is a restoration placed in combination to provide an improved seal is called double seal. The combination seems likely to overcome the disadvantages of each while utilizing their advantages. The double seal functions in the following manner:

- The inner layer of Cavit has good marginal seal and prevents leakage into the root canal system if it has been able to penetrate the IRM/GIC margins.
- The outer layer of IRM or GI is stronger, antibacterial and more wear resistant.

Informed consent: is the permission granted in full knowledge of the possible consequences, typically that which is given by a patient to a doctor for treatment with knowledge of the possible risks and benefits.

Interim Restoration: is a term used to describe a restoration that has been placed in a tooth after the previous restoration and/or caries has been removed at the commencement of endodontic treatment (i.e.) after pulpotomy or pulpectomy and prior to referral to the endodontist. Such a restoration will remain in place while the endodontic treatment is being performed, and after the root canal filling is completed until the definitive coronal restoration is placed.

Normal apical tissue: normal periradicular tissue that is not sensitive

Normal pulp: is a clinical diagnostic category in which the pulp is symptom-free and normally responsive to pulp testing.

Previously initiated therapy: is a clinical diagnostic category indicating that the tooth has been previously treated by partial endodontic therapy (e.g., pulpotomy, pulpectomy. The tooth may or may not respond to pulp testing modality.

Previously treated tooth: is a clinical diagnostic category indicating that the tooth has been endodontically treated and the canals are obturated with various filling materials other than intracanal medicaments. The tooth does not respond to thermal or electric pulp testing.

Pulp necrosis: is a clinical diagnostic category indicating death of the dental pulp. The pulp is usually nonresponsive to pulp testing.

Reversible pulpitis: is a clinical diagnosis based upon subjective and objective findings indicating that the inflammation should resolve and the pulp return to normal.

Root Resorption: is dissolution of tooth root; either external, with loss or blunting of apical portion, or internal, with loss of dentin from inside (pulpal) part of root area.

Symptomatic apical periodontitis: is inflammation, usually of the apical periodontium, producing clinical symptoms including a painful response to biting and/or percussion or palpation. It may or may not be associated with an apical

radiolucent area. Severe pain to percussion and/or palpation is highly indicative of a degenerating pulp and root canal treatment is needed.

Symptomatic irreversible pulpitis: is a clinical diagnosis based on subjective and objective findings indicating that the vital inflamed pulp is incapable of healing. Additional descriptors: Lingering thermal pain, spontaneous pain, referred pain.

Temporary/Provisional Restoration: is a term used to describe a restoration placed within an endodontic access cavity; such a cavity is likely to have been cut through an interim restoration. This restoration remains for a shorter time than the interim restoration.

Tooth whitening: is a very conservative and economical modality of aesthetic treatment of endodontically treated teeth.

ABBREVIATIONS

3D	:	Three Dimensional
AAE	:	American Association of Endodontists
ALARA	:	As Low As Reasonably Achievable
ADA	:	American Dental Association
ASA	:	American Society of Anesthesiologists
BMI	:	Body Mass Index
$Ca(OH)_2$	:	Calcium Hydroxide
CDT	:	Current Dental Terminology
CEJ	:	Cemento Enamel Junction
CHX	:	Chlorhexidine digluconate
CNS	:	Central Nervous System
CPC	:	Clinical Privileging Committee
DHA	:	Dubai Health Authority
DHIC	:	Dubai Health Insurance Corporation
EAL	:	Electronic Apex Locator
EDTA	:	Ethylenediaminetetraacetic Acid
EIR	:	External Inflammatory Resorption
ERR	:	External Replacement Resorption
GA	:	General Anaesthesia
GIC	:	Glass Ionomer Cement
H_2O_2	:	Hydrogen Peroxide

HPSD	:	Health Policies and Standards Department
HRS	:	Health Regulation Sector
IIR	:	Internal Inflammatory Resorption
IRM	:	Intermediate Restorative material
IRR	:	Internal Replacement Root Resorption
ISR	:	Internal Surface Resorption
MTA	:	Mineral Trioxide Aggregate
NaOCl	:	Sodium hypochlorite
OPG	:	Orthopantomograph
PHCSS	:	Primary Healthcare Services Sector
RCT	:	Root Canal Treatment
TDIs	:	Traumatic Dental Injuries
UAE	:	United Arab Emirates

A. GUIDELINES FOR INFORMED CONSENT AND HEALTH RECORDS IN ENDODONTICS

1. BACKGROUND

Conforming to applicable standards of care in the performance of procedures alone does not prevent the endodontist or the general dental practitioner from being subjected to a claim by the patient for an untoward result. Failure to inform the patient of the risk of an unfavourable result prior to a procedure will just as likely result in a claim by the patient for failing to obtain his/her consent. As a general rule, informed consent is satisfied after the practitioner has discussed with his or her patient all relevant information pertaining to a proposed procedure to assist the patient in making an informed decision.

The dentist has an obligation to document the clinical and radiographic findings of the case that led to the diagnosis. The health record may consist of several different elements, which include written notes, radiographs, study models, referral letters, consultants' reports, clinical photographs, results of special investigations, drug prescriptions, laboratory prescriptions, patient identification information and a comprehensive medical history. This is a large amount of information, and it is essential that a practitioner maintains this in an easily accessible manner.

There are many cases that do not fit the recognized patterns and are difficult to diagnose. In these cases, the dentist should still apply the principles, document the findings, and refer as needed. Thus, while the correct diagnosis may not be reached in every case, but the clinical evaluation must always be performed and documented in accordance with the standards of prudent dental care. The health

records are the proof of what took place during the treatment and must describe what was performed in detail. The health records must also document cases in which referral to a consultant/specialist was offered to the patient and the patient declined to take advantage of this offer. Finally, the records must document the consent of the patient to receive treatment after all available options were discussed and instances when the patient was informed of special risks and potential complications. In endodontic treatment, it is important to remember that the obturation is not the completion of the treatment. Prompt, adequate restoration, referral to a specialist if required and follow-up, which can extend up to 2 to 4 years after the obturation, are all necessary to ensure the success of treatment.

2. SCOPE

2.1. To identify the minimum requirements for all Endodontists and general dental practitioners to maintain health records in a standardised manner and to obtain informed consents prior to root canal treatment/re-treatment.

3. PURPOSE

3.1. To increase the awareness among the dental practitioners regarding the importance of case documentation and treatment records.

3.2. To ensure that the health records are maintained in a standardised manner.

3.3. To increase the awareness among the dental practitioners regarding the importance of informed consent and its documentation.

3.4. To ensure a standardized Informed consent process and form.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. **RECOMMENDATION ONE**: INFORMED CONSENT

5.1. The endodontist must ensure the following:

5.1.1. Share the diagnosis of the existing condition with the patient in a manner that is readily understood by the patient.

5.1.2. Inform the patient about the choice of "no treatment" as an alternative to every treatment or procedure and also the likely results of it.

5.1.3. Discuss the proposed procedure and alternatives and prognosis in a language and terminologies understandable by each individual patient.

5.1.4. Share details of the case with the patient.

5.1.5. Encourage the patient to ask questions regarding the treatment or alternatives.

5.2. A written consent form, while imperative for accurate record keeping, cannot be used as a substitute for a thoughtful, well documented dialogue between the doctor and the patient can reduce misunderstandings and incidence of claims and suits alleging a lack of informed consent.

5.3. The administrative staff does not have the power to obtain consent.

5.4. The informed consent form must be signed and dated by the patient (legal guardian if under 18 years of age) and should be signed and dated by the practitioner as testimony to the fact that the endodontist did discuss the

elements of the consent form. The signature of a witness is also recommended.

5.5. It is important to note that the informed consent is limited to the procedures discussed and is not open ended. Therefore, informed consent should be thought of as an ongoing process that may have to be modified if procedures change (i.e., nonsurgical to surgical unexpected results, or procedural mishaps).

5.6. The informed consent should have the following elements:

5.6.1. Date and time of the consent process.

5.6.2. A statement that the patient was given the opportunity to question the dentist regarding treatment or alternatives.

5.6.3. Space for signatures by the patient, parent or guardian, the provider, and a witness.

Note:

- Refer to **Appendix 1** for a sample of the Informed Consent.
- Refer and align with DHA Guidelines for Patient Consent.

6. **RECOMMENDATION TWO**: HEALTH RECORDS

6.1. The patient Health records should include the following:

6.1.1. Chief complaint(s) in the patient's own words.

6.1.2. Current medical and dental history.

6.1.3. Results of diagnostic tests and clinical examination.

6.1.4. Clinical impressions based on subjective and objective evaluations.

6.1.5. Pulpal and periradicular diagnoses and treatment recommendations.

6.1.6. Description of treatment rendered, including pulpal status upon entry.

6.1.7. Prognosis as reported to the patient.

6.1.8. Recommendations for tooth restoration.

6.1.9. Preoperative, appropriate working, postoperative and follow-up radiographic examination.

6.1.10. Record of prescriptions and consultation.

Note: Refer to and align with DHA Guidelines for Managing Health Records.

B. GUIDELINES FOR THE USE OF ANTIBIOTICS IN ENDODONTICS

1. BACKGROUND

Current publications lay emphasis on the alarming resistance of bacteria to the antibiotics, highlighting the objective of reducing unnecessary antibiotic use. Ever since antibiotics were discovered in 1928, they have been of a great advantage to the humanity in fighting bacterial infections and overcoming many diseases. However, misuse or overuse of antibiotics can lead to serious downsides including bacterial resistance which results in patients not responding to the treatment when needed, hence increased morbidity and mortality.

The presentation of endodontic infections varies between being asymptomatic to life threatening. As a common practice, antibiotics are often prescribed indiscriminately to manage endodontic emergencies.

2. SCOPE

2.1. To ensure DHA licensed Endodontists make informed choices in prescribing antibiotics in order to achieve effective results.

3. PURPOSE

3.1. To increase the awareness and knowledge among DHA licensed dentist on the appropriate use of antibiotics to ensure effective but safe practices.

3.2. Reduce overuse and misuse of antibiotics.

3.3. To ensure patient receive standardized care.

4. APPLICABILITY

4.1. DHA licensed Endodontist.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: ANTIBIOTICS AND DRUG-RESISTANT BACTERIA

5.1. Administration of systemic antibiotics alone without a local procedure such as pulpotomy or incision and drainage is not recommended in treating localized endodontic infections or in treating asymptomatic infected teeth.

5.2. It is prudent to outweigh the benefits of antibiotic treatment with the risks of side effects of the same treatment when making the decision of treating an endodontic infection.

5.3. Antibiotics may have adverse effects by altering the normal flora.

5.4. A major side effect is bacterial resistance to antibiotics e.g. acquired resistance of Staphylococcus aureus to multiple antibiotics.

5.5. Resistant genes could be transferred vertically to all daughter cells or horizontally to other strains of bacteria by transduction, transformation and conjugation, which means strains of bacteria that were never exposed to the antibiotic may acquire resistance. This occurs when a low dose of an antibiotic is administered, when antibiotics are taken for long periods of time, through noncompliance by patients, or inappropriate prescriptions. Increase in antimicrobial resistance is highly related to antimicrobial utilization.

6. **RECOMMENDATION TWO:** INDICATIONS FOR SYSTEMIC ANTIBIOTICS IN ENDODONTICS

6.1. Adjunctive systemic antibiotic treatment in conjunction with endodontic therapy is indicated in the following settings:

6.1.11. Medically compromised patients with acute apical abscess.

6.1.12. Acute apical abscess with systemic involvement such as (localized fluctuant swellings, elevated body temperature >38°C, malaise, lymphadenopathy and trismus.

6.1.13. Progressive infections (rapid onset of severe infection in <24 h, cellulitis or a spreading infection, osteomyelitis) where onward referral to oral surgeons may be necessary.

6.1.14. Replantation of permanent avulsed teeth. In these cases, topical administration of antibiotics may also be indicated.

6.1.15. Soft tissue trauma requiring treatment such as sutures and debridement.

7. **RECOMMENDATION THREE:** CONTRA- INDICATIONS FOR SYSTEMIC ANTIBIOTICS IN ENDODONTICS

7.1. Most endodontic infections are confined within the tooth and can be well managed by establishing local operative treatment, drainage or tooth extraction without the necessity of using local or systemic antibiotics.

7.2. Thus, adjunctive systemic antibiotic treatment during endodontic therapy is not indicated in the following:

7.2.1. Symptomatic irreversible pulpitis, with no other sign of infection and symptoms.

7.2.2. Necrosis of the pulp

7.2.3. Symptomatic apical periodontitis with pain on percussion and biting and widening of periodontal ligament space.

7.2.4. Chronic apical abscess teeth with periapical radiolucency and sinus tract.

7.2.5. Acute apical abscess with localized fluctuant swellings and no systemic involvement.

7.2.6. From current knowledge, antibiotic use is not indicated in the treatment of fractures, concussion, subluxation, luxation injuries and extrusion of the tooth.

8. **RECOMMENDATION FOUR:** MANAGEMENT OF ENDODONTIC INFECTIONS

8.1. The objective of endodontic treatment is to remove microbes, their by-products and pulpal debris from the infected root canal system to establish a favourable condition for the periradicular inflammation to resolve.

8.2. Effective removal of infection from the root canal system is achieved by appropriate endodontic treatment, which typically includes chemo-mechanical debridement of the root canal system in aseptic conditions, using rubber dam isolation to demote microbial contamination to obtain successful outcomes.

8.3. In case of symptomatic severe endodontic infection where endodontic treatment is provided and intracanal medication is placed, the access opening should be sealed to prevent coronal leakage of bacteria from the oral cavity.

8.4. Swellings associated with cellulitis should be managed by incision and drainage and adjunctive antibiotics.

8.5. Systemic antibiotics are recommended along with local procedures in cases of systemic involvement of endodontic infections. They are also recommended prophylactically in susceptible cases to cardiac infection such as endocarditis, or in immunocompromised patients. The various antibiotics prescribed for endodontic infections are elaborated in **Appendix 2**.

9. **RECOMMENDATION FIVE:** ANTIBIOTIC PROPHYLAXIS FOR MEDICALLY AT-RISK PATIENTS

9.1. The principle indication for antibiotic prophylaxis for dental patients is the prevention of infective endocarditis in patients with specific medical conditions that are receiving specified dental treatments. Indications include dental patients with complex congenital heart defects, orthopaedic prosthetic devices, prosthetic cardiac valves, indwelling catheters and impaired (immunosuppressed) host defences.

9.2. Antibiotic prophylaxis is also indicated in patients whose jawbones are exposed to high-dose irradiation for cancer treatment in the head and neck.

9.3. Patients receiving intravenous bisphosphonate treatment warrant antibiotic prophylaxis in bone invasive procedures, such as endodontic surgery. For Further details refer to **Appendix 3.**

10. RECOMMENDATION SIX: PRESCRIPTION OF ANTIBIOTIC

10.1. Antibiotics should be prescribed at the correct duration, frequency and dose so that minimal inhibitory concentration is exceeded and so that the side effects and the selection of resistant bacteria are avoided.

10.2. First line of treatment.

10.2.1. Penicillin VK and amoxicillin, both beta-lactam antibiotics, are the first line of antibiotics chosen as adjunct therapeutic agents in endodontics. If symptoms are not improved after endodontic debridement and/or drainage, amoxicillin may be combined with clavulanic acid (125 mg bid or tid), (a beta-lactamase inhibitor that increases the susceptibility of Penicillin resistant strains).

a. Dose:

I. Penicillin VK A loading dose of 1,000 mg followed by 500 mg every four to six hours for 3-7 days.

II. Amoxicillin 500 mg three times a day (with or without a loading dose of 1,000 mg) for 3-7 days.

b. If allergic to penicillin:

I. Clindamycin is the first drug of choice for patients with a history of hypersensitivity to penicillin drugs.

II. Dose: clindamycin 600 mg as a loading dose followed by 300 mg every 6 hours for 3-7 days.

10.2.2. Metronidazole - A synthetic antibiotic with bactericidal activity against obligate anaerobes to be used along with penicillin or clindamycin.

a. Dose:

I. Metronidazole 1,000 mg loading dose followed by 500 mg every six hours for 5-7 days.

C. GUIDELINES FOR USE OF CONE BEAM COMPUTED TOMOGRAPHY (CBCT) IN ENDODONTICS

BACKGROUND

Magnification and radiographic imaging are integral to the performance of modern endodontics. Advancements in these areas have helped endodontists save more teeth as well as identify when a tooth cannot be saved. The ultimate decision to use a particular diagnostic tool or perform a specific procedure must be made by the clinician in light of all the circumstances, including the clinician's training and experience, the condition and preferences of the patient and available resources.

Dental Cone Beam Computed Tomography (CBCT) is a special type of x-ray equipment used when regular dental or facial x-rays are not sufficient. A dentist may use this technology to produce three dimensional (3D) images of teeth, soft tissues, nerve pathways and bone in a single scan.

1. SCOPE

1.1. Guide DHA licensed Endodontists with evidence-based criteria on the use of CBCT in Endodontics.

2. PURPOSE

2.1. To standardize decision making process when the dentist encounters a situation requiring the use of CBCT in endodontics.

2.2. To decrease number of unnecessary temporary fillings and multiple visits for the same treatment and hence saving both physicians' and patients' time.

2.3. Improve diagnostic accuracy.

2.4. Optimize treatment planning and construct an efficient and individualized plan for each patient.

2.5. Achieve patient's satisfaction by providing the accurate indicated treatment.

2.6. Increase patient confidence and satisfaction with the service.

3. APPLICABILITY

3.1. DHA licensed Endodontists.

4. RECOMMENDATION ONE: INDICATIONS FOR CBCT

4.1. CBCT is indicated for the following:

4.1.1. Diagnosis of radiographic signs of periapical pathosis when there are contradictory (nonspecific) signs and/or symptoms.

4.1.2. Confirmation of non-odontogenic causes of pathosis.

4.1.3. Assessment and/or management of complex dento-alveolar trauma, such as severe luxation injuries, suspected fracture of the overlying alveolar complex and horizontal root fractures, which may not be readily evaluated with conventional radiographic views.

4.1.4. Appreciation of extremely complex root canal systems prior to endodontic management (for example, class III & IV dens invaginatus).

4.1.5. Assessment of extremely complex root canal anatomy in teeth treatment planned for nonsurgical endodontic re-treatment.

4.1.6. Assessment of endodontic treatment complications (for example, post- perforations) for treatment planning purposes when existing conventional radiographic views have yielded insufficient information.

4.1.7. Assessment and/or management of root resorption, which clinically appears to be potentially amenable to treatment.

5. **RECOMMENDATION TWO:** CLINICAL STAGES

5.1. Review medical history, physical evaluation when appropriate, discussion of patient's goals and expectations for long-term function.

5.2. A CBCT scan may only be considered after a comprehensive clinical examination has been carried out and appropriate conventional radiographs have been taken and assessed.

5.3. Refer indicated cases for CBCT imaging followed by proper assessment and interpretation for accurate diagnosis and optimal treatment planning.

6. **RECOMMENDATION THREE:** SPECIAL CONSIDERATIONS

6.1. As with any device emitting ionizing radiation, the benefits of the CBCT scan must outweigh the risks. This is particularly important in children and adolescents who are more radiosensitive to the potential effects of ionizing radiation. The ALARA principle "as low as reasonably achievable" has to be considered in all cases.

6.2. A request for a CBCT scan should only be considered if the additional information from reconstructed 3D images will potentially aid formulating a diagnosis and/or enhance the management of a tooth with an endodontic problem(s).

6.3. Patient's health and acceptance.

7. **RECOMMENDATION FOUR:** SPECIAL ENDORSEMENTS

7.1. CBCT should be used if there are clear benefits for diagnosis and treatment, including follow up.

7.2. Increase awareness regarding the use CBCT in Endodontics.

7.3. About half of clinicians who referred their patients for CBCT imaging changed their treatment plan. Thirty percent (30%) of practitioners chose to act instead of monitoring and extracted more teeth after viewing the images.

7.4. It has been suggested that dentists conceive of periapical disease or health on a sliding scale and lean towards retreatment when the radiolucency becomes medium in size.

7.5. Teeth can appear flush-filled and healed on the periapical area but may display an over-filled obturation with a widened periodontal ligament on the CBCT. However, an argument could be made that, in some cases, non-intervention and radiographic monitoring is still a good option.

7.6. CBCT may become standard of care for some therapies, but it is not necessary for every Root Canal Treatment (RCT). CBCT is not a general

screening tool. Doctors can be sued for not ordering a scan that would have circumvented injuries. They can also land in court for not documenting informed refusal. In most cases, it is not enough to talk about it; when in doubt, write it out.

D. GUIDELINES FOR CLEANING AND SHAPING ROOT CANALS

1. BACKGROUND

1.1. In order to improve the success rate of Root Canal Treatment (RCT) in general dental practice, the referral of difficult cases to dentists with advanced knowledge and training in endodontics should be made possible for the benefit of patients.

1.2. In order to be able to refer patients with complex endodontic problems, at least two (2) requirements should be met, as follows:

1.2.1. A sufficient number of endodontists must be available to handle the demand for specialist endodontic care.

1.2.2. General dentists must be able to judge the difficulty of treatment required.

1.3. The American Association of Endodontists (AAE) has published a form, which describes seventeen (17) areas that should be assessed when evaluating the potential difficulty of an endodontic situation **Appendix 4**.

1.4. The assessment form makes case selection more efficient, more consistent and easier to document. Dentists may also choose to use the assessment form to help with referral decision making and record keeping.

2. SCOPE

2.1. Provide DHA licensed Endodontists with an overview of the topic of case difficulty assessment in endodontics.

3. PURPOSE

3.1. Standardize decision-making process for assessing case difficulty and refer the endodontic case.

3.2. Decrease number of mishaps which might happen due to lack of knowledge.

3.3. To assist dental practitioners with documentation and decision making regarding referral.

3.4. Improve the success rate of RCT in general dental practice, by referring the difficult cases to Endodontist with advanced knowledge, training and experience in the subject.

3.5. Increase patient confidence and satisfaction with the service.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: LEVELS OF DIFFICULTY

5.1. The assessment form enables a practitioner to assign a level of difficulty to a particular case. The levels of case difficulty could be categorised as follows:

5.1.1. Minimal Difficulty: Preoperative condition indicates routine complexity (uncomplicated). These types of cases would exhibit only those factors listed in the minimal difficulty category.

Achieving a predictable treatment outcome should be attainable by a competent practitioner with limited experience.

5.1.2. Moderate Difficulty: Preoperative condition is complicated, exhibiting one or more patient or treatment factors listed in the moderate difficulty category. Achieving a predictable treatment outcome will be challenging for a competent, experienced practitioner.

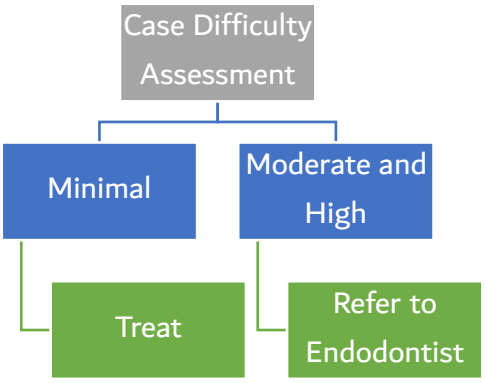
5.1.3. High Difficulty: Preoperative condition is exceptionally complicated, exhibiting several factors listed in the moderate difficulty category or at least one in the high difficulty category. Achieving a predictable treatment outcome will be challenging for even the most experienced practitioner with an extensive history of favourable outcomes. Review your assessment of each case to determine the level of difficulty. If the level of difficulty exceeds your experience and skill level, you might consider referral to an endodontist

6. **RECOMMENDATION TWO:** SPECIAL ENDORSEMENTS

6.1. Assess each case separately, for its difficulty.

6.2. Treat each case within the level of experience.

6.3. Refer the cases beyond ability in order to reduce the iatrogenic errors which might happen due to lack of knowledge or sufficient experience.


Case Difficulty Assessment
Minimal
Moderate and High
Treat
Refer to Endodontist

E. GUIDELINES FOR RUBBER DAM ISOLATION

1. BACKGROUND

Tooth isolation using the dental rubber dam is considered the standard of care during non-surgical Root Canal Treatment (RCT). RCT without rubber dam has a negative impact on the treatment outcome.

The rubber dam usage during non-surgical RCT serves many benefits:

- It protects the patient against possible aspiration of instruments, restorative materials, or tooth particles.
- It improves visibility by providing some degree of soft tissue retraction.
- It provides clean, dry, disinfected operating field by sealing away the saliva and blood.
- It protects the adjacent soft tissue from the irritating effects of the irrigating solutions and medications used during treatment.

2. SCOPE

2.1. Provide DHA licensed Endodontists an overview of implementing proper isolation with a dental rubber dam during RCT.

3. PURPOSE

3.1. To guide the dentist on the proper isolation technique of teeth during RCT.

3.2. To reduce unfortunate incidents resulting from lack of proper isolation during RCT.

3.3. To avoid medico legal issues as a consequence of lack of standard of care.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: TECHNIQUES FOR RUBBER DAM APPLICATION

5.1. Single motion technique

5.1.1. The most efficient technique of application through the use of winged clamps resulting in the clamp, dam, and frame being applied to the tooth in a single motion.

5.2. Double motion technique

5.2.1. It is also an efficient technique of application through the use of winged or wingless clamps. It involves placing the clamp on the tooth to be isolated then stretching the dam attached to the frame over the clamp in place.

NOTE: Most commonly used clamps are listed in **Appendix 5**.

6. RECOMMENDATION TWO: SPECIAL TECHNIQUES FOR UNIQUE CASES

6.1. Partially erupted teeth or teeth with short clinical crown

6.1.1. Modified clamps:

a. Clamps with apically inclined prongs, these will help in engaging the tooth subgingivally.

b. Clamps with serrated jaws (tiger clamps), these serrations help in stabilization of the clamp.

6.1.2. Self-curing resin beads placed on the cervical area of the tooth; this will help in stabilizing the clamp in position during treatment.

6.1.3. Because partially erupted tooth lacks undercut to retain the clamp, a small acid etched composite lip can be placed on the tooth; this serves as an artificial undercut and remains on the tooth between appointments.

6.2. Severely broken down teeth

6.2.1. Modified clamps:

Clamps with apically inclined prongs and tiger clamps. In addition to these, there is S-G (Silker Glickman) clamp that can be used for severely broken down teeth. It has an anterior extension that allows retraction of the rubber dam around the tooth under treatment with the clamp placed on the adjacent tooth.

6.2.2. Clamping of the alveolar process through attached gingiva, but this is usually not recommended as it causes bleeding and pain.

6.2.3. Double clamp technique:

It might be possible to place the clamp in position, but due to inadequate tooth structure the elasticity of the dam might interfere in the stabilization of the clamp, in such circumstances one clamp is placed on the distal tooth, whereas the second clamp is gently positioned on the tooth under treatment.

6.2.4. Orthodontic bands can be cemented over the remaining clinical crown. This will not only allow clamp to be held on to the tooth but also serves as a seal for the retention of intracanal medicament and the temporary filling material between appointments. Orthodontic bands require sufficient supragingival tooth structure for it to be retained on to the tooth.

6.2.5. Split dam technique:

In this technique the tooth posterior to the tooth to be treated is clamped. Two holes are punched in the dam corresponding to the teeth anterior and posterior to the tooth to be treated. The dam between the holes is then cut with scissors to expose the tooth to be treated. This technique can also be used where the tooth to be treated has porcelain crown or veneers and clamp may chip the margins of the restoration.

6.2.6. Use of copper band:

A copper band is either pre-annealed or heat softened. It is then trimmed such that it adapts to the gingival contour of the tooth. The band is closely and passively placed over the remaining supraosseous tooth structure. Because of the flexibility of the softened copper band, it can be pressed over the supraosseous tooth structure and pushed subgingivally with minimal trauma.

6.2.7. Temporary crowns:

Can be cemented over the remaining tooth structure. Access cavity preparation is then made through the temporary crown.

6.2.8. Provisional restorations:

Sometimes there is so little remaining tooth structure that even orthodontic band or crown placement is not feasible. In such cases it becomes necessary to replace the missing tooth structure to allow placement of the rubber dam clamp and prevent leakage into the pulp cavity. It can be accomplished by means of amalgam build up, composite, glass ionomer.

6.3. Crowded teeth

6.3.1. In these cases, there is no enough space to place the clamp in position. In such a situation rubber dam is placed on to the tooth, and it is teased beneath the contact area with the help of a floss and is stabilized by two fragments of the dam instead of the clamp.

6.3.2. Widgets can also be used in place of dam fragments.

6.4. Bridge abutments, teeth with orthodontic wire or splints

6.4.1. Orthodontic wire prevents tight sealing of the rubber dam sheet. Punch a larger than normal hole in the dam.

6.4.2. Tight seal can be achieved by the use of OraSeal™.

6.5. Isolation of third molar

6.5.1. In the standard clamp the bow interferes with the ramus of the mandible. Modified bow clamps are designed so that the bow lies on to one side i.e. palatal side and thus it does not interfere with the ramus.

6.6. Multiple adjacent teeth requiring treatment or extreme mobility of the tooth to be treated

6.6.1. The posterior tooth is clamped normally whereas a second clamp is reversed on the most anterior tooth (the bow pointing mesially).

6.6.2. Another way is to clamp the posterior tooth normally and the anterior part of the dam is stabilized with a piece of dam, dental floss, or widget cord placed interproximal to hold the dam in place.

F. GUIDELINES FOR CLEANING AND SHAPING ROOT CANALS

1. BACKGROUND

It is well-recognized and universally accepted that a successful outcome in endodontic treatment essentially depends on the following three factors:

- Cleaning and shaping
- Disinfection
- Three-dimensional obturation of the root canal system.

Proper cleaning and shaping establish the necessary conditions for the success of the next two factors. Successful Root Canal Treatment (RCT) is based on:

- Establishing an accurate diagnosis and developing an appropriate treatment plan
- Applying knowledge of tooth anatomy and morphology (shape)
- Performing the debridement, disinfection, and obturation of the entire root canal system.

2. SCOPE

2.1. Provide DHA licensed Endodontists and general dentists an overview on which instruments are supposed to be used and when to ensure improved success rate and treatment outcome.

3. PURPOSE

3.1. To increase the awareness among general dental practitioner regarding the importance of the use of different instruments and techniques.

3.2. Ensure rubber dam placement during the root canal treatment.

3.3. Ensure that all endodontic patients receive the same quality of root canal treatment.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: CLINICAL STEPS FOR ROOT CANAL PREPARATION

5.1. Access Opening and initial preparation

5.1.1. First step in root canal preparation is the access cavity, the opening in the dental crown that permits localization, cleaning, shaping, disinfection and three-dimensional obturation of the root canal system.

5.1.2. Ultrasonic tips are recommended for safe removal of reparative dentine and other calcified tissues.

5.1.3. After locating the orifices, coronal part or the canals could be pre-flared to facilitate irrigants and to facilitate instruments to reach and clean apical area of the canals.

5.2. Working length Determination

5.2.1. Measurement of root canal length should be determined using electronic apex locator (EAL), if it is not possible to be determined by EAL then additional radiographs should be taken with a diagnostic file inside the canal.

5.3. Cleaning and shaping: technical issues

5.3.1. Biological objectives:

a. Biological objectives aim to eliminate microorganisms from root canal system, to remove pulp tissue or organic remnants that may support microbial growth, to avoid forcing debris beyond the apical foramen, which may sustain apical inflammation, and to create sufficient space for intra-canal medicaments.

5.3.2. Mechanical objectives

a. Develop a continuously tapering conical form in the root canal preparation.

b. Make the canal narrower apically, with the narrowest cross-sectional diameter at its terminus.

c. Make the preparation in multiple planes.

d. Never transport the foramen.

e. Keep the apical foramen as small as practical.

f. Schilder concept is summarized in creating 'a three-dimensional continuously tapering cone in multiple planes with sufficient apical enlargement preserving foramen position and size'.

5.4. Canal preparation Techniques:

5.4.1. Hand instrumentation:

a. Circumferential filing: Circumferential filing is used for canals that are large and/or not round. The file is placed into the canal and withdrawn in a directional manner sequentially against the mesial, distal, buccal, and lingual walls.

b. Step-back technique: it reduces procedural errors and improves debridement. After coronal flaring and determining the initial apical file (initial file that binds slightly at the corrected working length), the succeeding larger files are shortened by 0.5 or 1.0 m increments from the previous file length. This step back process creates a flared, tapering preparation while reducing procedural errors.

5.4.2. Recapitulation: is important regardless of the technique selected. This is accomplished by taking a small file to the correct working length to loosen accumulated debris and then flushing it with 1-2 ml of irrigant. Recapitulation is performed between each successive instrument regardless of the cleaning and shaping technique.

5.4.3. Nickel Titanium Rotary instrumentation: It prepares the root canals utilizing a crown-down approach. The specific technique is based on the instrument system selected. One instrument sequence uses nickel titanium files with a constant taper and variable ISO tip sizes. Using the crown down approach creates

coronal flare and reduces the contact area of the file so torsional forces are reduced. Refer to **Appendix 7.**

G. GUIDELINES FOR ROOT CANAL IRRIGATION

1. BACKGROUND

In order to improve the success rate of root canal treatment in general dental practice, the referral of difficult cases to dentists with advanced knowledge and training in endodontics should be made possible for the benefit of patients.

In order to be able to refer patients with complex endodontic problems, a minimum of two (2) requirements should be met, as follows:

- Sufficient endodontists must be available to handle the demand for specialist endodontic care.
- General Dentist must be able to judge the difficulty of treatment required.

The American Association of Endodontists (AAE) has published a form, which describes 17 areas that should be assessed when evaluating the potential difficulty of an endodontic situation **Appendix 4**.

The Assessment Form makes case selection more efficient, more consistent and easier to document. Dentists may also choose to use the Assessment Form to help with referral decision making and record keeping.

2. SCOPE

2.1. To formulate a root canal irrigation guideline to guide both endodontists and general dental practitioners on the use of the right irrigant for the right case to improve the success rate and treatment outcome.

3. PURPOSE

3.1. To increase the awareness among general dental practitioner and Endodontists regarding the importance of the use of different irrigation regimens.

3.2. Ensure that rubber dam placement during the root canal treatment is necessary.

3.3. Ensure that all endodontic patients receive the same quality of root canal treatment.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: AGENTS USED FOR ROOT CANAL IRRIGATION

5.1. The agents used for root canal irrigation are Chlorhexidine digluconate (CHX), Ethylene diamine Tetraacetic Acid (EDTA) and Sodium hypochlorite (NaOCl).

5.2. Chlorhexidine digluconate (CHX)

5.2.1. It has a broad-spectrum antibacterial action, sustained action and low toxicity. Because of these properties, it has been recommended as a potential root canal irrigant.

5.2.2. The major advantages of CHX over NaOCl are its lower cytotoxicity and lack of foul smell and bad taste. However, unlike

NaOCl, it cannot dissolve organic substances and necrotic tissues present in the root canal system.

5.2.3. It is unable to kill all bacteria and cannot remove the smear layer.

5.3. Ethylene Diamine Tetraacetic Acid (EDTA)

5.3.1. Chelating agents such as EDTA, citric acid and tetracycline are used for removal of the inorganic portion of the smear layer.

5.3.2. Irrigation with 17% EDTA for one (1) minute followed by a final rinse with NaOCl is the most commonly recommended method to remove the smear layer.

5.3.3. Longer exposures can cause excessive removal of both peritubular and intratubular dentin.

5.3.4. EDTA has little or no antibacterial effect.

Note: For further details refer to **Appendix 6**.

5.4. NaOCl

5.4.1. NaOCl is the most commonly used root canal irrigant.

5.4.2. It is an antiseptic and inexpensive lubricant that has been used in dilutions ranging from 0.5% to 5.25%.

5.4.3. Free chlorine in NaOCl dissolves vital and necrotic tissue by breaking down proteins into amino acids. For sequence of root canal irrigation in different clinical situations refer to **Appendix 7**.

5.4.4. Decreasing the concentration of the solution reduces its toxicity, antibacterial effect and ability to dissolve tissues.

5.4.5. Increasing its volume or warming it increases its effectiveness as a root canal irrigant. The major disadvantages of this irrigant are its cytotoxicity when injected into periradicular tissues, foul smell and taste, ability to bleach clothes and ability to cause corrosion of metal objects.

5.4.6. It does not kill all bacteria, nor does it remove all of the smear layer.

5.5. Interaction between irrigants:

5.5.1. NaOCl and EDTA are the most prevalent irrigants. EDTA, however, in combination with NaOCl decreases the amount of chlorine and finally reduces the NaOCl activity. Accordingly, these two solutions should not be combined together.

5.5.2. Chlorhexidine is not tissue soluble and can be mixed with NaOCl to get useful features, yet these two solutions are not soluble and the resultant becomes orange-brown sediment.

5.5.3. Using saline between different types of irrigants to prevent undesirable effect.

5.6. Activation of root canal irrigants:

5.6.1. Ultrasonic Activation of root canal irrigants

a. The use of ultrasound during and at the end the root canal preparation phase improves endodontic disinfection.

b. The effectiveness of ultrasound in the irrigation is determined by its ability to produce “cavitation” and “acoustic streaming”.

c. Ultrasonic activation of NaOCl from thirty (30) seconds to one (1) minute for each canal with three (3) cycles of 10-20 seconds (with constant irrigant renewal) proved to be a sufficient time to obtain cleaned canals at the end of the preparation, although recent systemic review concluded that Ultrasonic activation did not improve the healing rate of apical periodontitis compared with syringe irrigation after primary root canal treatment of teeth with a single root canal.

6. **RECOMMENDATION TWO:** TO BE AWARE

6.1. Persistent infection, is defined as microorganism that resisted intracanal antimicrobial procedures and survived in the treated canal

6.2. Clinically it will present as follows:

6.2.1. Post treatment apical periodontitis, continuous signs and symptoms.

6.2.2. Infections complications such as apical abscess arising after the treatment of no infected vital pulps.

6.2.3. Cases in which apical radiolucency was absent at the time of treatment but present on the follow up radiograph.

7. **RECOMMENDATION THREE:** SPECIAL CRITERIA TO BE CONSIDERED

7.1. Use of rubber dam is a must in endodontic treatment procedure.

7.2. During instrumentation, irrigation should be done using copious amounts of the NaOCl solution. Once the shaping procedure is completed, canals can be thoroughly rinsed using five (5) mL of 17% EDTA solution for at least one (1) minute.

7.3. In persistent infection, final irrigation using 5-10ml of 2% chlorhexidine solution is advantageous.

7.4. Saline should be used between chlorhexidine and NaOCl to prevent the formation of brown-reddish precipitate.

7.5. Irrigation activation using sonic or ultrasonic activation from thirty (30) seconds to one (1) minute for each canal with three (3) cycles is suggested in order to increase the effectiveness of NaOCl.

H. GUIDELINES FOR OBTURATION

1. BACKGROUND

The ultimate goal of endodontic treatment is the long-term retention in functionality of teeth with pulpal or periapical disease. Depending on the diagnosis, this treatment typically involves the preparation and obturation of all root canals.

Prior to initiating therapy, a clinician must establish a diagnosis, take a thorough patient history and conduct clinical tests. Canal preparation is necessary to provide adequate access for disinfecting solutions without making major preparation errors such as perforations, canal transportations, instrument fractures or unnecessary removal of tooth structure.

Obturation is the cornerstone of nonsurgical endodontics and the healing outcome of endodontic treatment relies on technical quality and attention to details in this step. The purpose of obturation is to seal the cleaned, shaped and disinfected root canal system and to prevent re-infection.

2. SCOPE

2.1. Provide DHA licensed Endodontists and General Dentists a decision-making process when they encounter a situation requiring obturation of the root canal system focusing on clinical steps of management.

3. PURPOSE

3.1. To standardize the method and steps of obturation followed by the dental practitioners.

3.2. To ensure best practice is being followed during obturation of the root canal system.

3.3. To ensure best service is being delivered to the patient.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: OBTURATION MATERIALS

5.1. The ideal properties of root canal filling materials:

5.1.1. Antimicrobial

5.1.2. Biocompatible

5.1.3. Has good flow

5.1.4. Adhesive in nature

5.1.5. Dimensionally stable

5.1.6. Not affected by moisture

5.1.7. Radio-opaque

5.1.8. Good handling

5.1.9. Easily removed, in case of need for post preparation or retreatment

5.1.10. Does not stain dentine

5.2. The primary obturation materials are as follows:

5.2.1. Gutta Percha

5.2.2. Calcium Silicate Cement.

5.3. Sealers used with the primary obturation materials are as follows:

5.3.1. Zinc oxide eugenol-based

5.3.2. Calcium hydroxide-based

5.3.3. Glass ionomer-based

5.3.4. Resin-based

5.3.5. Calcium silicate-based

5.3.6. Silicone-based.

6. **RECOMMENDATION TWO:** VARIOUS TECHNIQUES FOR OBTURATION

6.1. Best practices dictate that root canals should be well cleaned and prepared before filling them completely and effectively, in order to prevent ingress of nutrients or oral microorganism.

6.2. The various obturation techniques are listed below:

6.2.1. Single cone technique

6.2.2. Lateral compaction (Cold Lateral Compaction technique)

6.2.3. Warm Vertical Compaction

6.2.4. Warm Lateral Compaction

6.2.5. Carrier-based thermoplasticized technique

6.2.6. Thermomechanical compaction

6.2.7. Plasticized GP injection techniques

6.2.8. Apical barrier.

7. **RECOMMENDATION THREE:** COLD LATERAL COMPACTION

7.1. Cold lateral compaction is the gold standard obturation technique and is relatively easy to carry out, allows for good apical control and is cost effective. The step-by-step technique is described below:

7.1.1. Measure the working length with a spreader that provides apical gauging.

7.1.2. Fit a gutta percha master cone with a tug back to full working length.

7.1.3. Prepare the accessory cones correspondent to the spreader size and measure them 1 mm less than the working length.

7.1.4. Coat the tip and the sides of the master cone with sealer, insert it in the canal and make sure that the sealer coats the canal walls, make sure the master cone reaches the full working length.

7.1.5. Ease the finger spreader down to 1 mm from the working length. Mark the spreader with a silicon stop.

7.1.6. Remove the finger spreader, place an accessory point precisely from where the spreader is removed and insure it penetrates to 1 mm from working lengths.

7.1.7. After placing enough accessory points and once the obturation is complete, cut the cones off at the orifices level and vertically compact with a plugger.

8. RECOMMENDATION FOUR: CONTINUOUS WAVE COMPACTION TECHNIQUE

This is a modified version of warm vertical compaction by SCHILDER 1967.

8.1. Cone adaptation

8.1.1. Fit the master cone to 0.5 mm from the working length with a tug back.

8.2. Plugger Measurement

8.2.1. Select a System B plugger that binds gently in the prepared canal at around 5 to 7 mm from the working length with a silicone stopper.

8.3. Sealer

8.3.1. Coat the master cone lightly with sealer and apply to the walls of the canal.

8.3.2. Seat the master cone.

8.4. System B

8.4.1. Heat source is best at 200^0 C and a power setting of ten and in touch mode.

8.5. Heat

8.5.1. The plugger is inserted into the canal and activated to remove excess coronal material, then the heated plugger is driven through the gutta percha while activating the heat over maximum of three seconds 5 to 7 mm from the working length.

8.5.2. Maintain firm apical pressure for ten seconds, sustain push to take up any shrinkage that might occur upon cooling of the apical mass of gutta percha.

8.6. Backfill

8.6.1. The rest of the canal can be backfilled using thermoplastic injection technique using devices such as Obtura, Elements, or Calamus.

9. RECOMMENDATION FIVE: CARRIER BASED THERMOPLASTICIZED TECHNIQUE

Carrier systems represent another convenient means of delivering thermally softened gutta percha to the canals. The systematic technique is described below:

9.1. Verify

9.1.1. Choose the matching verifier to your master apical file.

9.2. Heat

9.2.1. Heat the matching gutta percha core in the purpose design oven until you hear a beep.

9.3. Insert and Cut

9.3.1. Insert the gutta percha to the canal, cut the tip of the core and compact with a plugger.

10. RECOMMENDATION SIX: SPECIAL CONSIDERATIONS FOR EFFECTIVE OBTURATION

10.1. Obturation should only be carried out following thorough chemo-mechanical debridement of the root canal system.

10.2. If the root canal system is, dry and time permits, obturating at the same visit is recommended

10.3. If it is not possible to achieve a dry root canal system that is free from blood or exudate, then the suggested course of action would be to dress the tooth with an inter-appointment dressing

10.4. Only a well-prepared canal system can provide ideal conditions for appropriate Obturation.

10.5. A well-shaped and well-debrided canal system will potentially create the conditions for healing periapical tissues.

10.6. Ideally, a root canal filling should seal all foramina leading to the periodontium, be without voids, be adapted to the instrumented canal walls, and end at the apical terminus.

10.7. Prevent coronal leakage of microorganisms or potential nutrients to support their growth into the dead space of the root canal system

10.8. Prevent periapical or periodontal fluids percolating into the root canals and feeding microorganism.

10.9. Entomb any residual microorganisms that have survived the debridement and disinfection stages of treatment, in order to prevent their proliferation and pathogenicity.

11. RECOMMENDATION SEVEN: SPECIAL ENDORSEMENTS

11.1. While the result of Obturation is followed by a radiographic examination, these factors should be considered:

11.1.1. Radiographic apex is relatively different than the anatomical apex due to radiographic angulation.

11.1.2. Proximity of the root canal filling to the radiographic apex affects the outcome of root canal treatment.

11.1.3. Apical termination of root canal filling between 0.5-1.5 mm from the radiographic apex is considered Golden Standard.

11.1.4. Studies have shown that homogenous root filling will result in more consistent healing.

11.1.5. Root canal filling should be adequately compacted laterally and vertically to avoid any voids.

11.1.6. High success rate of root canal filling was shown to be with canals with homogenous and dense root canal fillings.

11.1.7. Smooth and continuous taper of root canal filling is recommended.

I. GUIDELINES FOR MANAGEMENT OF IMMATURE TEETH

1. BACKGROUND

A major part of the Endodontic treatment is to preserve the vitality and the tooth structure, in immature teeth, the aim is to continue the development of the root, to restore function and to eliminate any further infection.

Developing a guideline in management of immature teeth Aids in:

- Eliminating symptoms and healing of bone.
- Increased root wall thickness and/or increased root length.
- Positive response to vitality testing.

The baseline conditions to manage immature teeth are as follows:

- Pulp Revascularization can only be done in an Immature Necrotic tooth.
- Pulp Revascularization should be done in two visits.
- It is indicated only after following a comprehensive examination and accurate diagnosis.
- Regenerative endodontic procedure is one of the most innovative progress in the field of endodontics, it uses tissue engineering to restore the pulp vitality allowing the root of immature permanent teeth and surrounding tissue to continue forming.

2. SCOPE

2.1. To provide standards in the treatment of immature teeth and provide the best quality of care.

3. PURPOSE

3.1. To assure the quality of service provided.

3.2. Standardize decision making in management of immature permanent teeth with necrotic pulps.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: DIAGNOSTIC MODALITIES/DIFFERENTIAL DIAGNOSIS

5.1. Pulp Revascularisation Case Selection:

5.1.1. Necrotic immature permanent teeth.

5.1.2. Restorable teeth does not need post and core.

5.1.3. Not allergic to the intra canal medications used in the procedure.

5.1.4. Compliant patient.

5.1.5. ASA 1 (Normal healthy patient) or ASA 2 (Patients with mild systemic disease).

Note: Refer to **Appendix 8** for Classification of patient's current health status

6. RECOMMENDATION ONE: CLINICAL STEPS

6.1. Consent for regenerative endodontic procedure:

6.1.1. Procedure explained to the patient / parents.

6.1.2. Two-appointment procedure.

6.1.3. The need to use antibiotics as intra canal medicament.

6.1.4. Possible adverse effect like staining of the crown.

6.1.5. Possible pain, infection and failure of the procedure.

6.1.6. Alternative to this procedure

a. Mineral trioxide aggregate (MTA) apexification

b. Root canal treatment

c. Extraction.

6.2. First Appointment:

6.2.1. Local Anesthesia, Dental Dam isolation, cleaning the area with Betadine, then open an access cavity.

6.2.2. Remove necrotic pulp tissue; avoid mechanical instrumentation of the walls.

6.2.3. Copious, gentle irrigation with 20ml sodium hypochlorite concentration 1.5-3% (using an irrigation system that minimizes the possibility of extrusion of irrigants into the periapical space), using the side-vented needle.

6.2.4. Irrigation with saline if there is any exudates or bleeding dry with paper points.

6.2.5. Irrigate with EDTA 17% (20 mL/canal, 5 min), with irrigating needle positioned about 1 mm from root end.

6.2.6. Dry canals with paper points.

6.2.7. Place calcium hydroxide or low concentration of triple antibiotic paste (ciprofloxacin, metronidazole and minocycline).

6.2.8. If the triple antibiotic paste is used:

d. Consider sealing pulp chamber with a dentin-bonding agent (to minimize of staining).

e. Mix 1:1:1 ciprofloxacin: metronidazole: minocycline to a final concentration of 0.1-1.0 mg/ml.

Triple antibiotic paste has been associated with tooth discoloration. Double antibiotic paste without minocycline paste or substitution of minocycline for other antibiotic (e.g., clindamycin; amoxicillin; cefaclor) is another possible alternative as root canal disinfectant.

6.2.9. Deliver into canal system via syringe.

6.2.10. If triple antibiotic is used, ensure that it remains below Cemento enamel junction (minimize crown staining).

6.2.11. Seal with 3-4mm of a temporary restorative material such as Cavit™, IRM™, or glass- ionomer.

6.2.12. Dismiss patient for 2-4 weeks.

6.3. Second Appointment:

6.3.1. Assess response to initial treatment, if there are signs/symptoms of persistent infection; consider additional treatment time with antimicrobial, or alternative antimicrobial agent.

6.3.2. Anesthesia without vasoconstrictor.

6.3.3. Field Isolation with Dental Dam.

6.3.4. Remove temporary seal.

6.3.5. Copious, gentle irrigation with 20ml of 17% EDTA, use side vented needle and 2mm above vital tissue.

6.3.6. Irrigate with 5ml of sterile physiological saline.

6.3.7. Dry with paper points.

6.3.8. Induce bleeding by mechanical irritation of the periapical tissue and rotational movement of an apically pre bent file, for example- Hedstrom file.

6.3.9. The goal is to have the entire canal filled with blood to the level of the Cemento–enamel junction).

6.3.10. Wait for blood clot formation (around 15 minutes).

6.3.11. An alternative to creating a blood clot is the use of platelet-rich plasma (PRP), platelet rich fibrin (PRF) or autologous fibrin matrix (AFM).

6.3.12. Stop bleeding at a level that allows for 3-4 mm of restorative material.

6.3.13. Cut a resorbable collagen matrix such as CollaPlug™, Collacote™, CollaTape™ to a diameter larger than the coronal part of the root canal, and a height of 2-3 mm.

6.3.14. Place it over the blood clot, allow it to soak with blood to avoid formation of a hollow space.

6.3.15. Place a silicate cement (e.g. MTA as capping material MTA has been associated with discoloration, Bio dentin or Bio ceramics can be used as an alternative) on top of the collagen matrix in a thin layer of 2mm below the Cemento-enamel junction.

6.3.16. Restore with 3-4 mm of Glass Ionomer Gently over the capping materials and light cure for 40 sec.

6.4. Follow up:

6.4.1. Clinical

a. Absence of:

I. Pain

II. soft tissue swelling

III. Sinus tract.

b. Positive pulp vitality test.

6.4.2. Radiographic

a. Resolution of apical radiolucency (often observed 6-12 months after treatment).

b. Increased width of root walls (this is generally observed before apparent increase in root length and often occurs 12-24 months after treatment).

c. Increased root length.

J. GUIDELINES FOR MANAGEMENT OF TRAUMATIC DENTAL INJURIES

1. BACKGROUND

Traumatic dental injuries (TDIs) occur frequently in children and young adults, comprising five (5) percent of all injuries. Twenty-five (25) percent of all school children experience dental trauma and thirty-three (33) percent of adults have experienced trauma to the permanent dentition, with the majority of the injuries occurring before age nineteen (19). Luxation injuries are the most common TDIs in the primary dentition, whereas crown fractures are more commonly reported for the permanent teeth. Proper diagnosis, treatment planning and follow-up are important to assure a favourable outcome.

These guidelines offer recommendations for diagnosis and treatment of specific TDI's. While they do not provide guarantees, their application can maximize the chances of a favourable outcome.

2. SCOPE

2.1. To offer recommendations for diagnosis and treatment of specific TDI's.

3. PURPOSE

3.1. To provide information for the immediate and urgent care of TDIs.

4. APPLICABILITY

4.1. Dubai Health Authority (DHA) licensed General Dentists.

4.2. DHA licensed Endodontists.

4.3. DHA licensed Oral and Maxillofacial Surgeons.

5. **RECOMMENDATION ONE**: SPECIAL CONSIDERATIONS

5.1. Immature versus Mature Permanent Teeth

5.1.1. Every effort should be made to preserve pulpal vitality in the immature permanent tooth to ensure continuous root development. Pulp exposures secondary to TDIs are amenable to proven conservative pulp therapies that maintain vital pulp tissue and allow for continued root development. In addition, pulp revascularization/ regeneration can also be can also be attempted in canals of immature permanent teeth with necrotic pulps.

5.2. Avulsion of Permanent Teeth

5.2.1. The prognosis for avulsed permanent teeth is very much dependent on the actions taken at the time of accident. Periodontal ligament (PDL) cells on the root surface will remain viable if they are hydrated. Vital PDL cells can reattach when replanted and viability is best maintained if the tooth is replanted within the first 15-20 minutes after avulsion.

5.3. Pulp canal obliteration

5.3.1. Pulp canal obliteration (PCO) occurs more frequently in teeth with open apices which have suffered a severe luxation injury. It usually indicates ongoing pulpal vitality. Additionally, PCO is a common occurrence following root fractures.

6. **RECOMMENDATION TWO**: GENERAL INSTRUCTIONS

6.1. Clinical examination

6.1.1. Evaluation of soft tissue wounds including the presence of impacted foreign body in the wounds has to be attempted.

6.1.2. The teeth are examined for fractures or infractions.

6.1.3. Any tooth mobility has to be recorded and percussion test is to be performed gently to evaluate the periodontal condition.

6.2. Radiographic examination

6.2.1. Several projections and angulations are routinely recommended, but the clinician should decide which radiographs are required for the individual. The following are suggested:

a. Periapical radiograph with a 90" horizontal angle with central beam through the tooth in question.

b. Occlusal view.

c. Periapical radiograph with lateral angulations from the mesial or distal aspect of the tooth in question.

6.2.2. Another application of radiography is to examine for the presence of impacted foreign bodies in penetrating soft tissue wounds

6.2.3. Cone-beam computerized tomography (CBCT) provide enhanced visualization of TDIs, particularly root fractures and lateral luxation, monitoring of healing, and complications.

6.3. Splinting type and duration

6.3.1. Current evidence supports short-term, non-rigid splints for splinting of luxated, avulsed, and root-fractured teeth. It is considered best practice to maintain the repositioned tooth in correct position, provide patient comfort and improved function. Two general types of splint exist in the category of flexible splint; a flexible temporization material splint and a flexible wire/fiber composite splint.

6.4. Use of antibiotics

6.4.1. Antibiotic use remains at the discretion of the clinician as TDI's are often accompanied by soft tissue and other associated injuries, which may require other surgical intervention. In addition, the patient's medical status may warrant antibiotic coverage.

6.5. Sensibility tests

6.5.1. Sensibility testing refers to tests (cold test and/or electric pulp test) attempting to determine the condition of the pulp. At the time of injury, sensibility tests frequently give no response indicating a transient lack of pulpal response. Therefore, at least two signs and symptoms are necessary to make the diagnosis of necrotic pulp. Regular follow up controls are required to make a pulpal diagnosis.

6.6. Patient/Parent Instructions

6.6.1. Patient compliance with follow-up visits and home care contributes to better healing following a TDI. Both the patient and the parents of young patients should be advised regarding care of the injured tooth/teeth for optimal healing, prevention of further injury by avoidance of participation in contact sports, meticulous oral hygiene, and rinsing with an antibacterial mouthwash such as Chlorhexidine Gluconate 0.1% alcohol free for 1-2 weeks. Alternatively, with a young child, it is desirable to apply Chlorhexidine Gluconate to the affected area with a cotton swab.

7. **RECOMMENDATION THREE:** TREATMENT GUIDELINES FOR MANAGEMENT OF FRACTURES AND LUXATION OF PERMANENT TEETH

7.1. Treatment guidelines for fractures of teeth and alveolar bone.

					Follow up Procedures for fractures of teeth and alveolar bone*	Favorable and Unfavorable outcomes include some, but not necessarily all, of the following:
	Clinical Findings	Radiographic Findings	Treatment	Follow-Up	Favourable Outcome	Unfavourable Outcome
Infraction	• An incomplete fracture (crack) of the enamel without loss of tooth structure. • Not tender. If tenderness is observed, evaluate the tooth for a possible luxation injury or a root fracture.	• No radiographic abnormalities. • Radiographs recommended: a periapical view. Additional radiographs are indicated if other signs or symptoms are present.	• In marked cases, etching and sealing with resin to prevent discoloration of the infraction lines • Otherwise, no treatment is necessary	• No follow-up is generally needed for unless they are associated with a luxation injury or other fracture types.	• Asymptomatic • Positive response to pulp testing. • Continuing root development in immature teeth	• Symptomatic • Negative response to pulp testing • Signs of apical periodontitis • No continuing root development in immature teeth • Endodontic therapy appropriate for stage of root development is indicated.

Enamel Fracture	• A complete fracture of the enamel. • Loss of enamel. No visible sign of exposed dentin. • Not tender. If tenderness is observed evaluate the tooth for a possible luxation or root fracture injury. • Normal mobility. Sensibility pulp test usually positive.	• Enamel loss is visible. • Radiographs recommended: periapical, occlusal and eccentric exposures. They are recommended in order to rule out the possible presence of a root fracture or a luxation injury. • Radiograph of lip or cheek to search for tooth fragments or foreign materials.	• If the tooth fragment is available, it can be bonded to the tooth. • Contouring or restoration with composite resin depending on the extent and location of the fracture.	• 6-8 weeks C** • 1 year C**		

* For crown fractured teeth with concomitant luxation injury, use the luxation follow up schedule.

C^{++} = clinical and radiographic examination.

7.2. If resorption is diagnosed, treatment must be considered. Resorption may be rapid, resulting in tooth loss in as little as two (2) months. Management is largely based upon the etiology; whether the process is sterile or infective.

7.3. If the stimulus is sterile due to orthodontic tooth movement, treatment should not necessarily be discontinued but the forces should be reduced.

7.4. If resorption is due to stimulation from an infective process, the stimulus should be halted and orthograde endodontics is the treatment of choice.

8. RECOMMENDATION FOUR: INTERNAL INFLAMMATORY RESORPTION

8.1. If there is a cervical defect that may expose external root surface to internally placed bleaching products, these should be managed before treatment.

8.2. Once the access cavity has been prepared, the Gutta Percha and floor of cavity should be sealed to prevent passage of the bleaching agent through the dentine. It is recommended this is at least two (2) mm thick. This can be done with glass ionomer, composites or materials such as Cavit or Intermediate Restorative material (IRM). It is recommended that this seal is at least 2 mm thick. The restorative material should be placed at the level of the cemento-enamel junction.

8.3. The focus of treatment is to access the resorptive lesion, remove resorptive tissue and restore the cavity. The site, extent and pulpal

involvement of the cervical resorptive lesion will dictate the treatment protocol. Heithersay (2004) suggests that Class 1-3 lesions are restorable but Class 4 lesions rarely so.

8.4. If there is pulpal involvement or suspected near pulpal involvement Root canal treatment (RCT) should be performed.

8.5. Remove any stimulus and vital tissue that may be allowing the resorptive process to perpetuate.

8.6. If the tooth is restorable, RCT is usually the treatment modality of choice.

8.7. A range of materials may be used for restoration of the prepared cavity. Suggests the use of a glass ionomer, composite and Mineral Trioxide Aggregate (MTA).

9. **RECOMMENDATION FIVE:** EXTERNAL REPLACEMENT RESORPTION

9.1. Once External replacement resorption (ERR) is established there is no effective treatment. Progression will result in complete resorption of the root and eventual crown fracture.

9.2. The patient should be informed of this and routine monitoring should be instigated to allow more accurate prediction of when elective intervention may be necessary.

10. **RECOMMENDATION SIX:** INTERNAL REPLACEMENT RESORPTION

10.1. Management protocols should follow that for internal inflammatory resorption but the clinician must be aware of an additional level of

complexity owing to calcific tissue within the canal. The lesion should be thoroughly curetted. The application of 90% trichloracetic acid may help inactivate the lesion.

10.2. The use of ultrasonic may aid removal of mixed calcific tissue obstructing access. Orthograde RCT may not be possible and surgical endodontics may be considered to be the only option.

11. **RECOMMENDATION SEVEN:** CONCLUSION

11.1. Resorption presents with a range of aetiologies and prognoses. A thorough understanding of the pathology is essential to allow appropriate treatment planning.

11.2. Timely intervention is essential for optimum management. Practitioners must be aware of when to intervene and have the confidence to do so. Delays in treatment via late diagnoses and referral waiting times may be catastrophic. The outcome for treatment may be uncertain and patients should always be well informed of this.

12. **RECOMMENDATION EIGHT:** ENDORSEMENTS

12.1. Patients at risk of dental trauma should be provided with custom made gum shields to be worn when the risk is present.

12.2. Prevention of cervical root resorption is especially important when internal bleaching is concerned.

K. GUIDELINES FOR NON-SURGICAL ENDODONTIC RE-TREATMENT

1. BACKGROUND

Post-treatment endodontic disease remains a challenge in our daily endodontic practice despite all the potentials of endodontic treatment success rate. The management of cases requiring retreatment should comply with the general rules of primary root canal treatment namely: Accurate diagnosis, antiseptic treatment consisting of cleaning and shaping the root canals, followed by effective disinfection, canal filling, and a coronal restoration that prevents reinfection. In order to achieve a successful non-surgical root canal re-treatment, it is important to begin with accurate diagnosis of the need of root canal retreatment. Although root canal retreated teeth have a lower prognosis than primary root canal treated teeth, saving these teeth is becoming more preferable in today's practice than other surgical modalities.

2. SCOPE

2.1. To aid Endodontists to facilitate successful non-surgical endodontic re-treatment and to outline treatment considerations so that the potential for any adverse effects can be minimized and a systematic approach for satisfactory results is outlined.

3. PURPOSE

3.1. To assure the quality of service provided.

3.2. Standardize management of non-surgical endodontic re-treatment procedures.

3.3. To eliminate microorganisms and prevent reinfection through the root canal filling and tooth restoration.

3.4. To create a well-obturated root canal filling which is radiographically extending to the apices of the roots.

3.5. To ensure under filled and over filled root canal fillings in patent canals, ledges, perforations and separation of instruments are avoided.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

5. **RECOMMENDATION ONE:** INDICATIONS AND CONTRAINDICATIONS

5.1. The existence of any of the following clinical conditions necessitates the need of a nonsurgical endodontic retreatment:

5.1.1. Continued and recurrent apical pathosis e.g. apical periodontitis or abscess

5.1.2. Salivary contamination which allows for bacterial micro leakage

5.1.3. Loss of coronal seal or coronal micro leakage which exposes the root canal filling to the oral cavity for a duration of one month of more

5.1.4. Radiographic evidence of a deficiency in the quality of the primary root canal obturation

5.1.5. Persistent symptoms which fail to resolve after primary root canal treatment

5.1.6. Planning a prosthetic procedure on a tooth with questionable primary root canal treatment quality

5.1.7. The presence of a periapical pathosis adjacent to an area with anticipated dental implant placement.

5.1.8. Inability to extract a non-restorable tooth due to the patient's medical history and medications taken e.g. bisphosphonates

5.2. The existence of any of the following clinical conditions discourages the need of a nonsurgical endodontic retreatment:

5.2.1. Active root resorption lesion present in the accused tooth as a result of longstanding inflammation of the periapical tissues, which has been confirmed via radiography in two different angulations.

5.2.2. Confirmed diagnosis of a fractured root.

5.2.3. Presence of perforation that cannot be sealed e.g. strip perforation.

5.2.4. Tooth, which cannot withstand a prosthodontic final restoration due to insufficient remaining coronal tooth structure.

5.2.5. Faulty but asymptomatic existing root canal filling which never had any signs and/or symptoms.

6. **RECOMMENDATION TWO:** PREOPERATIVE DIAGNOSIS

6.1. Accurate pre-operative diagnosis is critical to predict the possibility of facing a difficult previously treated root canal system during re-

instrumentation. Valid reasons which may have contributed to the failure of the existing root canal treatment should be provided prior to initiating the retreatment therapy, such as:

6.1.1. The type and quality of existing root canal filling. The existing root canal filling material present in the tooth plays an important role in assessing the difficulty of the re-treatment case. The type and quality of root canal filling are both addressed via radiographic interpretation of the tooth prior to initiation of root canal therapy.

6.1.2. Obstructions present within the root canals. The presence of foreign objects in the root canal systems, such as separated instruments and posts, prior to the initiation of the root canal therapy greatly increases the difficulty of the re-treatment.

6.1.3. The anatomy of the root canal system. Pre-operative assessment of the number of roots and root canals plays a role in assessing the difficulty of the case. The greater the number of roots and/or root canals, the greater the difficulty of the case.

6.1.4. The potential of previously undetected/missed root canal(s). The presence of a missed canal in a root canal filled tooth indicates that the canal could not be located by the previous practitioner, which may be due to the presence of calcifications in the root canal system, improper use of equipment, and/or not enough

awareness of the tooth anatomy. Enough precautions should be taken into consideration in such cases.

6.1.5. The degree of canal curvature(s). The greater the degree of canal curvature, the more difficult the case is and the more chance of any instrument to separate intra-operatively.

6.1.6. The degree of previous straightening, apical transportation, or furcal perforation.

6.1.7. The presence of a faulty coronal restoration enhancing coronal leakage into the root canal system. The coronal seal is just as important as the apical seal. Any coronal leak into the root canal systems for a period of more than 30 days arises a sign of extra effort should be put into the cleaning and shaping of the tooth.

6.1.8. The presence of fractures or fracture lines which involve the furcation area and/or the roots.

7. **RECOMMENDATION THREE:** CLASSIFICATION CRITERIA

7.1. After radiographic analysis, the root canal system is classified into two groups.

7.1.1. Group 1: Teeth with root canal morphology respected by previous endodontic treatment.

7.1.2. Group 2: Teeth with root canal morphology altered by previous endodontic treatment.

7.2. Group 1 includes:

7.2.1. Calcification: natural obstacles with complete or partial obliteration of the root canal space frequently encountered when pastes or cements were left shorts inside the root canal system

7.2.2. Apical stop: closure of the apical part of the canal related to the previous instrumentation.

7.2.3. Broken instrument: one or more stainless steel K-files or similar, or NiTi files.

7.2.4. Under-filled canal with Gutta percha or cement: root canal system insufficiently instrumented and sealed by a single cone technique or poorly compacted lateral condensation. Both short and long levels of sealing are included in this category.

7.3. Group 2 includes:

7.3.1. Internal or external transportation: alterations toward the outer or inner part of the curvature not leading to a perforation at the apical third.

7.3.2. Perforation: endodontic-periodontic communication of iatrogenic origin, either those located at the pulp chamber floor or in the lower third of the canal space.

7.3.3. Stripping: endodontic-periodontic communication of iatrogenic origin of the coronal third extending to the middle third of the canal space.

7.3.4. Internal resorption: round enlargement of the canal determined by a degenerative pulp left uncleaned by former treatment.

L. GUIDELINES FOR ENDODONTIC MISHAPS

1. BACKGROUND

Dentists have a profound responsibility to follow codes of conduct to act in the best interest of the patient. Any circumstances causing lack of duty amount to negligence and may give a chance to a patient to proceed in the court of law. To understand the legal status of the clinical error and to prevent future litigations in the court of law, knowledge regarding the medico legal aspects of particular clinical scenario with respect to the provision of law is required.

Endodontic mishaps or procedural accidents are unfortunate occurrences that can occur during treatment. Some might be due to inattention to detail, whereas others are unpredictable.

2. SCOPE

2.1. To aid Endodontists to facilitate successful non-surgical endodontic re-treatment and to outline treatment considerations so that the potential for any adverse effects can be minimized and a systematic approach for satisfactory results is outlined.

3. PURPOSE

3.1. To classify mishaps which might occur any time in a day-to-day practice in endodontics.

3.2. To guide general dental practitioners and endodontists on how to prevent and treat such mishaps.

3.3. To prevent and tackle such future medico legal issues related to endodontic treatment, the knowledge of the legal aspect of such clinical situation is necessary.

3.4. To protect the dentist and the patient by understanding how to avoid and manage endodontics mishaps

3.5. To have sufficient knowledge and skills to perform the treatment because a breach in it causes negligence and legal action can be taken against the dentist.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. **RECOMMENDATION ONE:** CLASSIFICATION OF PROCEDURAL ERRORS

5.1. Procedural errors that may occur during root canal treatment can be categorized as follows:

5.1.1. Access related mishaps

a. Treating the wrong canal

b. Missed canal

c. Access cavity perforation

5.1.2. Instrumentation related mishaps

a. Ledge formation

b. Separated instrument

5.1.3. Obturation related mishaps

a. Vertical root fracture

5.1.4. Miscellaneous mishaps

a. Irrigation related mishaps

6. **RECOMMENDATION TWO:** ACCESS RELATED MISHAPS

6.1. Treating the wrong tooth

6.1.1. Prevention

a. Proper testing, examination and radiograph

b. Proper tooth isolation

6.1.2. Correction

a. Inform the patient

b. Provide treatment for both teeth

6.2. Missed canals

6.2.1. Prevention

a. Proper access cavity preparation

b. Knowledge of root canal anatomy

c. Magnification by lenses or microscope

6.3. Access cavity perforation

6.3.1. Detection

a. Bleeding in access cavity

b. Confirm by placement of small file and take a radiograph

6.3.2. Correction

a. Locate the site of perforation, clean it if bleeding stop place MTA

6.3.3. Prevention

a. Good radiograph examination

b. Align long axis of the cavity with long axis of tooth

c. Knowledge of tooth anatomy

7. RECOMMENDATION THREE: INSTRUMENTATION RELATED MISHAPS

7.1. Ledge Formation

7.1.1. Causes

a. Inadequate access

b. Using large stiff instrument

7.1.2. Detection

a. Root canal instrument no longer go to full working length

b. Hitting solid wall

7.1.3. Prevention

a. Adequate access cavity preparation

b. Use small file size 8,10 K-file to reach the working length

c. Using copious of irrigation and recapitulation

d. Create glide path and coronal flaring

e. Don't force instrument

f. Get sufficient training before using rotary instruments

g. Radiograph

7.2. Separated/intracanal fractured instruments

7.2.1. Factors to be considered

a. Strategic importance of the tooth

b. Position of the segment in the canal

c. Cleanliness of the root canal system

d. Good armamentaria

e. Risk of complications

f. Existence of periapical lesion

7.2.2. In case a clinician is incompetent to address the fractured instrument he/ she should refer the patient to a clinically more experienced and competent endodontist.

8. RECOMMENDATION FOUR: OBTURATION RELATED MISHAPS

8.1. Vertical root fracture

8.1.1. Prevention

a. Avoid excessive force to canal wall during gutta percha compaction

8.1.2. Recognition

a. Sudden cracking sound

b. Deep localized periodontal pocket

9. **RECOMMENDATION FIVE:** IRRIGATION RELATED MISHAPS

9.1. Irrigation related mishaps have to be recognised and treated as mentioned below:

9.1.1. Recognition

a. Sudden pain

b. Profuse bleeding

c. Almost immediate swelling

9.1.2. Prevention

a. Don't force irrigation

b. Passive placement of the needle (needle should not be wedged into the canal)

9.1.3. Treatment

a. Early management, reassurance, and close follow-up in the hours and days after the accident

b. In the presence of diffuse swelling, infiltration anesthesia is contraindicated to avoid spreading of any existing infection; a nerve block should be used instead.

c. Immediate canal irrigation using a saline solution.

d. Bleeding should not be prevented, and aspiration with a high-volume aspirator would help to evacuate NaOCl.

e. Post-treatment instructions included frequently applying extraoral cold packs on the day of the extrusion to minimize

edema replaced by warm packs on the following days to increase circulation.

f. Analgesics and antibiotics are prescribed.

10. RECOMMENDATION SIX: ENDORSEMENTS

10.1. Taking necessary precautions are better than managing bigger problems later.

10.2. Knowledge and implication of basic protocol as a routine practice in clinics must be adopted.

10.3. The treatment may vary from dentist to dentist, but it must adhere to the basis of dental science and medical literature.

10.4. Always promise less and deliver more to the patient.

M. GUIDELINES FOR SURGICAL ENDODONTICS

1. BACKGROUND

The etiology of periapical periodontitis is microbial infection that induces inflammatory and immune response causing bone destruction in the periapical tissues. Success rates for primary root canal treatment ranges between 47–97%. If the outcome of initial root canal treatment is unfavourable, retreatment or surgical endodontics are considered, with the preference of retreatment concerning long-term outcome. Whenever retreatment may not be possible and hence surgical endodontics is indicated, a range of success rates includes 44–95%. Prerequisites for a favourable prognosis includes accurate diagnosis and appropriate treatment plan. Endodontic surgical procedure involves root-end resection, apical curettage and root end filling. With the introduction of dental operating microscope and micro-instruments, surgical endodontics has advanced into endodontic microsurgery.

Surgical endodontic therapy aims at resolving periapical pathosis when orthograde endodontic retreatment is not achievable. The range of the surgical procedures in endodontics varies to include the following: incision for drainage, periradicular surgery, repair of perforation, hemi-section, root amputation and intentional replantation.

However, the current scope of surgical endodontics is mainly directed towards periradicular surgery, with the other surgical aspects being practiced by other specialties such as oral surgery and periodontics.

2. SCOPE

2.1. To provide an overview and systematic approach to endodontic surgery. This will provide the practitioner an easier access to recommendations aiming at high standard of care.

3. PURPOSE

3.1. To identify indications and contraindications for surgical endodontics.

3.2. To describe the recommended surgical techniques during surgical endodontics to ensure high quality of the surgical treatment provided for the patients.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

5. **RECOMMENDATION ONE**: INDICATIONS FOR SURGICAL ENDODONTICS

5.1. Presence of persistent periradicular disease in a previously treated tooth where non-surgical root canal retreatment is not possible or has failed.

5.2. Difficult access for conventional nonsurgical treatment or retreatment.

5.3. A full coverage (or post-retained) crown where access for orthograde retreatment may jeopardize the remaining tooth structure.

5.4. Access to the periapical area is necessary to aid diagnosis, as for biopsy or to identify a suspected root fracture, root crack, internal or external root resorption, or perforation.

5.5. Conventional re-treatment may be detrimental to the retention of the tooth.

5.6. Presence of iatrogenic or developmental anomalies that prevent non-surgical root canal treatment being undertaken, e.g. calcified canal, marked curvature of the root, presence of a separated instrument in the canal, perforation, or overextended filling material through the apex.

5.7. Visualization of the periradicular tissues and tooth root.

5.8. Procedures are required that require either tooth sectioning or root amputation.

6. **RECOMMENDATION TWO:** CONTRAINDICATIONS FOR ENDODONTIC SURGERY

6.1. Medical conditions: recent myocardial infarction or cerebrovascular accident, intravenous bisphosphonate use, immunosuppression, bleeding disorders, a history of radiotherapy to the oral cavity, psychological health issues and any debilitating illness. If there is any doubt about a patient's suitability to undergo surgical endodontic procedure, it is recommended that the patient's physician is consulted.

6.2. Dental factors: unusual bony, soft tissue or root configurations (e.g. short sulcus depth and prominent frenal/muscle attachments), lack of surgical access, possible involvement of neurovascular structures or maxillary sinus, subsequently unrestorable tooth, poor prognosis for the tooth

following apicectomy due to severe periodontal disease or extensive loss of coronal tooth tissue, poor supporting tissue, poor general oral status.

6.3. Experience of the operator: skill, training and expertise of the surgeon, and facilities availability. Currently, endodontic specialists use microscopes routinely.

7. **RECOMMENDATION THREE:** CLINICAL STEPS/SURGICAL TECHNIQUE

7.1. Surgical flap

7.1.1. A proper flap design allows a good view of the surgical site and adequate access for the used instruments during the procedure. The designs of the flaps are variable and they should include the following:

a. The blood supply from the base of the flap must be sufficient to maintain viability of the tissues involved.

b. The edges of the flap and the relieving incisions should lie on sound bone and the incision should not cross any bony eminence as this will make suturing of the flap more difficult and affect the predictability of healing.

c. The relieving incision should be perpendicular to the occlusal plane.

d. The incision line should be clean to avoid tearing of the margins, and the periodontal tissues should be healthy to permit optimal healing.

e. The raised flap must be protected from damage and desiccation during surgery and retractors should rest on sound bone.

f. It is not desirable to remove bleeding tags of tissue from the exposed bone or periodontal ligament fibers that were severed during tissue reflection as they will facilitate healing.

7.1.2. The designs of the flap are variable and depends on the following factors:

a. Access to and size of the periradicular lesion

b. Periodontal status (including biotype)

c. State of coronal tooth structure

d. The nature and extent of coronal restorations

e. Aesthetics

f. Adjacent anatomical structures.

7.1.3. For endodontic surgery, two types of flap are currently recommended: intrasulcular and sub marginal. The use of semilunar flap is precluded in endodontic surgery as the size of the periapical lesion is unpredictable and there is significant scarring associated with this technique.

a. Intrasulcular flap: is generally preferred, with relieving incisions one to two teeth proximal to the involved tooth. It provides excellent access to the operating area, without the

risks associated with other designs. The traditional intrasulcular flap type technique involves complete mobilization of the interdental papilla. The papilla base incision has been introduced recently which is a modified version of the same technique. This avoids opening of the interproximal space, which minimizes recession of the interdental papilla subsequently.

b. The sub marginal flap (Ochsenbein-Luebke flap): is indicated where aesthetics are paramount such as in the maxillary anterior teeth that have been restored with crowns. A scalloped incision is made below the attached gingiva with one or two relieving incisions, which follow the root angulation of the proximal teeth. Less gingival recession has been associated with this technique; however, this technique is not advised where there is a short root, a large periapical lesion or periodontal breakdown.

7.2. Location of the apex and osteotomy

7.2.1. An assessment of the length of the root and its axis is made to ensure that bone is removed accurately from the desired site. If the cortical bone plate is thin or the lesion have perforated the buccal plate, location of the apex will be straightforward or curettes may be used to expose the apex of the root. In sites

where there is a significant amount of bone, a round bur in a slow speed reverse-air hand piece will be required, cooled by copious sterile saline or sterile water. Steel or tungsten carbide burs produce less heat than diamond burs. The osteotomy size should be kept as small as possible but as large as necessary to carry out the surgical treatment. With the use of micro instruments, an osteotomy of 4–5 mm is sufficient to carry out the required instrumentation. The superficial osteotomy should be performed with a light shaving motion to reduce the heat generated and allow adequate visibility. A bony lid technique has been advocated for mandibular molar teeth. In general, it can be very difficult to distinguish bone from root; however, bone is whiter in colour and softer than root on probing, and also. Methylene blue can be used to preferentially stain the periodontal ligament, which aids with identification of the root apex. Magnification will help significantly.

7.3. Periradicular curettage

7.3.1. The soft tissue in the periradicular region should be removed with curettes. This aids in visualization of the root apex. Any pathological tissue should be sent for histological examination.

7.3.2. In some cases, it may not be possible to remove all the soft tissue around the root-end until the apex has been resected. The

majority of the inflammatory soft tissue should be removed but the peripheral tissues may be reparative in nature and, if other anatomical structures are likely to be violated, then this tissue should be left.

7.4. Root-end resection

7.4.1. Root-end resection is carried out to remove the apical delta and to create sufficient space for placement of the retrograde filling material.

7.4.2. It is carried out as close to 90 degrees to the long axis of the tooth as possible to reduce the number of exposed dentinal tubules and to ensure access to all the apical anatomy. If possible, at least 3mm of root end should be resected with a rotating bur (using saline or water coolant).

7.4.3. The resected root surface should be examined, preferably under magnification with a micro-mirror, to ensure that the resection is complete, that the surface is smooth and that there are no cracks in the root, and to check for canal irregularities.

7.4.4. The application of methylene blue to the root face may help visualization of the outline of the root, accessory canals, isthmuses and micro-fractures.

7.5. Root-end preparation

7.5.1. Retro-preparation aims to clean and shape the root tip. Remaining root-filling material is removed, along with any irritants. The preparation should be 3 mm deep, in the long axis of the tooth and incorporate the whole pulp space morphology.

7.5.2. Special ultrasonic tips are now routinely used for root-end preparation. It facilitates debridement of isthmuses. The tips should be used at low power and with a light touch to reduce the risk of root cracking. Root-end preparation should be carried out with sterile saline or water as a coolant. Consideration should be given to removing the smear layer with EDTA or citric acid, especially if a bur has been used.

7.5.3. The root-end cavity should be examined to ensure that the walls are free of debris, including previous root filling materials. Prior to filling, it is important to keep the surgical site dry. Cotton wool pledgets or ribbon gauze soaked with haemostatic agent may be used for this purpose.

7.6. Retrograde filling

7.6.1. A biologically compatible material should be used where possible. In recent years, zinc oxide and eugenol-containing materials [e.g. intermediate restorative material (IRM®)] and mineral trioxide aggregate (MTA) have shown to be superior to amalgam in terms of seal ability and biocompatibility. MTA has potential bactericidal

effects due to its release of hydroxyl ions and the production of a high pH environment. It has the ability to set in the presence of moisture. It is currently used for perforation repair, root-end induction and root-end filling. MTA is typically placed with a flat plastic and packed into place with a microplugger. There should be no excess material on the resected root face and any excess is removed with a damp cotton wool roll. The surgical site is normally washed out with sterile saline prior to closure to remove any debris. Radiographic verification of the quality of the root end filling is appropriate before wound closure.

7.7. Closure of the surgical site

7.7.1. The flap is replaced and is sutured. After suturing, the tissues should be compressed with damp gauze for 3–5 minutes. Sutures are removed 48–96 hours post-operatively, when reattachment of the periodontal fibers at the gingival margin has taken place, and suture removal is easy and painless.

8. **RECOMMENDATION FOUR:** POST-SURGICAL CONSIDERATIONS

8.1. Post-operatively, patients report little pain and moderate swelling after periapical surgery. In general, complications are uncommon.

8.1.1. Post-operative pain: May be controlled with non-narcotic analgesics. Patients are advised to take non-steroidal anti-inflammatory drugs (NSAIDs) and/or paracetamol if post-

operative pain is experienced. A long-acting local anaesthetic given at the end of the procedure may also be beneficial.

8.1.2. Post-operative swelling: Minimized by the application of cold compresses with an ice pack for the first 4–6 hours after surgery. Chlorhexidine mouthwash is advised twice daily to keep the surgical site clean and to allow quicker healing. Antibiotics are not used routinely in conjunction with periapical surgery.

8.1.3. Haemorrhage: Must be controlled during the surgery. Soft tissue bleeding is controlled by haemostatic agents delivered via local anesthesia, epinephrine pellets, ferric sulphate, electro surgery and/or with sutures. Bleeding in the bony crypt is also affected by the vasoconstrictor in the local anesthetic agent and topically applied agents. Topically applied agents are removed from the crypt prior to closure of the surgical site.

8.1.4. Ecchymosis: bruising may occur. It is self-limiting and will usually resolve within two weeks of surgery.

8.1.5. Infection: may result in secondary haemorrhage, cellulitis or local abscess formation. It is best prevented by maintenance of good oral hygiene measures and the use of chlorhexidine mouthwashes immediately pre-operatively and post-operatively. Antimicrobials should be prescribed where signs of systemic involvement are

present with pyrexia and regional lymphadenopathy, in combination with surgical drainage if appropriate.

8.2. Clear, written post-operative instructions given to the patient, together with telephone communication within 24 hours avoids misunderstandings and allows further supportive care and advice.

9. RECOMMENDATION FIVE: FOLLOW UP AND OUTCOMES

9.1. A post-operative radiograph is usually taken on the day of the procedure or at the initial review appointment within 2 to 3 days of surgery.

9.2. An initial review appointment is required to remove sutures and assess early healing.

9.3. Following this, in the absence of any complications, further radiographic follow-up is indicated at 3 months.

9.4. Then, annual clinical and radiographic review is indicated until healing has taken place.

9.5. Outcomes may be classed as successful, incomplete, uncertain and unsuccessful.

9.5.1. Successful outcome:

a. Clinical: This is achieved when the presenting symptoms and signs of the disease associated with the tooth have been eliminated.

b. Radiological: The treated tooth should show a normal periodontal ligament width or a slight increase, not wider than

twice the normal periodontal ligament space. The periradicular rarefaction should be eliminated and the lamina dura and osseous pattern should be normal. There should be no root resorption evident.

Note: Clinical criteria cannot be used to determine the amount and type of repair histologically. The aim should be to provide an environment that allows regeneration of the cementum and periodontal ligament over the resected root apex. However, in many cases repair of the tissue takes place with the formation of a fibrous tissue scar.

9.5.2. Incomplete outcome:

a. Clinical: There are no signs or symptoms.

b. Radiological: There is partial regeneration of the periapical bone. This may be due to the formation of fibrous scar tissue and is often associated with a through and through lesion where both buccal and lingual cortical plates have been perforated by infection or during the surgical procedure.

9.5.3. Uncertain outcome:

a. Clinical: There may be vague symptoms, which may include mild discomfort or a feeling of pressure and fullness around the treated tooth.

b. Radiological: There is partial regeneration of periapical bone

9.5.4. Unsuccessful outcome:

a. Clinical: The presence of signs and/or symptoms of periradicular disease, including root fracture.

b. Radiological: There is no regeneration of periapical bone

Note: Should failure occur after surgery then the cause needs to be established prior to a plan of treatment. Further surgical intervention has been associated with a lower success rate (35.7%). In general, Success rates of 44–90% have been reported for traditional surgical endodontics. Whereas, microsurgical endodontics yielded success rates of 57–97%.

N. GUIDELINES FOR MANAGEMENT OF ROOT RESORPTION

1. BACKGROUND

Root resorption is the progressive loss of dentine and cementum through the continued action of osteoclastic cells. In the primary/mixed dentition, this is a normal physiological process resulting in exfoliation of deciduous teeth but in the adult dentition it is largely pathological.

Resorption can occur both internally and externally and is known to be initiated and maintained by many factors but pulpal necrosis, trauma, periodontal treatment, orthodontic treatment and tooth whitening agents are the most commonly described stimulants. Irrespective of the initial cause, the process is largely inflammatory in origin.

Without intervention premature loss of the affected tooth may occur. Successful management is dependent upon a thorough understanding of the diagnosis.

2. SCOPE

2.1. To aid both endodontists and general dental practitioners to identify the etiology, pathology, diagnosis and management of root resorption.

3. PURPOSE

3.1. To increase the awareness among general dental practitioners regarding the types, diagnosis and management of the root resorption.

3.2. To increase the awareness among general dental practitioner regarding the root resorption prevention methods.

3.3. Ensure that all endodontic patients receive the same quality of root resorption management.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dental Practitioners.

5. RECOMMENDATION ONE: CLASSIFICATION

5.1. Resorptive lesions can be most simply classified as external or internal. In the former the lesion occurs on the external aspect of the root. In the latter the lesion occurs within the root upon the dentine of the root canal and/or pulp chamber.

5.2. Root resorption may further be classified based upon the site and type of resorptive process. Classification based on Andreasen's descriptions of resorption (**Appendix 10**) is as follows:

5.2.1. External inflammatory resorption (EIR)

a. Prolonged stimuli to areas of damaged/denuded root surface allows continuation of the process of surface resorption. Andreasen proposes a series of four events necessary for this to occur: Firstly, there must be trauma to the root surface; typically, after replantation where there is damage to the periodontal ligament and extended drying of the root surface. Following this the exposure of the dentinal

tubules into the resorptive cavity, which must communicate with an infective or necrotic pulp. Finally, the age of the tooth must be considered with immature and younger teeth being more frequently affected. It may also occur with the application of pressure. Unchecked, this process can completely resorb roots in months.

5.2.2. External cervical resorption (ECR)

a. External cervical resorption is a localized resorptive lesion of the cervical area of the root below the epithelial attachment (thus it may not always be in the cervical region.). In a vital tooth, unless the lesion is extensive there is rarely pulpal involvement. It is the feature that helps distinguish ECR from EIR; in the latter pulpal necrosis or infection is a prerequisite.

b. Heithersay subdivided cervical resorptive lesions into four categories:

I. Class 1 lesions just penetrate the root dentine of the cervical area.

II. Class 2 lesions are deeper and in closer proximity to the pulp but remain within coronal dentine.

III. Class 3 lesions are more extensive and involve the coronal third of the root.

IV. Class 4 lesions extend into the coronal half of the root dentine and may completely envelop the pulp: there is a possibility of pulpal involvement.

5.2.3. External replacement resorption (ERR)

a. This is the process of replacement of root surface with bone otherwise known as ankylosis. The aetiology remains poorly understood.

5.2.4. Internal root resorption

a. This process takes place within the canal system. It has been described as apical or intra-radicular. The precise etiological and pathological mechanisms remain poorly understood.

5.2.5. Internal Surface Resorption (ISR)

a. This process is analogous with external surface resorption. It is self-limiting without further stimulation.

5.2.6. Internal Inflammatory Resorption (IIR)

a. Characterized by ovoid or fusiform enlargement of pulp chamber or root canal. The enlargement typically expands in an apical and lateral direction. There may be chronic pulpal inflammation. This process may be analogous with EIR.

5.2.7. Internal Replacement Root Resorption (IRR)

a. Internal replacement root resorption is rare. There may be more irregular enlargement of the canal space. There are

diffuse areas of mixed radiolucencies and radio-opacities. It may lead to obliteration of the canals space with cancellous-like bone.

6. RECOMMENDATION TWO: CAUSES OF ROOT RESORPTION

6.1. Pulpal disease and peri-apical or apical pathosis

6.1.1. Caries or mechanical trauma will elicit an inflammatory process within the pulpal tissue. If there is, damage to the protective pre-dentine layer osteoclasts may bind to the dentine. In the presence of such inflammation osteoclastic activity may be stimulated resulting in internal resorption.

6.2. Periodontal Disease:

6.2.1. When gingivitis is present, there is a low grade, continual inflammatory process within the marginal gingivae in response to persistent challenge of bacterial plaque. When this process leads to apical migration of the epithelial attachment, loss of collagen attachment and loss of bone the inflammatory process results in a periodontitis. Down growth of epithelium has been hypothesized as providing a barrier to resorptive processes.

6.3. Trauma

6.3.1. Traumatic injuries to teeth may result in resorption. For this to occur there must be damage to the protective barriers, cementum and/or periodontal ligament.

6.4. Pressure

6.4.1. The iatrogenic stimulus of orthodontics and the patho-physiological stimulus of impacted teeth or tumors are two principal initiators of resorption related to pressure.

6.4.2. Resorption has been reported in 19-31.4% of all patients undergoing orthodontic treatment, its prevalence being highest in mandibular and maxillary incisors, with molar and canines being least effected.

6.5. Temperature

6.5.1. Ultrasonic devices and warm obturation techniques are known to generate potentially high temperatures locally. Inflammatory tissue responses have been demonstrated to local temperature increases above 47 °C and tissue necrosis to temperature rises above 60 °C.

6.6. Chemical

6.6.1. With the increased number of patients using bleaching products a correlation has been seen with reports of resorption. It is known that the interface between enamel and cementum may not be continuous and thus open dentinal tubules in the cervical portion of the tooth may present a pathway for not only ingress but egress of substances and bacteria.

6.7. Systemic disease

6.7.1. Hyperparathyroidism is a rare condition usually associated with adenomas of the parathyroid gland. Over production of parathyroid hormone stimulates resorption leading to systemic hard tissue decalcification and cyst-like lesions within bones. It has been suggested this disease process may also result in increased dental hard tissue resorptive tendencies.

6.8. Idiopathic

6.8.1. In these conditions, there is no evident etiological factor.

7. **RECOMMENDATION THREE:** DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

7.1. Diagnosis should be based upon a sound clinical history. Teeth affected by resorption lesions are often asymptomatic and may present as an incidental finding upon radiographic examination so it is essential that the clinician should pay particular attention to aspects of the history that may play a role in the development of resorption. These factors include:

7.1.1. History of trauma.

7.1.2. History of crown preparation.

7.1.3. History of pulpotomy.

7.1.4. Orthodontic history.

7.1.5. Use of intra-pulpal chemicals such as internal bleaching products.

7.1.6. History of removal of impacted teeth.

7.1.7. History of surgical procedures in proximity to the affected roots.

7.1.8. History of periodontal disease and its management.

7.1.9. In more extensive resorptive conditions involving multiple teeth it may be of interest to discuss if the patient has any contacts with cats.

7.2. Clinical examination

7.2.1. Full extra and intra oral clinical examinations should be performed before more specific investigations of the relevant teeth are carried out.

7.2.2. The colour of the tooth should be noted with specific reference to precise site of any discoloration.

7.2.3. In the cervical portion of the teeth pinkish coloration is indicative of resorption.

7.3. Radiographic examination

7.3.1. If resorption is suspected one or more periapical radiographs should be taken.

7.3.2. The use of CBCT enables the precise determination of site, type and extent of the lesion.

8. **RECOMMENDATION FOUR:** CLINICAL STEPS

8.1. The fundamental principle related to management of any resorptive lesion is to halt osteoclast activity. This may be achieved by:

8.1.1. Removing the source of stimulation,

8.1.2. Reducing osteoclastic activity,

8.1.3. Stimulating repair

8.1.4. A combination of methods.

8.2. External inflammatory resorption:

8.2.1. If resorption is diagnosed, treatment must be considered: resorption may be rapid, resulting in tooth loss in as little as two months. Management is largely based upon the etiology: whether the process is sterile or infective.

8.2.2. If the stimulus is sterile, due to orthodontic tooth movement, treatment should not necessarily be discontinued but the forces should be reduced.

8.2.3. If resorption is due to stimulation from an infective process, the stimulus should be halted and orthograde endodontics is the treatment of choice.

8.3. External inflammatory resorption:

8.3.1. If there is a cervical defect that may expose external root surface to internally placed bleaching products these should be managed before treatment. Once the access cavity has been prepared, the gutta percha and floor of cavity should be sealed to prevent passage of the bleaching agent through the dentine. It is recommended this is at least two (2) mm thick. This can be done with glass ionomer, composites or materials such as Cavit or IRM. The restorative material should be placed at the level of the cemento-enamel junction.

8.3.2. The focus of treatment is to access the resorptive lesion, remove resorptive tissue and restore the cavity. The site, extent and pulpal involvement of the cervical resorptive lesion will dictate the treatment protocol. Heithersay suggests that Class 1-3 lesions are restorable but Class 4 lesions rarely so.

8.3.3. If there is pulpal involvement or suspected near pulpal involvement root canal treatment should be performed.

8.3.4. A range of materials may be used for restoration of the prepared cavity like glass ionomer, composite and MTA.

8.4. External replacement resorption

8.4.1. Once ERR is established there is no effective treatment. Progression will result in complete resorption of the root and eventual crown fracture.

8.4.2. The patient should be informed of this and routine monitoring should be instigated to allow more accurate prediction of when elective intervention may be necessary.

8.5. Internal inflammatory resorption

8.5.1. The aim of treatment in internal resorption cases is to remove any stimulus and vital tissue that may be allowing the resorptive process to perpetuate. If the tooth is restorable, root canal treatment is usually the treatment modality of choice.

8.6. Internal replacement resorption

8.6.1. Management protocols should follow that for internal inflammatory resorption but the clinician must be aware of an additional level of complexity owing to calcific tissue within the canal. The lesion should be thoroughly curetted. The application of 90% trichloracetic acid may help inactivate the lesion.

8.6.2. The use of ultrasonic may aid removal of mixed calcific tissue obstructing access. Orthograde root canal treatment may not be possible and surgical endodontics may be considered the only option.

9. **RECOMMENDATION FIVE:** CONCLUSION

9.1. Resorption presents with a range of aetiologies and prognoses. A thorough understanding of the pathology is essential to allow appropriate treatment planning.

9.2. Timely intervention is essential for optimum management. Practitioners must be aware of when to intervene and have the confidence to do so. Delays in treatment via late diagnoses and referral waiting times may be catastrophic. The outcome for treatment may be uncertain and patients should always be well informed of this.

10. **RECOMMENDATION SIX:** ENDORSEMENTS

10.1. Patients at risk of dental trauma should be provided with custom-made gum shields to be worn when the risk is present.

10.2. Prevention of cervical root resorption is especially important when internal bleaching is concerned.

O. GUIDELINES FOR INTRA-CORONAL BLEACHING OF NON-VITAL TEETH

1. BACKGROUND

Tooth whitening is a very conservative and economical modality of aesthetic treatment of endodontically treated teeth.

The purpose of this guideline is to outline treatment considerations for dentists and their patients prior to tooth whitening/bleaching procedures so that the potential for adverse effects can be minimized.

2. SCOPE

2.1. To standardise the management of treating a discoloured tooth with intracoronal bleaching.

3. PURPOSE

3.1. To increase the awareness among general dental practitioners regarding the types, diagnosis and management of tooth discoloration.

3.2. Ensure that all endodontic patients receive the same quality of intracoronal bleaching management.

3.3. To outline treatment considerations for dentists and their patients prior to tooth whitening/bleaching procedures so that the potential for adverse effects can be minimized.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. **RECOMMENDATION ONE**: DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

5.1. An intracoronal bleaching procedure is indicated for a tooth that has both of the following clinical conditions

5.1.1. The tooth is discoloured from an internal source.

5.1.2. Acceptable root canal treatment has been performed.

5.2. Contraindications

5.2.1. Patients under the age of eighteen (18) years old.

5.2.2. Teeth with white or opaque spots.

5.2.3. Extremely dark stains, especially those with banding or those with uneven distribution.

5.2.4. Teeth that have been bonded, laminated, or have extensive or defective restorations.

5.3. Clinical examination

5.3.1. Patient history would include the cause of discoloration, history of allergies, and information regarding any past problems with tooth sensitivity.

5.3.2. Patients habits and lifestyle, and the presence of removable or fixed appliances or prostheses, should be considered.

5.3.3. Extra-oral examination of the head and neck are conducted to assess oral health problems as well as lumps, sores, or other signs of infection.

5.3.4. Intra-oral examination of the hard and soft tissues of the mouth. Condition of oral health: those patients infected by caries or periodontal disease should not receive aesthetic treatment before the disease has been brought under control.

5.4. Radiographic examination

5.4.1. Appropriate pre-treatment radiographs and shade guides is recommended prior to considering tooth bleaching.

6. RECOMMENDATION TWO: CLINICAL STEPS IN INTRACORONAL BLEACHING

6.1. Prerequisites

6.1.1. Properly obturated root canals to prevent bleaching agents from infiltrating the periapical tissues.

6.1.2. All existing carious dentin must be removed, as well as every residue of restorative material, from the pulp chamber.

6.2. Informed consent

6.2.1. Dentists will discuss the plan of treatment as well as the material and technique chosen. The probability of improvements must be analysed and presented to the patient in a realistic form.

7. RECOMMENDATION THREE: 1ST APPOINTMENT IN INTRACORONAL BLEACHING

7.1. Prophylaxis: Thorough scaling and oral hygiene compliance to have normal healthy gingival tissues of the treated teeth.

7.2. Registration of colour for control: by comparison of teeth with a prefabricated shade guide or by photography.

7.3. Soft tissue protection: a water soluble cream is applied to soft tissues and rubber dam isolation is achieved.

7.4. Coronal access: restorative materials are removed from the opening and from within the pulp chamber with compatible rotary instruments at high speed.

7.5. The access must be improved, if necessary, to prevent debris-retention zones in the pulp horns and on the lingual aspect of the pulp chamber.

7.6. Root canal access: about 3mm of the root canal material is removed in an apical direction beyond the clinical height of the crown.

7.7. This is done by measuring the clinical crown, before rubber dam placement with a periodontal probe and transferring the probe to the interior of the pulp chamber.

7.8. This procedure has a twofold purpose:

7.8.1. To create space for the application of the cervical seal and to expose dentinal tubules directed toward the cervical region.

7.8.2. The tooth is washed with three percent Hydrogen Peroxide (H2O2) solution, rinsed with water and dried.

7.9. Mechanical seal: A plug of a dual-cured glass ionomer cement is applied. This material confines the bleaching material within the pulp chamber, prevents its infiltration to the cervical region of the tooth.

7.10. Bleaching agent: the walking bleaching agent, sodium perborate-water OR sodium perborate-saline mixture are the most suitable bleaching materials used for internal bleaching due to their low extra radicular diffusion of hydrogen peroxide. A thick slurry mix is made and it must occupy the whole pulp chamber, leaving only sufficient room to restore the lingual access.

7.11. Lingual seal: a light-activated resin composite can be used to seal the lingual access.

7.12. Occlusion: adjust the occlusion if necessary.

8. RECOMMENDATION FOUR: 2ND APPOINTMENT IN INTRACORONAL BLEACHING

8.1. Seventy Two (72) hours to one (1) week following the 1st appointment, one of three situations:

8.1.1. Acceptable results: no further bleaching is required.

a. If the desired colour is obtained, the access restoration is removed; the pulp chamber is flushed copiously with water to remove the bleaching agents, and the pulp chamber is filled

with a Calcium Hydroxide (Ca (OH)2)and water paste for seven (7) days.

b. This is to render neutral and alkaline the pH in the cervical region of the tooth, offering adequate means of repair to any possible damage to the cervical periodontal ligament; and avoid resorption.

c. This time is also necessary to allow for the elimination of residual oxygen capable of interfering with the polymerization of restorative material, whereby adhesion of resin composite to the bleached tooth would be jeopardized.

8.1.2. Encouraging results: more bleaching is required.

a. If results were positive but further improvement can be achieved, the last two (2) steps of the 1st appointment must be repeated (application, lingual seal).

8.1.3. Negative results: association with some other bleaching technique is necessary **Appendix 11.**

9. RECOMMENDATION FIVE: NUMBER OF ATTEMPTS FOR INTRACORONAL BLEACHING

9.1. Treatment should be stopped if after three (3) attempts of thermocatalytic bleaching the tooth does not show significant improvement.

10. **RECOMMENDATION SIX:** RESTORATION OF INTRACORANALLY BLEACHED NON –VITAL TEETH

    10.1. The cervical biomechanical seal must not be removed. Light cured composite is used to restore the cavity.

11. **RECOMMENDATION SEVEN:** COMPLICATIONS AND THEIR PREVENTION DURING INTRACORANAL BLEACHING OF NON –VITAL TEETH

    11.1. Non vital bleaching has relative risks that are known and can be decreased.

    11.2. Safety issues have been raised regarding the effects of bleaching on the tooth structure, the mucosal tissues of the mouth as well as systemic ingestion.

    11.3. Concentrations of ten percent H_2O_2 or higher are potentially corrosive to mucous membranes or skin, and can cause a burning sensation and tissue damage.

    11.4. External cervical root resorption is one of the main concerns following intracoronal tooth bleaching.

    11.5. Three factors, bleach placed apical to the cemento enamel junction (CEJ), patent dentinal tubules in young pulpless teeth, and a defect in the cementoenamel junction may combine to allow the bleaching agent to diffuse into the periodontal ligament. An inflammatory reaction can be initiated, resulting in external cervical root resorption.

P. GUIDELINES FOR ENDODONTIC TEMPORIZATION

1. BACKGROUND

The main principle of endodontic treatment is aimed at eliminating bacteria and attempting to maintain the tooth in this disinfected state, by preventing any further ingress of bacteria during and after treatment. Root canal treatment may be carried out in a single visit or multiple visits. The general dentist may do some cases and some require referral to a specialist endodontist. Following pulpotomy or pulpectomy procedure and interim restoration is placed. Patient presents with an interim restoration for continuation/completion of endodontic treatment.

2. SCOPE

2.1. Aid both endodontists and general dental practitioners to facilitate successful Endodontic Temporization.

3. PURPOSE

3.1. Ensure that all endodontic patients receive effective endodontic temporization.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentists.

5. RECOMMENDATION ONE: CLINICAL MANAGEMENT

5.1. Patient attends with an interim restoration of GIC.

5.2. The dentist shall access cavity prepared through the GIC.

5.3. Endodontic procedures are performed intra-canal medicament is placed.

5.4. Provisional/temporary restoration is placed.

5.4.1. Shallow cotton pellet over orifice

5.4.2. Double seal of minimum four (4) mm

a. Cavit over the cotton pellet as the inner layer

b. GIC/IRM over it as the outer layer

c. In case of bridge, abutment or tooth with a short clinical crown cotton pellet + GIC is sufficient.

6. **RECOMMENDATION TWO:** POST ENDODONTIC TEMPORIZATION

6.1. The definitive coronal restoration may not be placed at the same appointment as when the root canal filling is placed.

6.2. The combination of an interim restoration with a temporary access cavity restoration may remain in place for variable periods. This restoration has to prevent post-endodontic coronal leakage, as bacterial penetration into the filled root canal system can cause recontamination and failure of treatment.

6.3. Recontamination of the obturated root canal system by coronal leakage occurs through:

6.3.1. Sealer dissolution by saliva

6.3.2. Percolation of saliva in the interface between sealer and root canal walls

6.3.3. Between sealer and Gutta-percha points

6.3.4. Any void.

6.4. Following obturation, cotton pellet is discouraged for the following reasons:

6.4.1. Reduced thickness of temporary restoration, which compromises seal.

6.4.2. The stability of restoration is compromised as the cotton acts as a cushion allowing displacement of the overlying restoration during masticatory loading.

6.4.3. Compromises adaptation of temporary cement.

6.4.4. Increased risk of leakage through exposed lateral canals.

7. **RECOMMENDATION THREE:** CLINICAL MANAGEMENT AFTER OBTURATION

7.1. There should be no cotton pellet in the pulp chamber

7.2. Cut back GP to the orifice level

7.3. Double seal:

7.3.1. Cavit plug over the gutta-percha as the inner layer

7.3.2. IRM/GIC as the outer layer

7.4. Minimum four (4) m.m. thickness of restoration

7.5. Permanent restoration has to be placed within three (3) weeks

7.6. After obturation, if the temporary filling has been lost or broken down causing recontamination for a period of more than one (1) month, tooth should be assessed clinically and radiographically if indicated for root canal retreatment.

Q. GUIDELINES FOR MANAGEMENT OF A TREATED WRONG TOOTH

1. BACKGROUND

Total failure of endodontic treatment would be the result of incorrect diagnosis entailing failure to diagnose present complaint or disease. In case of pulpal pain, it is often difficult for the patient to pinpoint the tooth causing the discomfort. This could eventually lead to treating a wrong tooth, especially in the presence of a neuropathic or a non-odontogenic condition that would be misdiagnosed as ailing tooth. As a consequence, the patient will continue to have the same symptoms and new diagnosis and management strategy should be established.

2. SCOPE

2.1. Management of a treated wrong tooth to help both endodontists and general dental practitioners to identify the etiology, diagnosis and management of such conditions.

2.2. Standardized management of a treated wrong tooth.

3. PURPOSE

3.1. To increase the awareness among general dental practitioner regarding prevention of treating wrong tooth.

3.2. To standardize decision-making process when the clinicians encounter a situation requiring management of a treated wrong tooth focusing on case selection, clinical steps of management and type of intervention.

3.3. Ensure that all endodontic patients receive the same quality of management of a treated wrong tooth.

4. APPLICABILITY

4.1. DHA licensed Endodontists.

4.2. DHA licensed General Dentist.

5. RECOMMENDATION ONE: DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

5.1. Diagnosis should be based upon a sound clinical history. It is essential that the clinician should pay particular attention to aspects of the history of the chief complaint of the patient.

5.1.1. A tooth can only be the source of pain if there are objective signs associated with that tooth.

5.1.2. Before making a definitive diagnosis, obtain at least three (3) good pieces of evidence supporting the diagnosis.

5.1.3. Correct pulpal diagnosis should be based on presenting symptoms, history of symptoms, diagnostic tests and clinical findings. If it is not possible to establish a diagnosis, therapy should not be initiated.

6. RECOMMENDATION TWO: CLINICAL STEPS IN MANAGEMENT OF A TREATED WRONG TOOTH

6.1. Recognition of the affected tooth through presenting symptoms, history of symptoms, diagnostic tests and clinical findings.

6.2. Appropriate treatment of both teeth: the one incorrectly opened and the one with the original pulpal problem.

6.3. Once a correct diagnosis has been made, this mishap can be easily prevented by marking the tooth to be treated with a felt-tip pen before isolating it with a rubber dam.

6.4. Preparation of an initial access cavity into the enamel or dentino-enamel junction can be completed before rubber dam application.

7. **RECOMMENDATION THREE:** CONCLUSION

7.1. A patient's description of the location of pain must be treated with caution.

7.2. If there is no question about diagnosis, treating the wrong tooth falls within the category of inattention on the part of the dentist.

8. **RECOMMENDATION FOUR:** ENDORSEMENTS

8.1. Do not hide errors from the patient. The safest approach is to explain to the patient what happened and how the problem may be corrected.

8.2. Before starting endodontic procedure, identification of painful or offended tooth is important. It is usually confirmed with the patient by showing the affected tooth in a mirror or asking the patient to show the tooth by pointing with finger or tongue.

8.3. For endodontic treatment, it is always recommended to take multi-angulated radiographs to rule out the presence of any additional root canal. Similarly, when canal anatomy is not clearly visible, it is advisable to take Cone Beam Computed Tomography (CBCT) scan after obtaining

patient's consent. Fail to do so may be considered as neglect and the endodontist would be held responsible for the future failure. Refer to **Appendix 12.**

R. GUIDELINES FOR MANAGEMENT OF INGESTED INSTRUMENTS

1. BACKGROUND

Accidental swallowing of a dental prosthesis, dental instrument or dental material during a dental procedure is often observed in the practice of dentistry. However, unexpected ingestion of an endodontic instrument during an endodontic therapy is the most undesirable happening in the practice of the endodontics. Although such mishaps are not observed on a regular basis, they do pose several clinical problems, undesirable consequences, and considerable distress on the part of the clinicians as well as patients.

It is determined that 87% of the ingested foreign bodies entered the gastrointestinal tract, and 13% entered the respiratory tract. Most of the foreign bodies that entered the gastrointestinal tract pass spontaneously. Only 10–20% cases require nonsurgical intervention, and 1% or less requires surgical removal.

Ingestion or aspiration of foreign bodies can be easily prevented by the universal use of rubber dam isolation. Flexible rubber dam frames are available, which can facilitate radiographs during treatment without removal of frame. It offers effective protection against aspiration or swallowing of endodontic instruments, broken burs and restorative materials. Lower molars have been reported with the highest prevalence among all teeth with ingestion, and it has been correlated to their close proximity to the pharyngeal cavity.

Accidental aspiration or ingestion of foreign bodies is a complication encountered across all age groups. Ingestion of an endodontic instrument happens accidentally due to the following factors:

- Non-application of rubber dam
- Uncooperative patient
- Apprehensive nature of the patient, gagging reflex, viscous saliva
- Restricted mouth opening.
- Pediatric patients
- Elderly patients.
- Unconscious, mentally ill.
- Disabled people whose coordination or control of deglutition is impaired.

Swallowed foreign objects can be lodged in the pharynx, oesophagus, stomach, intestine or simply pass through the gastrointestinal tract. Aspirated foreign objects can be lodged in the larynx, trachea or bronchus and is more serious situation with the possibility of suffocation.

2. SCOPE

2.1. Provide the endodontists with evidence-based criteria on how to report an accidental ingestion of endodontic instrument and its management.

3. PURPOSE

3.1. To provide patient with maximum safety precautions and care during different steps of endodontic therapy.

3.2. To provide the endodontist with strategies to prevent patient's aspiration of foreign bodies during non-surgical root canal treatment.

4. APPLICABILITY

4.1. DHA licensed Endodontists,

4.2. DHA licensed General Dentists

4.3. DHA licensed Pedodontists.

5. **RECOMMENDATION ONE**: CLINICAL MANAGEMENT

5.1. For management of accidental ingestion, it is essential that the dentist and the auxiliary staff do not panic and reassure the patient.

5.2. The patient should be subjected to clinical as well as radiological evaluation. Keeping in mind the foreign body type, nature and duration of symptoms and the lodgement site, which might be a useful indicators for immediate intervention.

5.3. After thorough evaluation, it should be decided whether surgical intervention is necessary for removal of the object or allow it to pass through the gastrointestinal tract naturally.

5.4. On clinical examination of the oral cavity, if the object is located in oral cavity or oropharyngeal region and is visible to the clinician it may be retrieved with forceps, high-volume suction or by sweeping the dentist finger. The patient should be instructed to turn his head to one side so that the object on removal will fall into the cheek region.

5.5. Most often, the objects will be entrapped in the supra-tonsillar recess followed by epiglottis vallecular and piriform recess. If no object is found, it should be presumed that it has either been ingested or aspirated.

5.6. Impacted objects in the airway may be removed by non-invasive procedures such as back blows in infants, Heimlich manoeuvre in adults and obese patients.

5.7. To avoid such mishaps the dentist should check the quality of instruments along with regular monitoring of the instruments for any damage occurring because of frequent use and/or sterilization procedures. This applies particularly to instruments having a few pieces, which are soldered in coupling areas. Soldered areas are usually the weak site of any instrument. Because of continuous sterilization, there is high chance of instruments breakage at this site due to slight force, such as dental mirrors, where handle and the head of the mirror are soldered. Therefore, appropriate monitoring of dental instruments has to be done mandatorily and cannot be overlooked in order to prevent such unforeseen incidents like aspiration or ingestion.

6. **RECOMMENDATION TWO:** SPECIAL CONSIDERATIONS TO AVOID INSTRUMENT INGESTION

6.1. Application of rubber dam

6.2. Consideration and education of apprehensive patient

6.3. Use a more upright position if possible

6.4. Use of a gauze throat pack

6.5. Use of high-velocity evacuation

7. **RECOMMENDATION THREE:** SPECIAL ENDORSEMENTS

7.1. Awareness regarding rubber dam being an integral and essential part of non-surgical endodontic treatment.

7.2. Awareness and preparedness for the medical emergencies.

7.3. Awareness of general practitioners and Pedodontists of the associated risks of such endodontic mishaps and the importance of timely and appropriate management.

7.4. Consideration and education of apprehensive patients.

7.5. Every general dental practitioner must undergo a training course on first aid skills and basic life support.

7.6. Assisting staff must be trained to recognize such emergencies. It is also recommended to update these skills at least once in every 2 years.

7.7. The dentist should be well aware of the legal aspect that such incidence can be seen as negligence and he could be sued by the patient. Hence it is always necessary that preventive measures are carefully followed.

KEY PERFORMANCE INDICATORS (KPIs)

1. Patient Happiness: Overall Assessment	
DHA Pillar	Patient Happiness
Indicator Name	Overall Assessment
Measure Type	Outcome
Data Source	Survey data
Measure Description	People who had a very favorable overall assessment of the facility during measurement period
Measure Denominator	All survey respondents who meet inclusion criteria
Measure Numerator	Survey respondent whose overall assessment of the facility was very high - patients with the highest possible score (scale has 2-7 options) or the two highest options (scale has 8+ options)
Measure Inclusion Criteria	Total number of valid responses to surveys that ask a patient to give their overall assessment of a facility
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

2. Patient Happiness: Recommendation to Others	
DHA Pillar	Patient Happiness
Indicator Name	Recommendation to Others
Measure Type	Outcome
Data Source	Survey data
Measure Description	Percentage of patients who were very likely to recommend the facility to other people during measurement period
Measure Denominator	All survey respondents who meet inclusion criteria
Measure Numerator	Survey respondent whose recommendation was very high - patients with the highest possible score (scale has 2-7 options) or the two highest options (scale has 8+ options)
Measure Inclusion Criteria	Total number of valid responses to surveys that ask whether the patient would recommend the facility to others
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

3. Patient Happiness: Doctors Made Sure Patient Understood All Information	
DHA Pillar	Patient Happiness
Indicator Name	Doctors Made Sure Patient Understood All Information
Measure Type	Outcome
Data Source	Survey data
Measure Description	Percentage of patients who answered favorably ('yes') that doctors made sure he/she understood all information
Measure Denominator	All survey respondents who met inclusion criteria
Measure Numerator	Survey respondent indicated 'yes,' doctors made sure that the patient understood all information
Measure Inclusion Criteria	Valid response to the survey question ('yes' or 'no')
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

4. Patient Safety: Rate of Medication Error	
DHA Pillar	Patient Safety
Indicator Name	Rate of Medication Error

Measure Type	Outcome
Data Source	Internal facility records, reports, or survey data
Measure Description	Rate of prescriptions per 100,000 with a dispensing error during measurement period
Measure Denominator	Number of medication prescriptions during measurement period
Measure Numerator	Number of prescriptions in which a medication error occurs (e.g. dispensing error, prescribing error, administering and preparing error, patient compliance error, vaccine error, administering a medicine for a known allergy patient, dose-related adverse drug reaction)
Measure Inclusion Criteria	All filled prescriptions
Measure Exclusion Criteria	Unsafe condition and near miss incident, adverse drug reactions
Source	TEC required measures http://apps.who.int/iris/bitstream/10665/252274/1/9789241511643-eng.pdf
International Benchmark	2.28 Per 100,000 (in the U.S.) Source: https://www.nationwidechildrens.org/newsroom/news-releases/2017/07/study-finds-rate-of-medication-errors-resulting-in-serious-medical-outcomes-rising . One medication error occurs for every five doses given in US hospitals and 1-2% of patients admitted to US hospitals are harmed by medication errors. Source: http://stateclaims.ie/wp-content/uploads/2017/11/Medication-Incidents-Report-2016.pdf
Higher is Better	No
Risk Adjust This Measure	No

5. Patient Safety: Rate of Medical Error	
DHA Pillar	Patient Safety

Indicator Name	Rate of Medical Error
Measure Type	Outcome
Data Source	Internal facility records, reports, or survey data
Measure Description	Rate of medical errors (errors in diagnosis, medication, surgery, equipment use, lab findings interpretation) per 100,000 patients in measurement period
Measure Denominator	All qualifying patients in measurement period
Measure Numerator	Medical errors as defined through proven reports (e-medical systems) during measurement period
Measure Inclusion Criteria	All patients with at least one medical encounter in measurement year
Measure Exclusion Criteria	None
Source	TEC required measures http://apps.who.int/iris/bitstream/10665/252274/1/9789241511643-eng.pdf
International Benchmark	To be discussed with DHA
Higher is Better	No
Risk Adjust This Measure	No

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APPENDICES:

APPENDIX 1: SAMPLE STATEMENT OF INFORMED CONSENT FOR ENDODONTIC TREATMENT

I hereby authorize Dr. _____and any other agents or employees of _____and assistants as may be selected by any of them to treat the condition(s) described below:

_____

_____

_____The procedure(s) necessary to treat the condition(s) have been explained to me, and I understand the nature of the procedure(s) to be:

_____

_____

_____

The prognosis for this (these) procedure(s) was described as:

_____

_____

_____

- I have been informed of possible alternative methods of treatment including no treatment at all.
- The doctor has explained to me that there are certain inherent and potential risks in any treatment plan or procedure. I understand that the following may be

inherent or potential risks for the treatment I will receive: swelling; sensitivity; bleeding; pain; infection; numbness and/or tingling sensation in the lip, tongue, chin, gums, cheeks, and teeth, which is transient but on infrequent occasions may be permanent; reactions to injections; changes in occlusion (biting); jaw muscle cramps and spasm; temporomandibular joint difficulty; loosening of teeth, crowns or bridges; referred pain to ear, neck and head; delayed healing; sinus perforations; treatment failure; complications resulting from the use of dental instruments (broken instruments—perforation of tooth, root, sinus), medications, anesthetics and injections; discoloration of the face; reactions to medications causing drowsiness and lack of coordination; and antibiotics may inhibit the effectiveness of birth control pills.

- It has been explained to me and I understand that a perfect result is not guaranteed or warranted and cannot be guaranteed or warranted.
- I have been given the opportunity to question the doctor concerning the nature of treatment, the inherent risks of the treatment, and the alternatives to this treatment.
- This consent form does not encompass the entire discussion I had with the doctor regarding the proposed treatment.

Patient's Signature: _____Date/Time _____

Dentist Signature: _____Date/Time _____

Witness' Signature: _____Date/Time _____

APPENDIX 2: SYSTEMIC ANTIBIOTICS RECOMMENDED FOR ENDODONTIC TREATMENT

1. Penicillin: beta-lactam antibiotics. An analog is amoxicillin which is rapidly absorbed and has a longer half-life which means higher and more sustained serum levels than penicillin VK. A disadvantage is its possible side effect of hypersensitivity reactions. Augmentin is the combination of amoxicillin with clavulanate. Amoxicillin's usual oral dose ranges from 250 mg to 500 mg every 8 hours, while Augmentin's usual oral dose ranges from 375 mg to 625 mg every 8 hours.
2. Clindamycin: antibiotic against Gram-positive facultative microorganisms and anaerobes. It is the drug of choice in cases of allergy to penicillin or if a change in antibiotic is indicated. A disadvantage is its possible side effect of diarrhea and pseudomembranous colitis. The usual dose ranges from 150 mg to 450 mg every 6 hours.
3. Metronidazole: a synthetic antibiotic with bactericidal activity against obligate anaerobes. Hence it is imperative to use it along with penicillin or clindamycin which are effective against facultative bacteria and bacteria resistant to metronidazole. The usual oral dose ranges from 200 mg to 400 mg every 8 hours.
4. Macrolides: a narrow spectrum antibiotic. An analog is erythromycin which is bacteriostatic and interferes with bacterial protein synthesis. It is no longer recommended for treatment of endodontic infections because of poor spectrum of

activity and significant gastrointestinal upset. Other analogs with improved pharmacokinetics include clarithromycin and azithromycin, which have a spectrum of activity against some anaerobes involved in endodontic infections. A disadvantage of macrolides is its possible side effect of nausea and vomiting and gastrointestinal distress. Clarithromycin's usual oral dose is 500 mg loading dose followed by 250 mg every 12 hours. Azithromycin's usual oral dose is 500 mg loading dose followed by 250 mg once a day.

5. Tetracycline: broad-spectrum bacteriostatic antibiotics that inhibit protein synthesis. A main disadvantage is the development of bacterial resistance to the tetracycline.
6. Quinolones: a class of synthetic, broad-spectrum antibiotic. An analog is ciprofloxacin that is not effective against anaerobic bacteria typically found in endodontic infections.

APPENDIX 3: ANTIBIOTIC PROPHYLAXIS

ANTIBIOTIC PROPHYLAXIS			Regimen: Single Dose 30 to 60 min **Before Procedure**
SITUATION	**AGENT**	**ADULTS**	**CHILDREN**
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin OR Cefazolin or ceftriaxone	2 g IM or IV 1 g IM or IV	50 mg/kg IM or IV 50 mg/kg IM or IV
Allergic to penicillins or ampicillin—oral	Cephalexin *+ OR Clindamycin OR Azithromycin or clarithromycin	2 g 600 mg 500 mg	50 mg/kg 20 mg/kg 15 mg/kg
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin or ceftriaxoneδ OR Clindamycin	1 g IM or IV 600 mg IM or IV	50 mg/kg IM or IV 20 mg/kg IM or IV
IM: Intramuscular IV: Intravenous * Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosage. + Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin.			

APPENDIX 4: ASSESSMENT FORM TO ASSESS THE DIFFICULTY QUOTIANT OF AN ENDODONTIC CASE

Criteria	Minimal Difficulty	Moderate Difficulty	High Difficulty
A. Patient Consideration			
Medical History	☐No Medical Problem	☐One or more medical problem	☐Complex medical history/serious illness/ disability (ASA classes 3-5)
Anaesthesia	☐No history of anaesthesia problem	☐Vasoconstrictor intolerance	☐Difficulty achieving anesthesia
Patient Disposition	☐Cooperative and compliant	☐Anxious but cooperative	☐Uncooperative
Ability to open mouth	☐No limitation	☐Slight limitation in opening	☐Significant limitation in opening
Gag reflex	☐None	☐Gags occasionally with radiographs/ treatment	☐Extreme gag reflex which has compromised past dental care
Emergency Condition	☐Minimal pain or swelling	☐Moderate pain or swelling	☐Severe pain or swelling
B. Diagnosis and Treatment Considerations			
Diagnosis	☐Signs and Symptoms Consistent with recognised pulpal and periapical conditions	☐Extensive differential diagnosis of usual signs and symptoms required	☐Confusing and complex signs and symptom: difficult diagnosis ☐History of chronic oral and facial pain.

Radiographic Difficulties	☐Minimum difficulty obtaining/interpreting radiographs	☐Moderate difficulty obtaining/interpreting radiographs (e.g. high floor of mouth, narrow or low palate vault, presence of Tori)	☐Extreme difficulty obtaining/ interpreting radiographs (e.g. superimposed anatomical structures)
Position in the Arch	☐Anterior/ premolar ☐Slight Inclination (<10) ☐Slight Rotation (<10)	☐1st Molar ☐Moderate inclination (10-30) ☐Moderate rotation (10-30)	☐2nd or 3rd Molar ☐Extreme Inclination (>30) ☐Extreme rotation (>30)
Tooth Isolation	☐Routine Rubber dam Placement	☐Simple pre-treatment modification required for rubber dam isolation	Extensive pre-treatment modification required for rubber dam isolation
Crown Morphology	☐Normal original crown morphology	☐Full coverage restoration ☐Porcelain restoration ☐Bridge abutment ☐Moderate deviation from normal tooth/root form (e.g. taurodontism microdens) ☐Teeth with extensive coronal destruction	☐Restoration does not reflect original anatomy/ alignment ☐Significant Deviation from normal Tooth/ root form (e.g. fusion dens in dente)
Canal and Root Morphology	☐Slight or no curvature (<10) ☐Closed Apex (<1 mm in diameter)	☐Moderate curvature (10-30) ☐Crown axis differs moderately from root axis. Apical opening 1-1.5 mm in diameter	☐Extreme curvature (>30) or S shaped curve ☐Mandibular premolar or anterior with 2 roots ☐Maxillary premolar with 3 roots ☐Canal divides in the middle or apical third ☐Very long tooth (>25 mm)

			☐Open apex (>1.5 mm in diameter)
Radiographic Appearance of Canal(s)	☐Canal(s) visible and not reduced in size	☐Canal(s) and chamber visible but reduced in size ☐Pulp Stones	☐Indistinct apical resorption ☐Canal(s) not visible
Resorption	☐No resorption evident	☐Minimal apical resorption	☐Extensive apical resorption ☐Internal resorption ☐External resorption
C. Additional Considerations			
Trauma History	☐Uncomplicated crown fracture of mature or immature teeth	☐Complicated crown fracture of mature teeth ☐Subluxation	☐Complicated crown fracture of immature teeth ☐Horizontal root fracture ☐Alveolar fracture ☐Intrusive, extrusive or lateral luxation ☐Avulsion
Endodontic Treatment History	☐No previous treatment	☐Previous access without complications	☐Previous access with complications (e.g. perforation, Non- negotiated canal, ledge, separated instrumentation) ☐Previous surgical or non-surgical endodontic treatment completed
Periodontal-Endodontic Condition	☐None or mild periodontal disease	☐Concurrent moderate periodontal disease	☐Concurrent severe periodontal disease ☐Cracked teeth with periodontal complications ☐Combined endodontic/ periodontic lesion ☐Root amputation prior to endodontic treatment

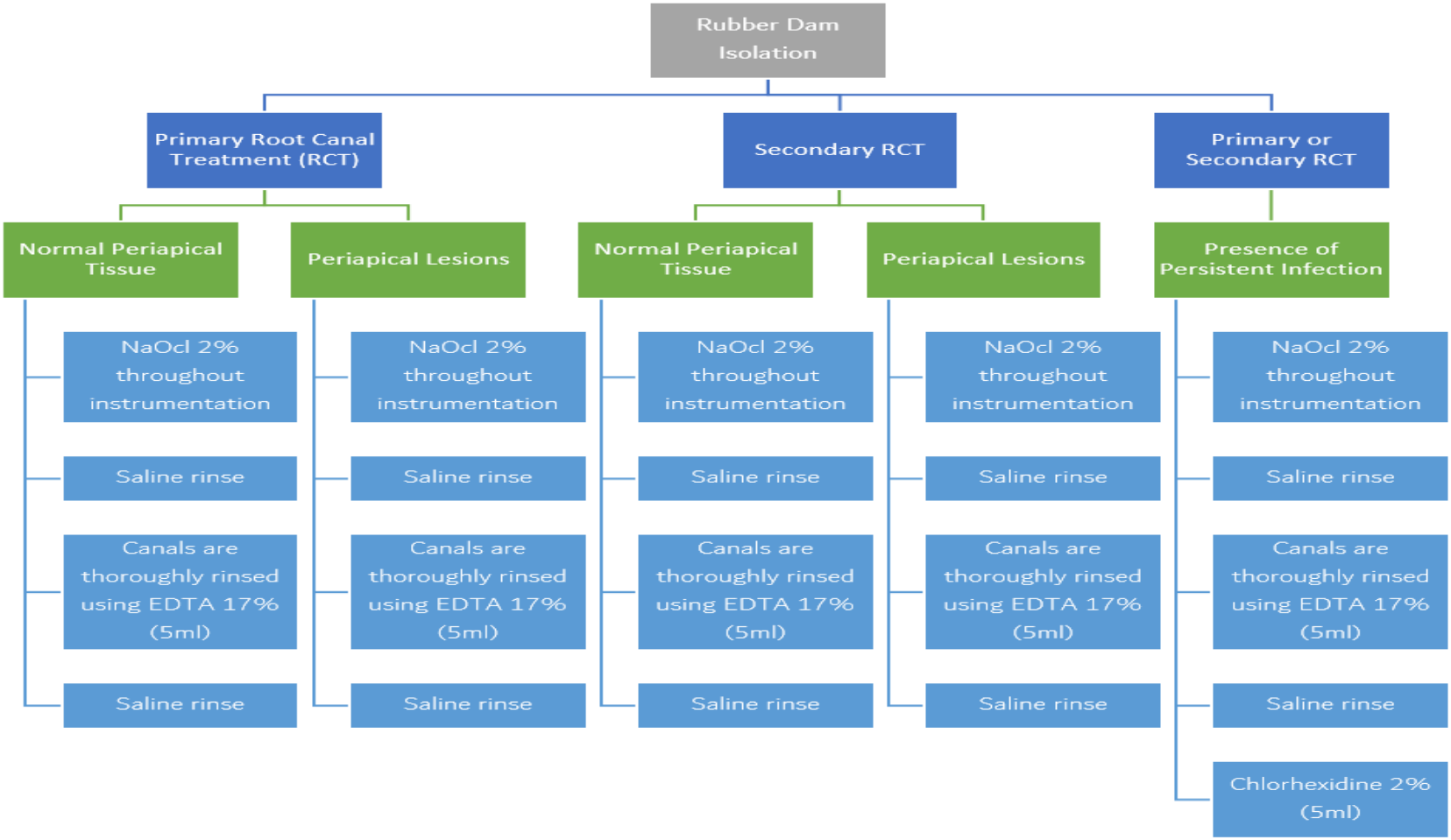
APPENDIX 5: MOST COMMONLY USED CLAMPS

Maxillary teeth	
Central incisors	Ivory # 6, 9, 210, 212
Lateral incisors	Ivory # 6, 9, 210, 00
Canines	Ivory # 6, 9, 210
Premolars	Ivory # 0, 1, 2, 2A, W2A
Molars	Ivory # 3, W3, W8A, 14, 14A, 4 (small maxillary molar clamp)
Mandibular teeth	
Incisors	Ivory # 6, 9, 210, 212
Canines	Ivory # 6, 9, 210
Premolars	Ivory # 0, 00, 2, W2A
Molars	Ivory # 3, W3, W8A, 14, 14A
**Molars that are incompletely erupted or already prepared for a full crown:*	Ivory # 14, 14A, 7A
Asymmetrical molars, in particular second and third:	Ivory # 10, 11, 12A, 13A

APPENDIX 6: SUMMARIZING THE ROOT CANAL IRRIGANTS USED

IRRIGANT	CONCENTRATION	ACTION			ADVANTAGE	DISADVANTAGE
		Organic Solvent	Inorganic Solvent	Antimicrobial		
NaOCl	2%	+++	×	+++	• It is an antiseptic • Inexpensive • Affordability	• Cytotoxicity when injected into periradicular tissues, • Foul smell and taste • Ability to bleach clothes and corrosion of metal objects • Does not remove all of the smear layer
Chlorhexidine	2%	×	×	++	• Broad-spectrum antibacterial action • Low toxicity	• It cannot dissolve organic substances and necrotic tissues in the root canal system • Cannot remove the smear layer
EDTA	17%	×	+++	×	• Removal of the inorganic portion of the smear layer	• Prolonged exposures can cause excessive removal of both peritubular and intratubular dentin

APPENDIX 7: SEQUENCE SUGGESTED FOR ROOT CANAL IRRIGATION IN DIFFERENT CLINICAL SITUATIONS

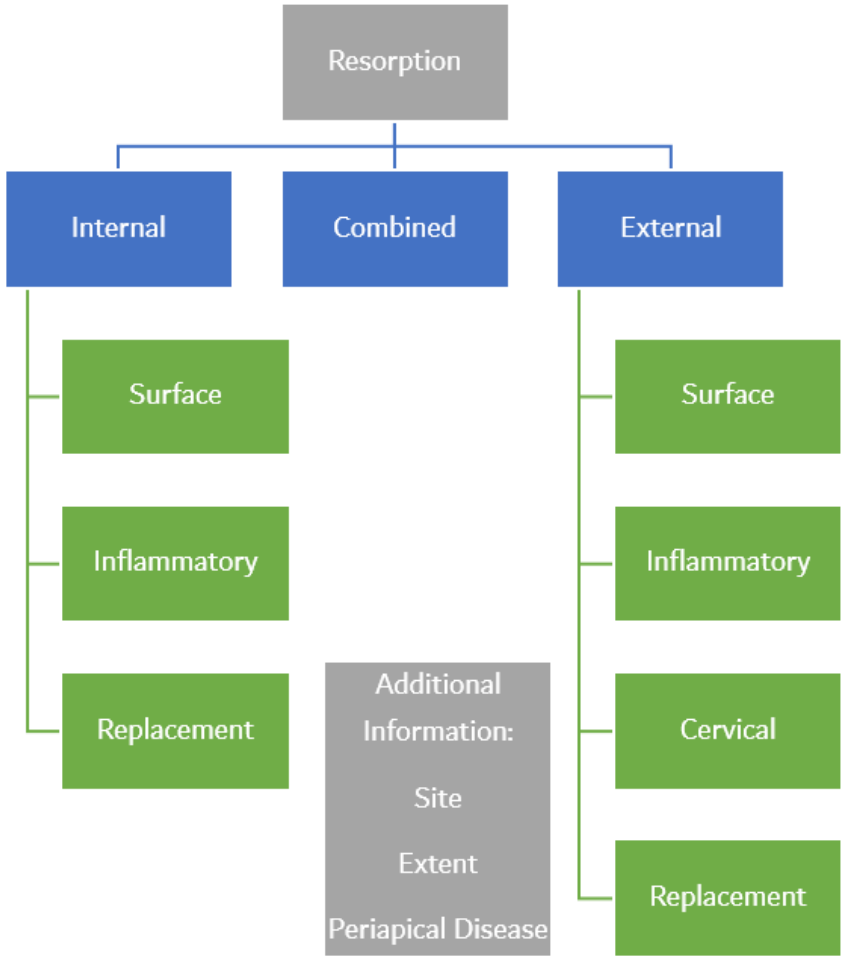


APPENDIX 8: CLASSIFICATION OF PATIENT'S CURRENT HEALTH STATUS

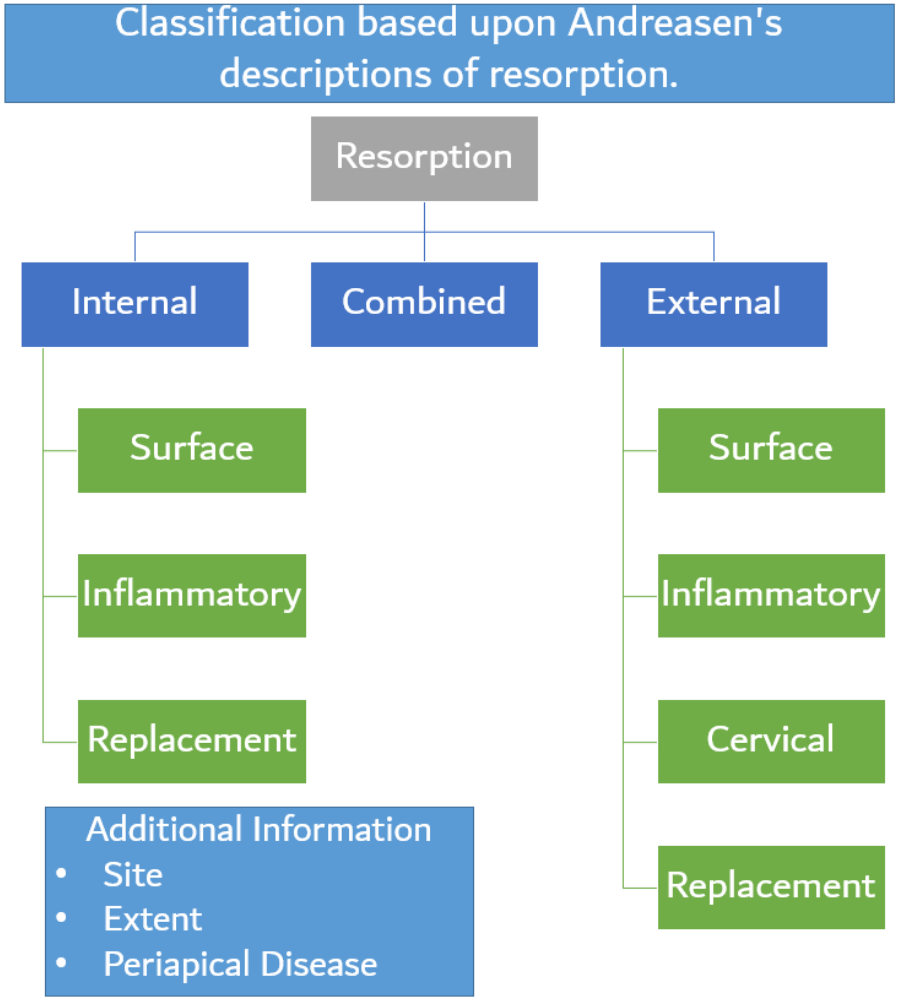
ASA PS Classification	Definition	Examples, include but are not limited to:
ASA I	A normal healthy patient, without organic, physiologic, or psychiatric disturbance	Healthy patient with good exercise tolerance, non-smoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30 < BMI < 40), well-controlled DM/HTN, mild lung disease, anaemia, pregnancy
ASA III	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled DM or HTN, CHF, Stable Angina, old MI, COPD, Bronchospastic disease with intermittent symptoms, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, chronic renal failure, premature infant PCA < 60 weeks, history (>3 months) of MI, CVA, TIA, or CAD/stents.
ASA IV	A patient with severe systemic disease that is a constant threat to life	Examples include (but not limited to): recent (< 3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis, unstable angina, Symptomatic COPD, Symptomatic CHF, Hepatorenal failure
ASA V	A moribund patient who is not expected to survive without the operation	Examples include (but not limited to): ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction, sepsis syndrome with hemodynamic instability, Hypothermia, Poorly controlled Coagulopathy
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	
E	This modifier is added to any of the above classes to signify a procedure that is being performed as an emergency and may be associated with a sub optimal opportunity for risk modification	

Note 1: The American Society of Anesthesiologists Physical Class System was designed to describe the patient's current health status. As such, it is one of the most important factors used to assess the overall.

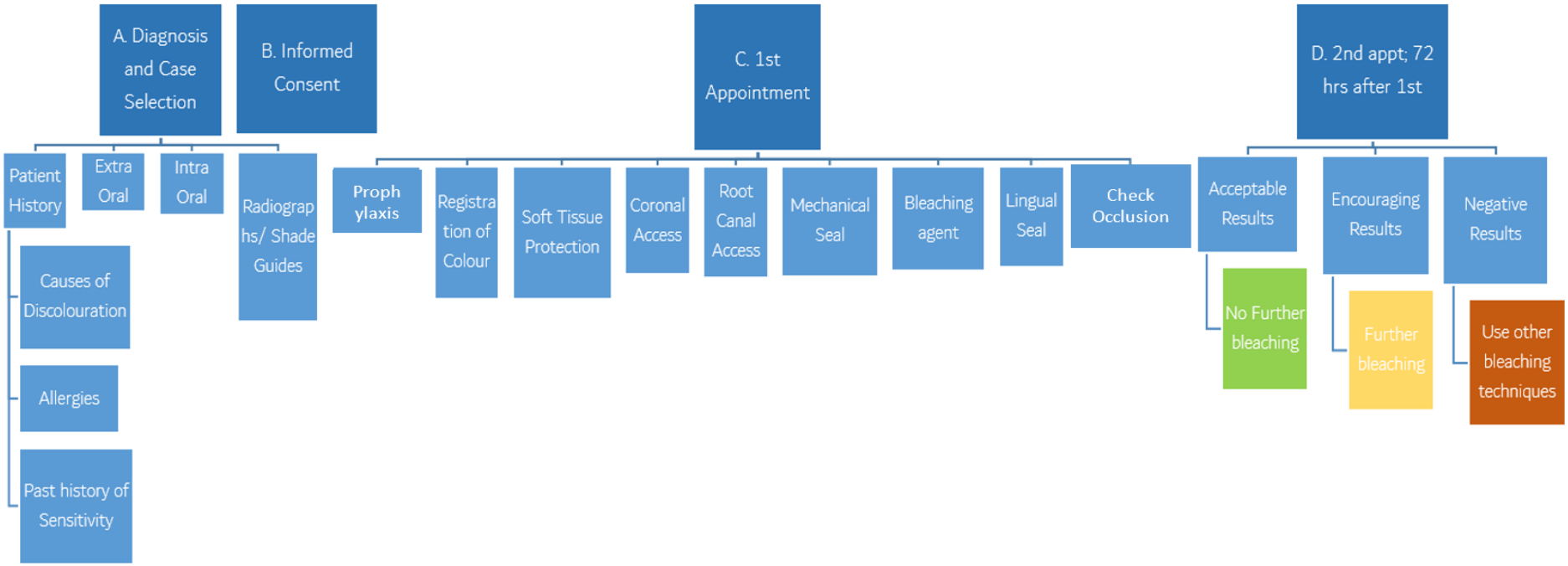
APPENDIX 9: ANDERSENS DESCRIPTIONS OF RESORPTION



APPENDIX 10: ANDERSENS CLASSIFICATION OF ROOT RESORPTION



APPENDIX 11: CHART SUMMARIZING THE STEPS FOR THE INTRACORONAL BLEACHING



APPENDIX 12: MANAGEMENT OF A TREATED WRONG TOOTH