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“Effective management of emergency situations is an important aspect of dental practice. Discuss the various endodontic emergencies that may present to your practice, and how you would manage them.”

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1. Introduction

Endodontic emergencies represent a significant and complex part of everyday clinical practice. These emergencies typically involve pain and/or swellings that occur pre-operative, intra-operative, inter-operative, and post-operative. Effective management for such cases includes a period of pain relief prior to a definitive restoration to ultimately prevent systemic involvement.

Before any treatment can commence, effective management involves reviewing and updating the medical and dental history of the patient. An important medical complication may be easily overlooked in an emergency and can greatly affect the patient's treatment and management. A thorough clinical examination and appropriate special investigations should be carried out to reach an accurate diagnosis following the medical history.

Pre-operative Emergencies

1. Management of Vital Pulp (irreversible pulpitis) with or without symptomatic apical periodontitis

Irreversible pulpitis is the presence of a degenerative inflammatory process within the pulp whereby the pulp is no longer capable of healing (1). When the inflammatory process extends into the apical periodontium producing clinical symptoms of pain on biting and percussion this is reported as symptomatic apical periodontitis (1). The classic signs and symptoms of irreversible pulpitis include extreme sensitivity, high intensity dull ache, spontaneous, constant, nocturnal, and sometimes water-

sipping (2).

Treatment commences with achieving profound local anaesthesia (LA). The clinician should be aware that this can be difficult in these cases due to the hypersensitivity of the pulp, which can result in failure of anaesthesia. Explanations for this can include the inflamed tissue decreasing the pH and effector form available, upregulation of Tetrodotoxin resistant class of sodium channels to LA, lack of penetration to the sensory nerves as stated by the central core theory or even patient's apprehensive nature lowering their pain threshold (3-8).

In order to improve achieving profound LA the following should be completed. Firstly, commence by reducing the patient's anxiety either psychologically and/or pharmacologically. A recent study found that 83.1% of patients with irreversible pulpitis suffered from moderate or high dental anxiety, which has been shown to lower the pain threshold (9, 10). A clinician can do this by gaining the patient's confidence, providing attention, sympathy, and allowing the patient control of the situation (11, 12). Pharmacotherapy should be considered in select cases after reviewing the patient's medical condition and psychology. As a small percentage of these patients can be extremely anxious, and may require being managed with nitrous oxide or oral benzodiazepines (9, 13-15). It is important to note that patients who have taken or are given an oral sedative in the dental office must have transportation provided and the potential drug interactions with other centrally acting agents considered.

Secondly, the method of LA delivery can improve the chances of achieving profound LA. Sufficient time for the solution to diffuse and reach activation sites should be allowed, which may take up to 20 minutes. The clinician should understand that this situation requires more volume of LA solution while still considering safe toxicity limits. For effective anaesthesia it is recommended the use Lignocaine 2% + Adrenaline 1:80,000 and Prilocaine 3% + Felypressin 0.53ug/ml. The adrenaline works to constrict arterioles, while Felypressin constricts venules and as a result there is a decrease in

the systemic absorption of the LA (16, 17). Other types of injections that can be used are intraseptal injections, intrapulpal and intraosseous injections (18, 19).

Once profound LA is achieved, complete cleaning and shaping of the root canals is the preferred treatment, if time permits. When there is limited time, most of the pulpal tissue is extirpated with a barbed broach (partial pulpectomy) in single-rooted teeth or, in molars a partial pulpectomy is performed on the largest canals (palatal or distal root) (20, 21).

Use of a barbed broach with a twist and rotation action can be used to engage the pulp in combination with H-files or rotary NiTi's to complete the extirpation. After final irrigation of the canals with sodium hypochlorite (NaOCl) and aspiration, an intracanal dressing is placed. The use of Odontopaste® (5% clindamycin hydrochloride and 1% triamcinolone acetonide) by paste-filler is recommended due to its anti-inflammatory and antibacterial properties assisting with pain relief and reducing bacteria viability by more than 99% (22). It should not be added to calcium hydroxide (Ca(OH)₂) as this will result in reductions of the respective antibiotic and steroid component (23, 24). Following this, the access cavity should be sealed with Cavit and a temporary filling material with a good seal (GIC or IRM).

Most symptoms should be relieved by the removal of the inflamed tissues for irreversible pulpitis with asymptomatic apical periodontitis. But for symptomatic apical periodontitis the use of post-operative analgesics may be necessary and should follow Figure 1 (25). If the patient has GI disorders, active asthmatics, hypertension, renal impairment and anticoagulant therapy then paracetamol should be used (Fig. 1). It is important for adequate analgesia that the patient take the first dose before the loss of local anaesthesia and then take the NSAID by the clock (4-6 hourly), rather than as needed (PRN) (26).

Administering a long acting anaesthetic, reassuring the patient, removing (or reducing) the irritant, and prescribing an analgesic will usually reduce post-operative pain significantly.







Pt can have NSAIDs		Pt can not have NSAIDs	
Mild Pain			
 Ibuprofen 400mg 4 - 6 hrly Max 2400mg/24hrs	 Paracetamol 500-1000mg 4 - 6hrly Max 4g/24hrs		
Moderate Pain			
 Ibuprofen 600mg + Paracetamol 1000mg 4 - 6 hrly	 Paracetamol 1000mg + Codeine 60mg 4 - 6hrly		
Severe Pain			
 Ibuprofen 600mg + Paracetamol 1000mg + Codeine 60mg 4 - 6 hrly	 Paracetamol 1000mg + Codeine 60mg or 10mg Oxycodone 4 - 6hrly		

Figure 1. Illustration comparing analgesic medications that can be administered for various severity of pain depending on whether the patient can have NSAIDs or not (27 – 29).

2. Non-vital pulp (pulp necrosis) with no swelling or with acute apical abscess (localized or diffuse swelling)

In this case an inflammatory reaction occurs as a result of pulpal infection and necrosis which is characterised by rapid onset, spontaneous pain, extreme tenderness of the tooth to pressure, possible pus formation, swelling of associated tissues and may have no radiographic signs of destruction (1). Treatment is biphasic in these situations involving the removal or reduction of the pulp irritants and the relief of the apical fluid pressure.

Treatment commences by obtaining profound LA, this can be achieved using the same techniques as mentioned previously with a few changes. Intraseptal, intraligamentary and intraosseous injections may not be as effective in these cases. Instead, anaesthesia for swellings, involves wide infiltrations around the swelling or block injections.

Occlusal reduction can be completed to prevent occlusion pressure on the tooth as this can reduce levels of post-operative pain (30, 31). The tooth is accessed, and any drainage is performed through the tooth. The canal is debrided and irrigated with copious amounts of NaOCl. If still draining, wait until it stops or is considerably reduced, fill with Odontopaste (32), seal with Cavit and a well-sealed temporary filling.

If there is a localised swelling, the above-mentioned debridement of the canal(s) is still performed first if drainage comes readily after opening and instrumentation this should be confined to the root canal system. If the fluctuant swelling is not deflated by the intracanal approach then incision and drainage of the swelling may be required.

Relief of pressure is the most important aspect in pain control for these patients, however, mild-moderate pain with analgesic regimen is appropriate (Fig. 1). The patient should be seen again within 2-4 days to re-dress and check for further drainage. Completion of the canal prep should be finished. $\text{Ca}(\text{OH})_2$ should be then placed for at least 7 days as this allows the slow acting antimicrobial agent to predictably eliminate bacteria (33).

Antibiotics are only required for diffuse, rapidly spreading swelling if systemic signs like fever, malaise and elevated temperature are present. However, it should be recognised that antibiotics are not an alternative to appropriate cleaning and disinfection of the root canal system (Fig. 2). If there are no systemic signs, then removal of the irritant by canal debridement is adequate.

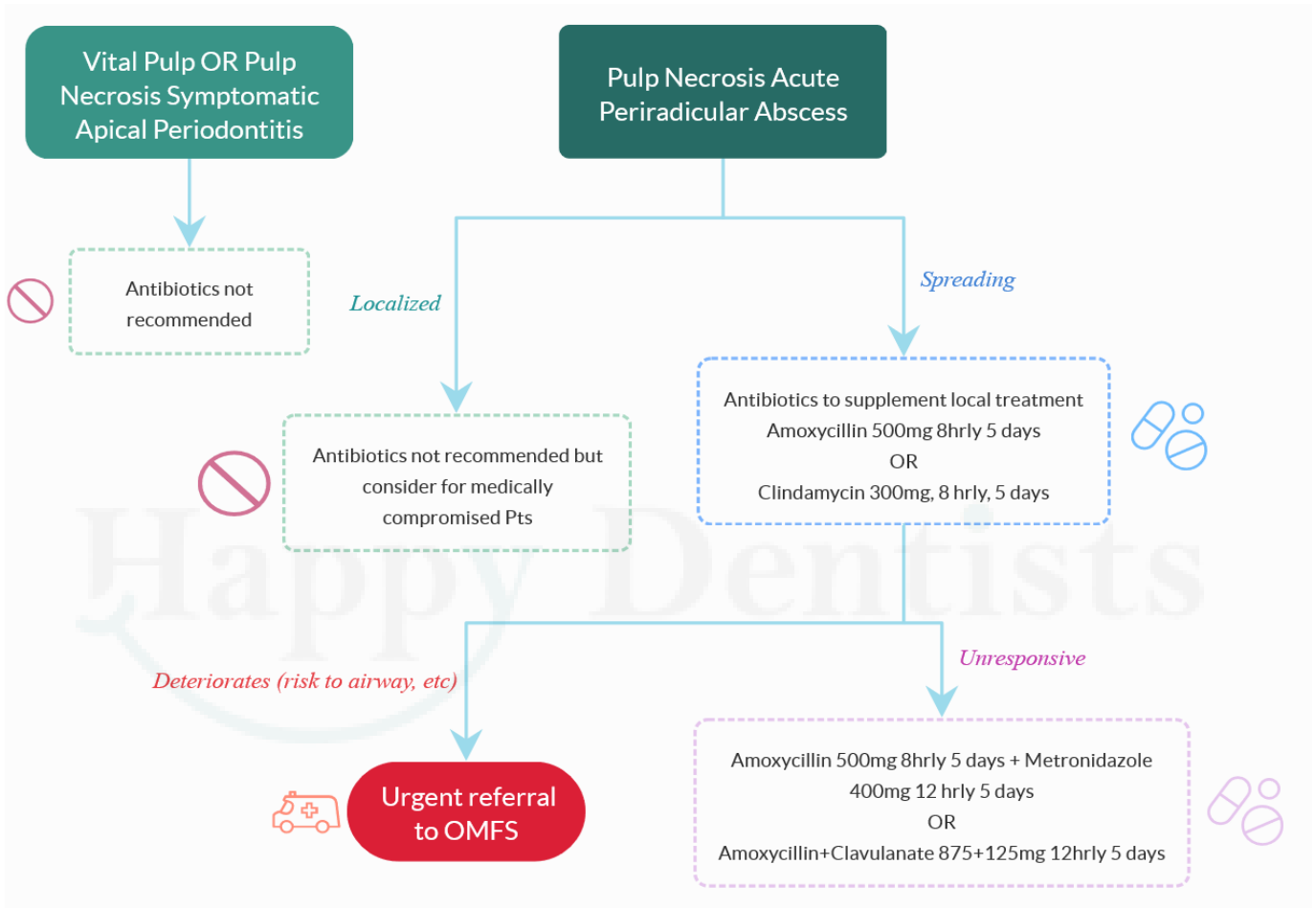


Figure 2. An illustration assisting decision making on when and which antibiotics are appropriate to take with what circumstance (27, 34).

Rapidly progressive and spreading swellings, commonly referred to as cellulitis, may have progressed into the fascial spaces. If there are systemic signs indicating a more serious infection like Ludwig's angina or there is any risk to the airways, this is classified as a medical emergency and the patient should urgently be referred to the hospital or OMFS clinic.

Post-operative Instructions:

Communication is vital for effective management. Patients must be informed of their responsibilities and what will transpire. The pain and swelling will take time to resolve, therefore patients must understand proper nutrition, adequate intake of fluids, and medications must be taken as prescribed. They must recognise that the problem may recur or worsen (flare-up), requiring another emergency visit (35). A follow-up call to the patient the next day has been shown to reduce pain perception and allows the clinician the opportunity of monitoring the progress of the patient (36).

3. Trauma

With any dental trauma that constitutes a head injury, the first step should involve checking for signs of serious concussion/haemorrhage such as vision changes, memory loss, vomiting, nausea and headaches. If signs are present, referral to a hospital is indicated (37).

In terms of dental trauma emergencies involving permanent teeth, these can either require immediate or urgent (being as soon as possible) attention.

3.1. Immediate attention

3.1.1. Avulsion

Avulsion is the complete displacement of the tooth out of its socket. It is vital that the clinician takes occlusal and periapical radiographs at initial presentation to confirm the diagnosis and rule out possible intrusion, root fracture, alveolar fracture or jaw fracture (37).

The area should be cleaned, haemostasis achieved and assessed for injuries. If the tooth has not been replanted, then LA administration and irrigation of the socket should be completed before replantation. Afterwards, suture any gingival lacerations if present. The position should be then verified clinically

and radiographically, followed by application of a flexible splint. Patient's tetanus status should be confirmed as they may require a booster.

Endodontic treatment depends on whether the tooth is an immature or mature tooth. Permanent immature teeth have the possibility of revascularisation of the pulp space and thus endodontic treatment should be delayed. The risk of infection-related root resorption should be weighed up against the chances of revascularisation. If revascularisation does not occur, endodontic treatment is recommended. Whereas, for mature permanent teeth, endodontic treatment is indicated at initial presentation.

The patient should be informed to avoid participation in contact sports, have soft foods for up to 2 weeks, brush teeth with a soft toothbrush after each meal and use chlorhexidine (0.1%) mouth rinse for 1 week. Splint removal, clinical and radiographic review should follow Figure 4 guidelines.

Ankylosis is unavoidable after delayed replantation and must be taken into consideration. Careful follow-up is required in combination with good communication to ensure the patient and guardian are informed about this likely outcome (37).

3.1.2. Luxation

Luxation injuries involve partial or total separation of the periodontal ligament (PDL), resulting in displacement of the tooth within the alveolar socket. These include Extrusion, Intrusion and Lateral Luxation. They differ based on the direction of displacement that occurs, being either forced out, forced in, or in another direction other than axially (respectively). In Extrusion the tooth is elongated, is tender to percussion, excessively mobile, usually lacks a pulpal response except for teeth with minor displacements and radiographic findings show an increased periapical ligament space.

In contrast, lateral luxation involves the tooth being displaced lingually or labially, having a high metallic (ankylotic) sound when percussed, usually immobile, generally lacks a pulpal response except for teeth with minor displacements and displays a widened PDL space radiographically.

Both extrusive and lateral luxation injuries require repositioning and splinting. The length of time needed for splinting varies with the severity of injury (Fig 4). Indications for endodontic treatment for these teeth have been shown in Figure 3. (37, 38).

Treatment of intrusive luxation injuries depends on root maturity. If the tooth is immature, it may be repositioned spontaneously, and the pulp may revascularise. Therefore, the patient must be monitored carefully for any complications (Fig. 3). Whereas for mature teeth, active extrusion may be required, either orthodontically or surgically. Endodontic treatment is indicated for mature intruded teeth, commencing 2-3 weeks after the trauma event.

The patient should be informed to have soft foods, brush teeth with a soft toothbrush after each meal and use chlorhexidine (0.1%) mouthrinse for 1 week. Splint removal, clinical and radiographic review should follow Figure 4 (37).

3.1.3. Crown Root Fracture

This is a fracture involving enamel, dentine, and cementum with loss of tooth structure and exposure of the pulp. The crown fracture extends below the gingival margin, is tender to percussion, has mobility of the coronal fragment and a positive sensibility test. Radiographic findings may show an apical extension of the fracture that is usually not visible clinically. Emergency treatment requires pulp therapy. Endodontic treatment is indicated except for those with immature roots, in which case pulpotomy is preferable (37). Monitoring and review should follow Figure 4.

3.1.4. Complicated Crown Fracture

This fracture involves the loss of tooth structure confined to enamel or in combination with dentine that does involve the pulp. There is evident loss of enamel and dentine, with visible sign of exposed pulp, not tender to percussion, normal mobility and usually has a positive sensibility test. Radiographic findings show enamel and dentine loss but should be performed to exclude displacement or possible presence of a root fracture. Treatment involves either pulp capping, pulpotomy or endodontic treatment before a restoration can be placed. If there is a small exposure occurring within a very short time of revealing the pulp, pulp capping is recommended. Whereas, a partial (Cvek) pulpotomy is indicated for large pulp exposures or if the pulp has been exposed for a longer period in immature teeth (39, 40). Mature roots can either have a pulpotomy or endodontic treatment, with more inclination for the latter especially when there are long wait times between the incident and treatment. Monitoring and review should follow Figure 4.

3.1.5. Transverse Root Fracture

This injury involves a fracture confined to the root of the tooth involving cementum, dentine and the pulp. The coronal segment may be mobile and, in some cases displaced, the tooth is tender to percussion, sensibility test is usually negative but may be positive and require monitoring. An occlusal radiographic will usually show a visible line through a horizontally or diagonal plane. Treatment involves the repositioning of the coronal fragment and use of a rigid splint (resin composite) for 3 months if required (41). Oral hygiene and antibiotics are indicated as this promotes healing, in combination with monitoring (Fig. 3). Endodontics should not be commenced unless complication signs are present (Fig. 3). Splint removal, clinical and radiographic review should follow Figure 4. Follow-up may include endodontic treatment of the coronal fragment if pulp necrosis develops. This decision may be taken after 3 months of follow-up if the tooth has pulpal signs (Fig. 3).

3.1.6. Alveolar Fracture

This injury involves a fracture of the alveolar process which may or may not involve the alveolar socket. The displacement of the alveolar segment, typically associated with these teeth will move as a unit, be tender to percussion and negative to a sensibility test. Radiographically, there will be a vertical line that may run along the PDL or in the septum. The horizontal line may be located anywhere from the marginal bone to the basal bone, with associated root fractures that may be present. The initial management involves stabilisation of the fracture, which should be performed by an Oral and Maxillofacial Surgeon. Endodontic treatment should be considered for teeth that lack a response to pulp testing that is not resolved within 3-6 months along with the presence of other indicators (Fig 3). Monitoring and review should follow Figure 4 (37).

3.2.Urgent:

3.2.1. Uncomplicated crown fracture

This injury involves the loss of tooth structure confined to enamel or in combination with dentine that does not involve the pulp. There is visible loss of enamel and dentine, with no visible sign of exposed pulp, no tender to percussion, normal mobility and usually positive sensibility test. Radiographic findings show enamel and dentine loss but should be performed to exclude displacement or possible presence of a root fracture. Treatment involves providing pulp protection, cleaning of exposing dentine and restoring ideally the fractured natural tooth. Review periods with continue monitoring of the pulpal status (Fig 3) that should follow Figure 4 guidelines (37).

3.2.2. Concussion and subluxation

Concussion is an injury to the tooth supporting structures without increased mobility or displacement of the tooth, but with pain to percussion (37). Whereas, subluxation is an injury to the tooth supporting

structures with increased mobility, but without displacement of the tooth. Radiographic findings for both are usually show no abnormalities. Treatment involves the use of a flexible splint to stabilize the tooth for patient comfort for up to 2 weeks and review periods with continue monitoring of the pulpal status (Fig 3) that should follow Figure 4 guidelines (37).

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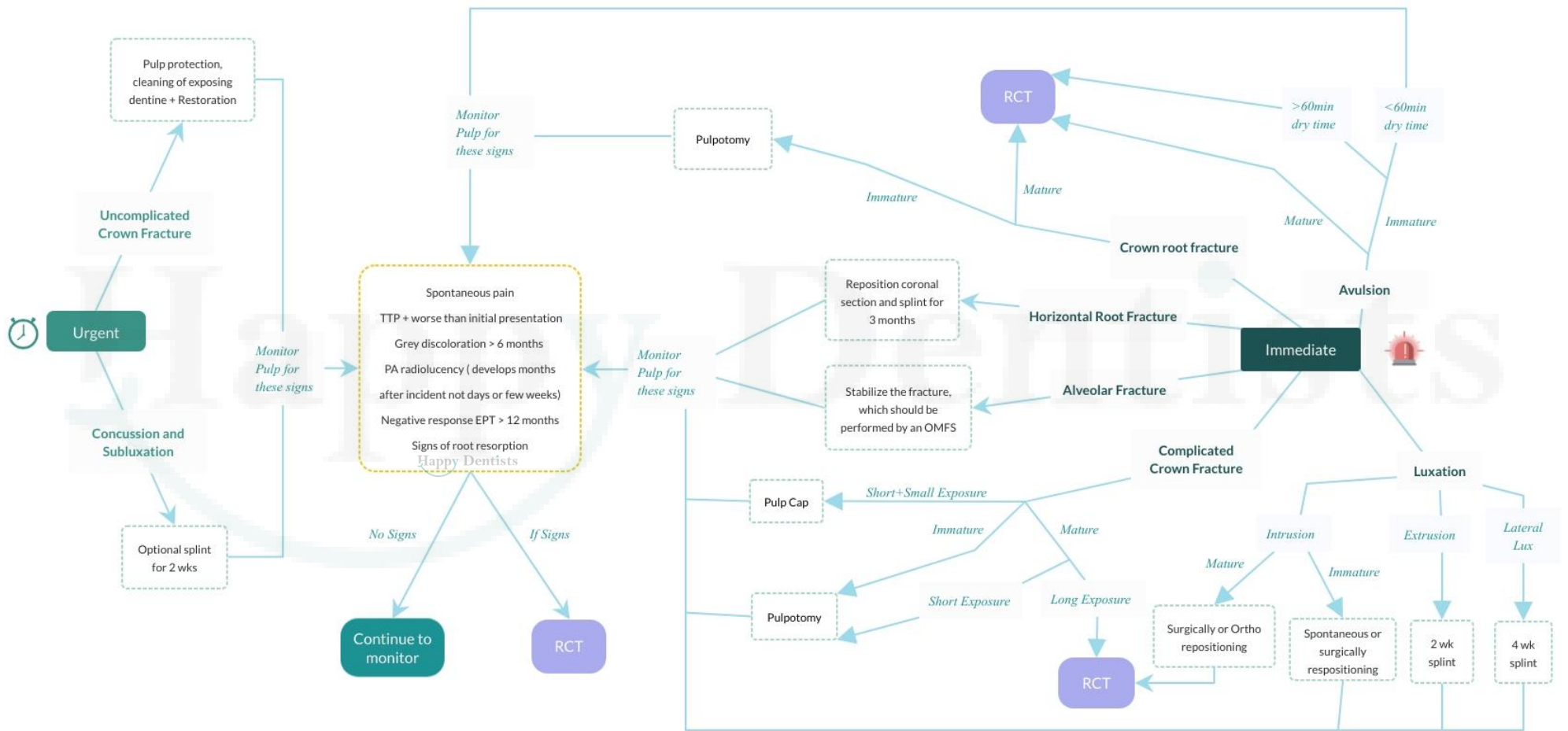


Figure 3. A Summary flow chart for decision marking regarding treatment for trauma emergencies involving permanent teeth. (adaptation to recommendations in Andreasen & Pedersen 1985) (37,38).

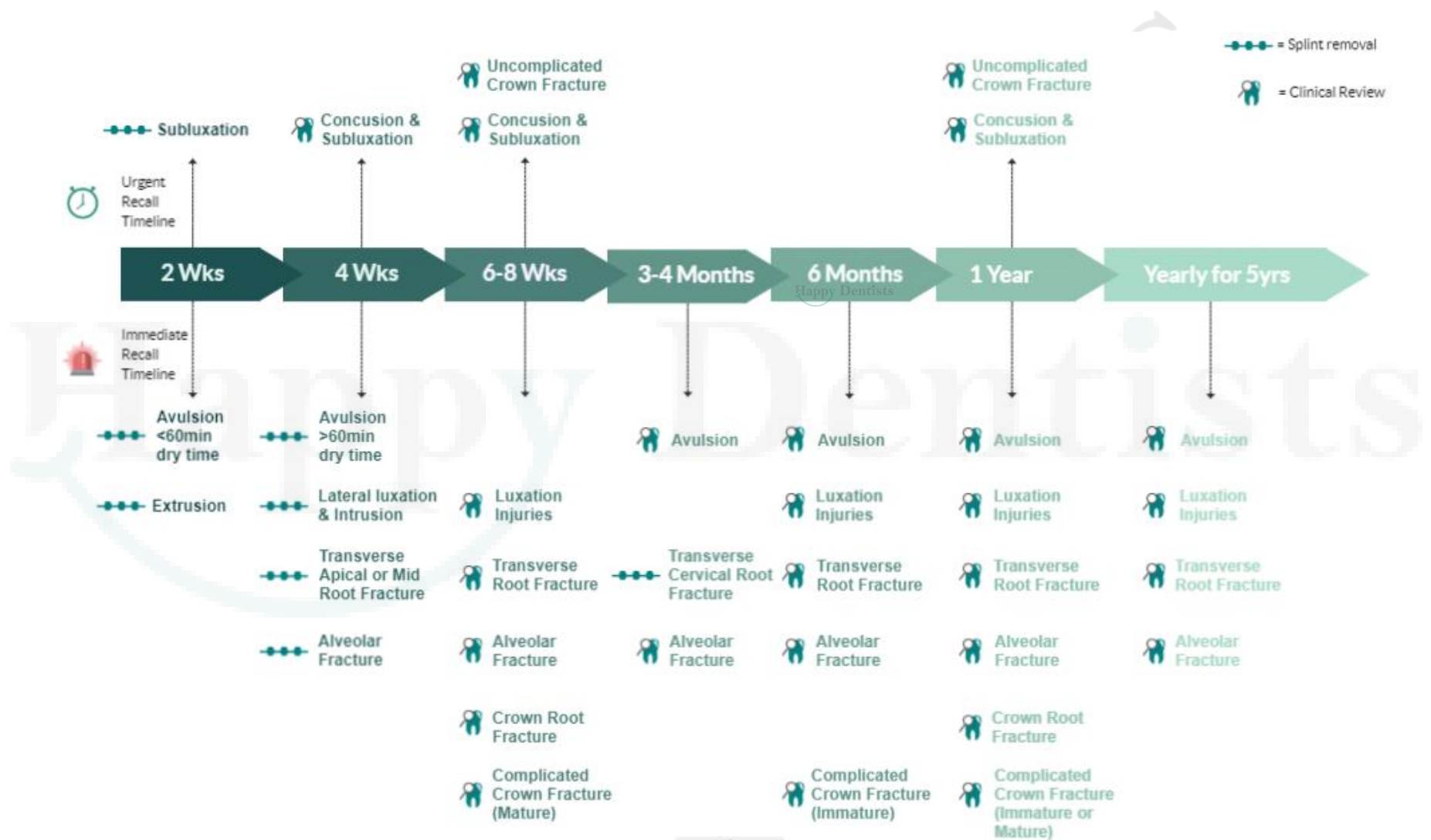


Figure 4. A recommended timeline for splint removal, and clinical review for trauma emergencies involving permanent teeth (37, 38, 42).

Intra-operative emergencies

A NaOCl incident is an emergency occurring during treatment. Management of which involves explanation to the patient about the situation, dilution of NaOCl with LA solution, pain control with the addition of more LA and NSAIDs. A cold pack should be used for the first 24hrs for 10 minutes on, 10 minutes off and then a warm pack as required on the second day. Referral to nearest maxillofacial team in which systemic antibiotics can be given and with the use of systemic steroid medication to control the inflammation in severe cases (43).

Inter-operative emergencies

The interappointment flare-up is a true dental emergency, usually involving the progression of a condition (44). Occasionally, a previously treated tooth (with or without complete debridement) will develop into an acute apical abscess or an acute apical abscess may become cellulitis again. This requires the appropriate drainage and reassurance as mentioned above.

Post-operative emergencies

Mild post-operative pain is common. Treatment should involve effective communication about possible discomfort for the first few days, especially for patients who had higher levels of preoperative

pain, reassurance and administration of analgesics for mild pain (Fig. 1). Patients with post obturation emergencies that do not respond to therapy should be referred to an endodontist for other treatment modalities.

Conclusion

As discussed throughout this essay, effective management of emergency situations form the backbone of care that dentists provide to the public. When done by a clinician with current knowledge and the cooperation of the patient, the probability of a favourable outcome is increased.

References:

1. AAE. Endodontic Diagnosis. American Association of Endodontists. 2017;Colleagues for excellence.
2. Carotte P. Endodontics: Part 3 Treatment of endodontic emergencies. British dental journal. 2004 2004/09/01;197(6):299-305.
3. Byers MR, Taylor PE, Khayat BG, Kimberly CL. Effects of injury and inflammation on pulpal and periapical nerves. J Endod. 1990 Feb;16(2):78-84. PubMed PMID: 2388022. Epub 1990/02/01. eng.
4. Roy ML, Narahashi T. Differential properties of tetrodotoxin-sensitive and tetrodotoxin-resistant sodium channels in rat dorsal root ganglion neurons. Journal of Neuroscience. 1992;12(6):2104-11.
5. Modaresi J, Dianat O, Soluti A. Effect of pulp inflammation on nerve impulse quality with or without anesthesia. Journal of endodontics. 2008;34(4):438-41.
6. Strichartz G. Molecular mechanisms of nerve block by local anesthetics. Anesthesiology. 1976;45(4):421-41.
7. de Jong RH. Neural blockade by local anesthetics. Life sciences. 1977;20(6):915-9.
8. Perković I, Romić MK, Perić M, Krmek SJ. The Level of Anxiety and Pain Perception of Endodontic Patients. Acta Stomatol Croat. 2014;48(4):258-67. PubMed PMID: 27688374. eng.
9. Khan S, Hamedy R, Lei Y, Ogawa RS, White SN. Anxiety Related to Nonsurgical Root Canal Treatment: A Systematic Review. Journal of Endodontics. 2016 2016/12/01;42(12):1726-36.
10. Dou L, Vanschaayk MM, Zhang Y, Fu X, Ji P, Yang D. The prevalence of dental anxiety and its association with pain and other variables among adult patients with irreversible pulpitis. BMC Oral Health. 2018;18(1):101-. PubMed PMID: 29879974. eng.
11. Marshall JG, Liesinger AW. Factors associated with endodontic posttreatment pain. Journal of endodontics. 1993;19(11):573-5.
12. Wepman B. Psychological components of pain perception. Dental clinics of North America. 1978;22(1):101.
13. Saxen M, Newton C. Managing the endodontic patient with disabling anxiety or phobia. Journal (Indiana Dental Association). 1999;78(4):21-3.
14. Berthold CW, Dionne RA, Corey SE. Comparison of sublingually and orally administered triazolam for premedication before oral surgery. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 1997;84(2):119-24.
15. Kaufman E, Hargreaves KM, Dionne RA. Comparison of oral triazolam and nitrous oxide with placebo and intravenous diazepam for outpatient premedication. Oral surgery, oral medicine, oral pathology. 1993;75(2):156-64.
16. Altura BM, Hershey SG, Zweifach BW. Effects of a Synthetic Analogue of Vasopressin on Vascular Smooth Muscle. Proceedings of the Society for Experimental Biology and Medicine. 1965;119(1):258-61.
17. Olgart L, Gazelius B. Effects of adrenaline and felypressin (octapressin) on blood flow and sensory nerve activity in the tooth. Acta Odontologica Scandinavica. 1977;35(1-3):69-75.

18. Dunbar D, Reader A, Nist R, Beck M, Meyers WJ. Anesthetic efficacy of the intraosseous injection after an inferior alveolar nerve block. *Journal of endodontics*. 1996;22(9):481-6.
19. Stabile P, Reader A, Gallatin E, Beck M, Weaver J. Anesthetic efficacy and heart rate effects of the intraosseous injection of 1.5% etidocaine (1: 200,000 epinephrine) after an inferior alveolar nerve block. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2000;89(4):407-11.
20. Oguntebi BR, DeSchepper EJ, Taylor TS, White CL, Pink FE. Postoperative pain incidence related to the type of emergency treatment of symptomatic pulpitis. *Oral surgery, oral medicine, oral pathology*. 1992;73(4):479-83.
21. Hasselgren G, Reit C. Emergency pulpotomy: pain relieving effect with and without the use of sedative dressings. *Journal of endodontics*. 1989;15(6):254-6.
22. Plutzer B, Zilm P, Ratnayake J, Cathro P. Comparative efficacy of endodontic medicaments and sodium hypochlorite against *Enterococcus faecalis* biofilms. *Australian Dental Journal*. 2018;63(2):208-16.
23. Athanassiadis M, Jacobsen N, Parashos P. The effect of calcium hydroxide on the steroid component of Ledermix® and Odontopaste®. *International Endodontic Journal*. 2011;44(12):1162-9.
24. Athanassiadis M, Jacobsen N, Nassery K, Parashos P. The effect of calcium hydroxide on the antibiotic component of Odontopaste® and Ledermix® paste. *International Endodontic Journal*. 2013;46(6):530-7.
25. Keiser K. Strategies for managing the endodontic pain patient. *Texas dental journal*. 2003;120(3):250-7.
26. Ong CK, Seymour RA, Lirk P, Merry AF. Combining paracetamol (acetaminophen) with nonsteroidal antiinflammatory drugs: a qualitative systematic review of analgesic efficacy for acute postoperative pain. *Anesthesia & Analgesia*. 2010;110(4):1170-9.
27. Dowden J, Abbott P, Goss AN, McCullough M, Matthews J, Pope J, et al. *Therapeutic Guidelines: Oral and Dental: Version 1*. Therapeutic Guidelines Limited; 2007.
28. Elzaki WM, Abubakr NH, Ziada HM, Ibrahim YE. Double-blind Randomized Placebo-controlled Clinical Trial of Efficiency of Nonsteroidal Anti-inflammatory Drugs in the Control of Post-endodontic Pain. *J Endod*. 2016 Jun;42(6):835-42. PubMed PMID: 27080115. Epub 2016/04/16. eng.
29. Keiser K, Hargreaves KM. Building effective strategies for the management of endodontic pain. *Endodontic Topics*. 2002;3(1):93-105.
30. Emara R, Abou El Nasr H, El Boghdadi R. Evaluation of postoperative pain intensity following occlusal reduction in teeth associated with symptomatic irreversible pulpitis and symptomatic apical periodontitis: a randomized clinical study. *International endodontic journal*. 2019;52(3):288-96.
31. Rosenberg PA, Babick PJ, Schertzer L, Leung A. The effect of occlusal reduction on pain after endodontic instrumentation. *Journal of Endodontics*. 1998 1998/07/01;24(7):492-6.
32. Ehrmann EH, Messer HH, Adams GG. The relationship of intracanal medicaments to postoperative pain in endodontics. *Int Endod J*. 2003 Dec;36(12):868-75. PubMed PMID: 14641427. Epub 2003/12/04. eng.
33. Mohammadi Z, Shalavi S, Yazdizadeh M. Antimicrobial activity of calcium hydroxide in endodontics: a review. *Chonnam medical journal*. 2012;48(3):133-40.
34. Fouad AF. Are antibiotics effective for endodontic pain? *Endodontic Topics*. 2002;3(1):52-66.
35. Walton R, Fouad A. Endodontic interappointment flare-ups: a prospective study of incidence and related factors. *Journal of endodontics*. 1992;18(4):172-7.
36. Touyz LZ, Marchand S. The influence of postoperative telephone calls on pain perception: a study of 118 periodontal surgical procedures. *Journal of orofacial pain*. 1998;12(3).
37. Andreasen JO, Lauridsen E, Gerds TA, Ahrensburg SS. *Dental Trauma Guide: A source of evidence-based treatment guidelines for dental trauma*. *Dental Traumatology*. 2012;28(5):345-50.
38. Andreasen J. Challenges in clinical dental traumatology. *Dental Traumatology*. 1985;1(2):45-55.
39. Cvek M. A clinical report on partial pulpotomy and capping with calcium hydroxide in permanent incisors with complicated crown fracture. *Journal of endodontics*. 1978;4(8):232-7.
40. Andreasen JO, Bakland LK, Flores MT, Andreasen FM, Andersson L. *Traumatic dental injuries: a manual*: John Wiley & Sons; 2011.
41. Andreasen FM, Andreasen JO, Bayer T. Prognosis of root-fractured permanent incisors—prediction of healing modalities. *Dental Traumatology*. 1989;5(1):11-22.
42. Diangelis AJ, Andreasen JO, Ebeleseder KA, Kenny DJ, Trope M, Sigurdsson A, et al. *International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth*. *Dental traumatology : official publication of International Association for Dental Traumatology*. 2012 Feb;28(1):2-12. PubMed PMID: 22230724. Epub 2012/01/11. eng.
43. Hülsmann M, Hahn W. Complications during root canal irrigation—literature review and case reports. *International Endodontic Journal*. 2000;33(3):186-93.
44. Jayakodi H, Kailasam S, Kumaravadivel K, Thangavelu B, Mathew S. Clinical and pharmacological management of endodontic flare-up. *Journal of Pharmacy & Bioallied Sciences*. 2012:S294-S8. PubMed PMID: 79923823.