ENDODONTIC RETREATMENT

PRESENTED BY : DR. SHIKHA KANODIA

CONTENTS

Introduction

The main objectives of endodontic treatment are to prevent or treat apical periodontitis so that the tooth can be retained in the oral cavity in healthy conditions .

Due to the central role of microbes in the pathogenesis of apical periodontitis, it is logical that eradication of the microbes from the infected tooth is regarded as the key to healing .

The technical and biological goal of root canal treatment is to shape the root canal in such a way that effective disinfection can be achieved and the root canal system can be adequately filled.

When treatment is done properly, healing of the periapical lesion usually occurs with osseous regeneration, which is characterized gradual reduction and resolution of the radiolucency on subsequent follow-up radiographs .

If eradication of the infection cannot be successfully completed and if the residual microbes (after the treatment) communicate with host tissues, healing will be compromised.

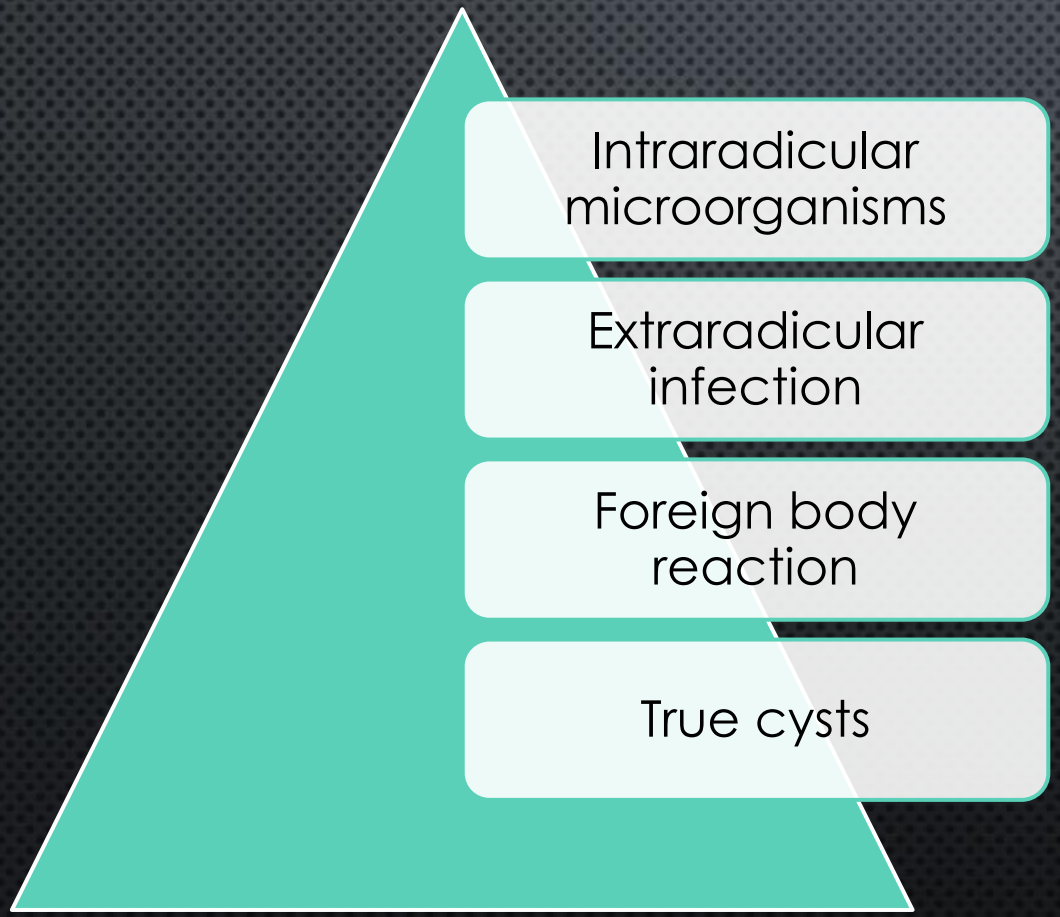
Endodontic treatment failure is usually characterised by the presence of post-treatment apical periodontitis.

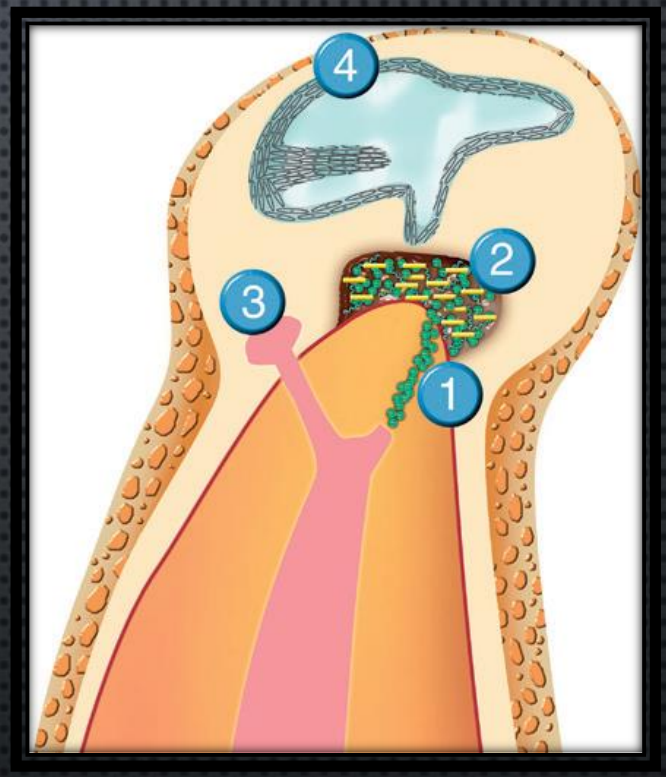
Healing of lesions in retreatment cases ranges from 56% to 84%, whereas initial treatment of apical periodontitis is 83 to 100%[ingle]

.

The reasons for treatment failure can be multivalent. Correct diagnosis of failure is very important for deciding the retreatment option.

- **ETIOLOGIC FACTORS**





INTRARADICULAR MICROORGANISMS

- MAJOR CAUSE OF POST TREATMENT DISEASE

Bacteria may sometimes be unaffected by endodontic disinfection procedures in areas such as isthmuses,ramifications, deltas, irregularities,, especially the most apical part of it, and the apical delta (apical lateral canals) are the most common sites for bacteria to remain and form biofilm

The bacteria found in these cases are predominantly Gram-positive cocci, rods and filaments. By culture-based techniques, species belonging to the **genera Actinomyces, Enterococcus and Propionibacterium (previously Arachnia)** are frequently isolated and characterized from such root canals.

E. FAECALIS IS THE ONLY SPECIES THAT HAS BEEN WIDELY STUDIED FOR ITS CAPACITY TO FORM BIOFILMS

E. faecalis **is a gram-positive, facultative anaerobic coccus persistant endodontic infections.**

Enterococcus faecalis can survive prolonged starvation . It can grow as mono infection in treated canals in the absence of synergistic support from other bacteria

it can use serum from dentin and as a source of nutrition. This ensures survival of E.faecalis and allows bacteria to adhere and invade the dentinal tubulesIt can use fluid in PDL as nourishment

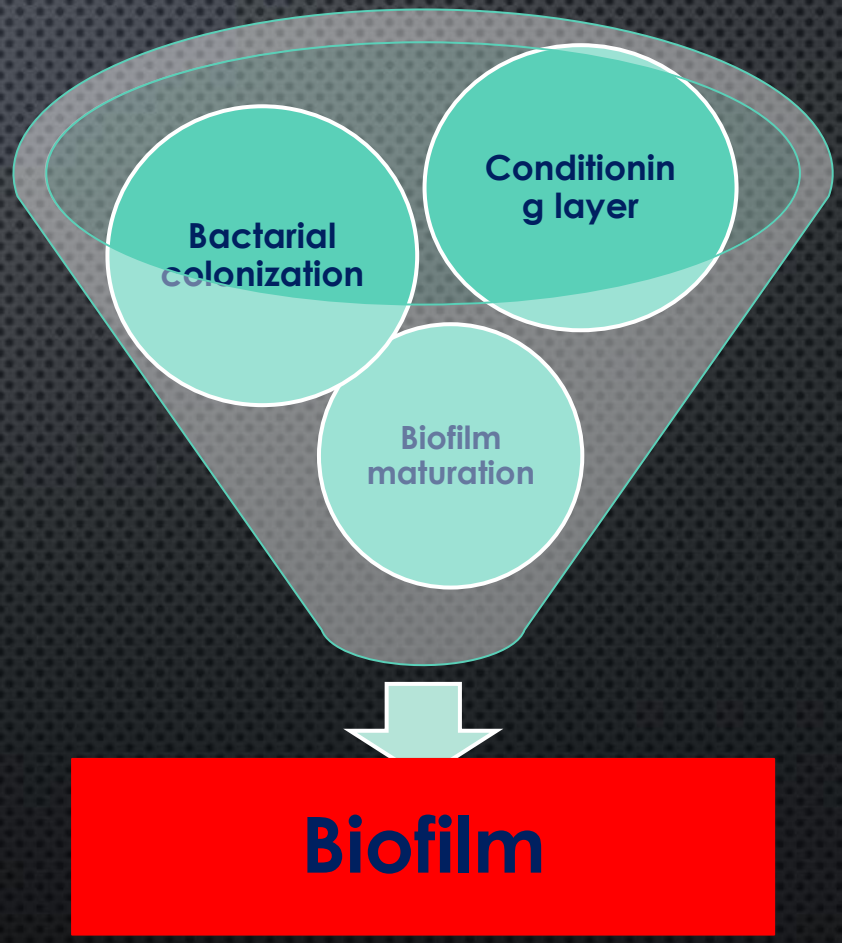
E. faecalis **in dentinal tubules can resist intracanal dressings of calcium hydroxide and can tolerate PH 11.5 for over 10 days by forming a biofilm at temperature 10 to 60degree. Resistance occurs probably by virtue of its ability to regulate internal pH withan efficient proton pump**

E. faecalis **is able to suppress the action of lymphocytesBacteria lose the ability to grow in culture media but maintain viability and pathogenicity and are able to resume division when favorable environmental conditions are restored**

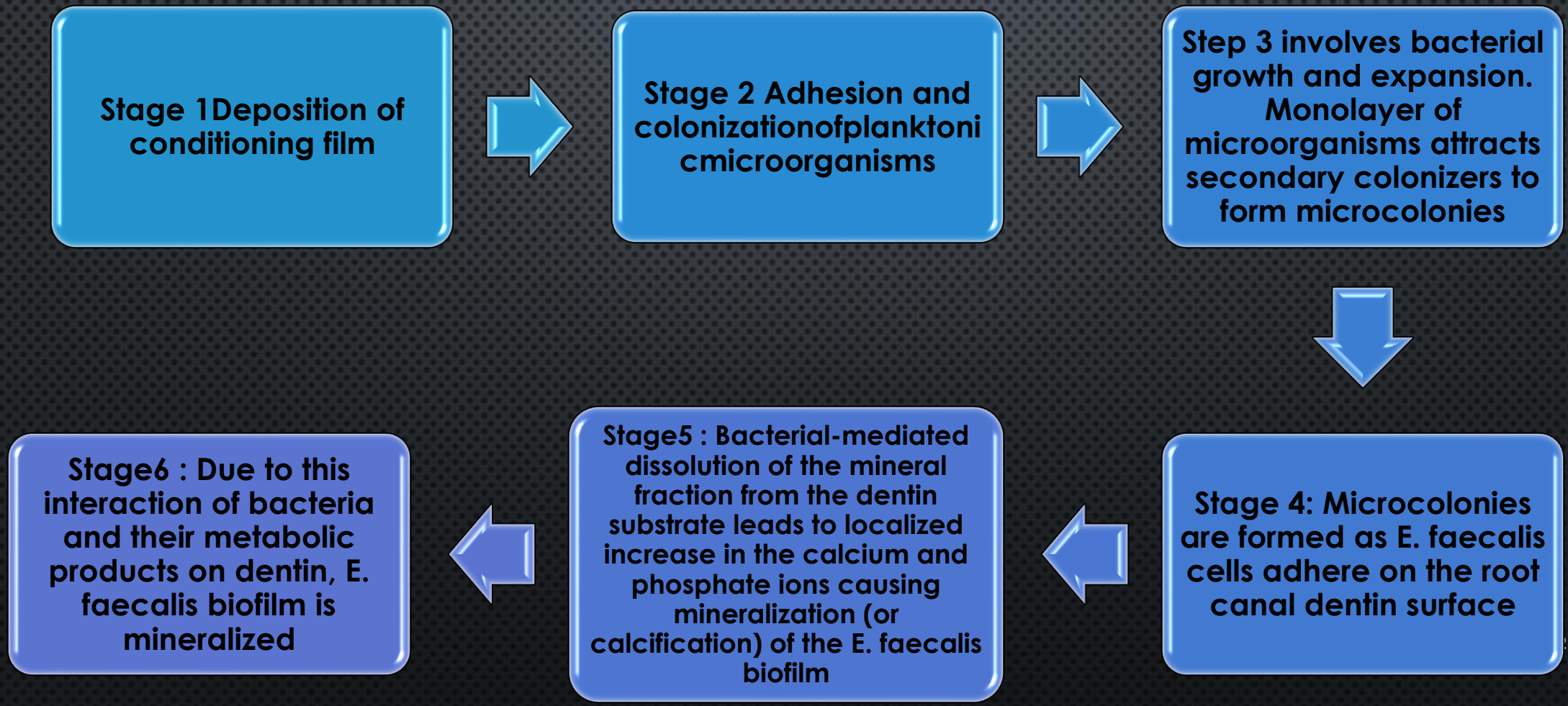
Enterococcus faecalis can inactivate antimicrobial agents such as metronidazole and also can protects organisms like B. Fragilis found in multispecies biofilm producing synergistic effect

Post treatment Endodontic disease is a biofilm-mediated infection.

Biofilms are defined as polysaccharide matrix enclosed bacterial population's adherent to each other and /or to surfaces or interfaces.
According to AAE biofilm defined as "Aggregrate of bacteria held together by a matrix of carbohydrate that adheres to a surface and solution interface"



The development of *E. faecalis* biofilm on the root canal dentin involve stages as follows:



Microbiological and correlative electron microscopic studies have shown the presence of yeasts in canals of root filled teeth with unresolved apical periodontitis. Candida albicans is the most frequently isolated fungus from root filled teeth with apical periodontitis (Molander et al. 1998, Sundqvist et al. 1998).

Extraradicular cause

- Well treated tooth might also fail if microorganisms reach the periradicular tissues

  - Bacteria invade periradicular tissue either by
    - Direct spread of infection from the root canal space
    - Extrusion of infected dentin chips
    - Contamination with overextended, infected endodontic instruments.
  - Host response : destroy organisms
  - Some microorganisms : resist the immune defenses and persist in the periradicular tissues

Endodontic Topics 2003, 6, 78–95
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ENDODONTIC TOPICS 2003

Periapical Actinomycosis and infection with *Propionibacterium Propionicum*

JOSÉ F. SIQUEIRA JR

- Study using PCR identified P. propionicum ,Actinomyces species have also been identified .
- Actinomyces have been shown to posses a hydrophobic cell surface property, Gram-positive cell wall surrounded by a fuzzy outer coat through which fimbriae-like structures protrude (Figdor & Davies 1997). These may help the cells to aggregate into cohesive colonies (Figdor et al. 1992
- Because of the ability of the actinomycotic organisms to establish extra radicularly, they can perpetuate the inflammation at the periapex even after proper root canal treatment

Extraradicular biofilms formed on the root surface adjacent to the root apex of endodontically infected teeth are **ROOT SURFACE BIOFILMS**.

.

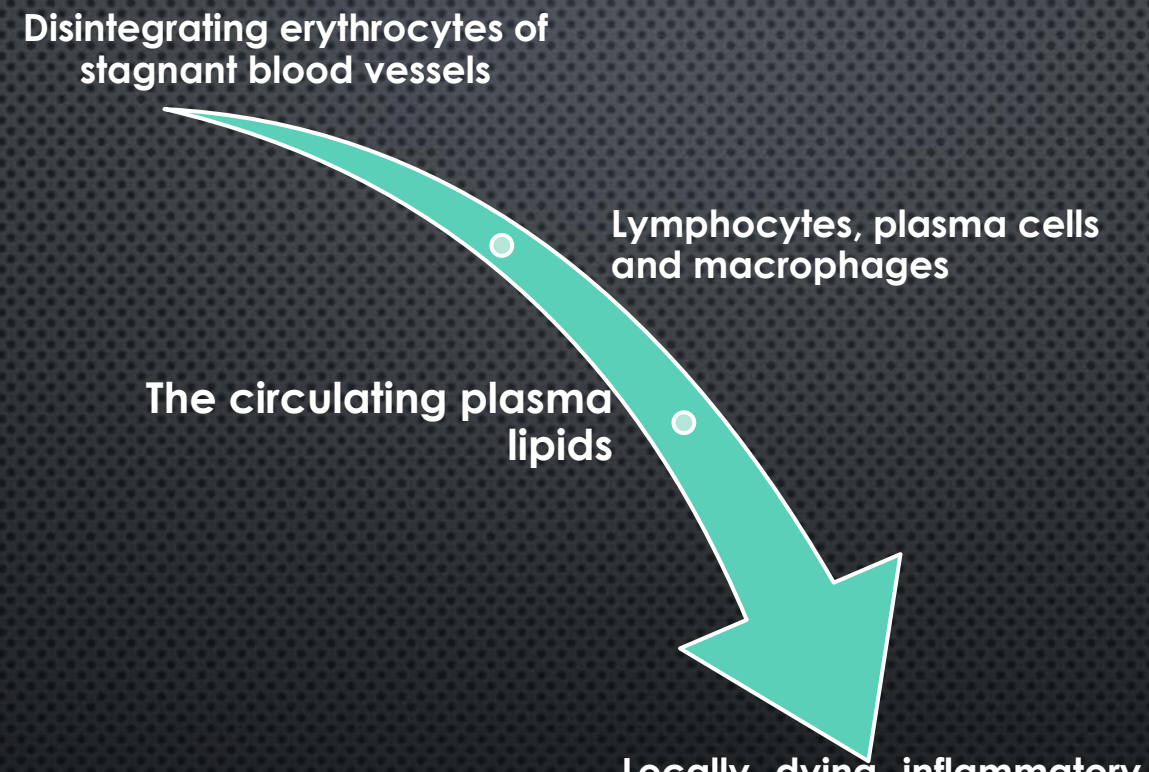
Extra radicular biofilm are usually dependent on the intraradicular infections.

CHOLESTEROL CRYSTAL

Cholesterol is a steroid lipid that is present in abundance in all 'membrane-rich' animal cells, can perpetuate apical periodontitis after root canal treatment by initiating a foreign-body reaction at the periapex (Nair, 20003) .

The incidence of cholesterol clefts in apical periodontitis varies from 18% to 44% of such lesions

The crystals are believed to be formed from cholesterol released by:



The macrophages and giant cells that surround cholesterol crystals are not only unable to degrade the crystalline cholesterol but also are major sources of apical inflammatory and bone-resorptive mediatorsCholesterol crystals are intensely sclerogenic . They induce granulomatous Lesions.

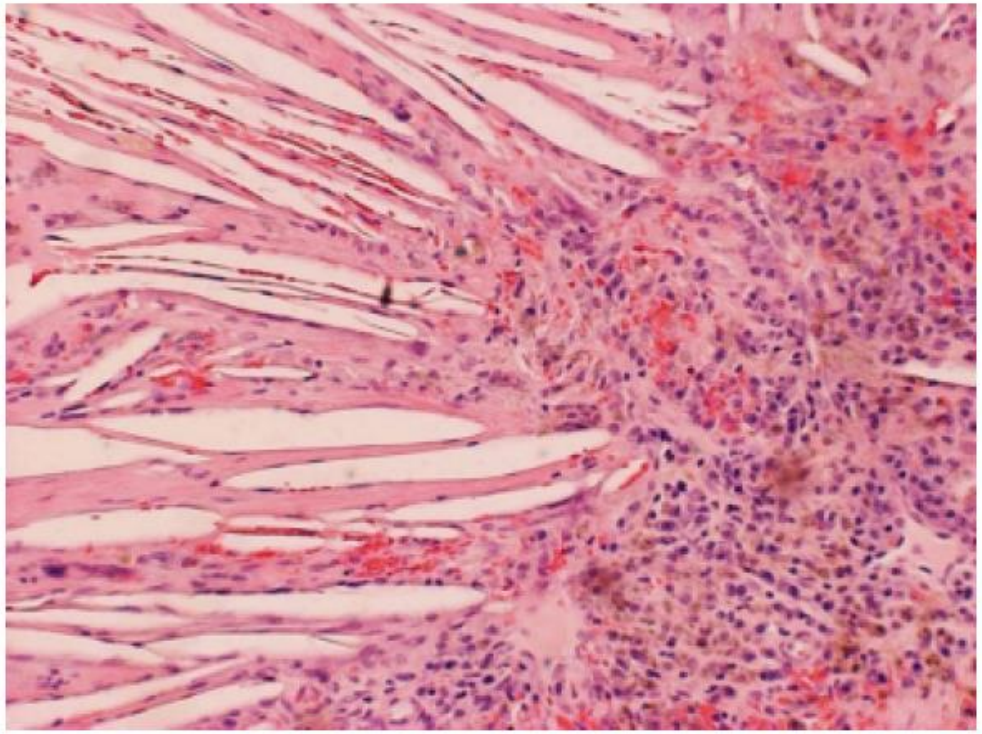


Fig. 16. A histological section (haematoxylin-eosin staining) shows numerous cholesterol crystals and a heavy accumulation of inflammatory cells in a specimen obtained from a tooth with a periapical inflammation.

Foreign material may become lodged in the periapical tissue and cause irritation and inflammation in the area, leading to the delay or prevention of healing.

Large pieces of gutta-percha are well encapsulated in collagenous capsules but fine particles of gutta-percha induce an intense, localized tissue response, characterized by the presence of macrophages and giant cells .

The congregation of macrophages around the fine particles of gutta-percha is important for the clinically observed impairment in the healing of apical periodontitis when teeth are root filled with excess material.

- Vegetable food particles, particularly pulses, the periapical tissue before and/or during endodontic treatment and cause treatment failures).
- Pulse granulomas are characterized by the presence of intensely iodine- and PAS-positive hyaline rings or bodies surrounded by giant cells and inflammatory cells.
- The endodontic paper points and cotton wool consist of cellulose that cannot be degraded by human body cells. They remain in tissues for long periods of time and induce a foreign-body reaction around them.

Fig. 19. A piece of a plant (green salad) was found during periapical surgery in the periapical abscess of a maxillary lateral incisor. Courtesy of Dr. Stefaan Vandenwijngaert in: *Visual Endodontics*, 2010.

Cysts

The differential diagnosis of a periapical lesion that is greater than 1 cm in diameter with well-defined margins will include the possibility of a radicular cyst

- 2 types of periapical cysts :
  - Periapical true cyst
  - Periapical pocket cyst.
  - Only 10 % cyst is true cyst

- True cysts, due to their self-sustaining nature, probably do not heal following nonsurgical endodontic therapy : Usually require surgical enucleation

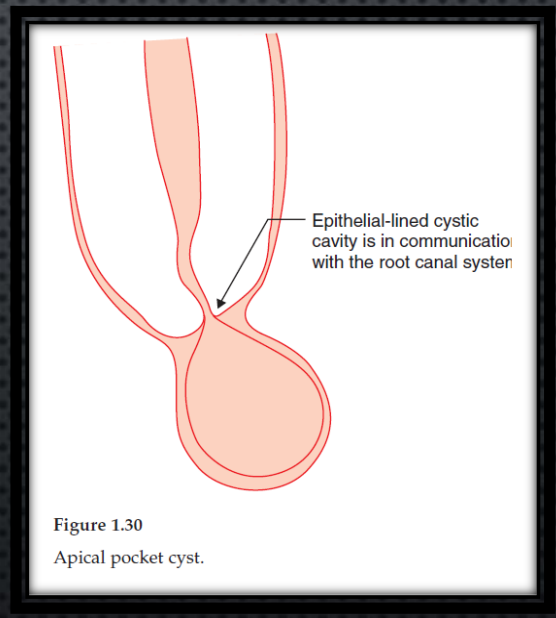


Figure 1.30
Apical pocket cyst.

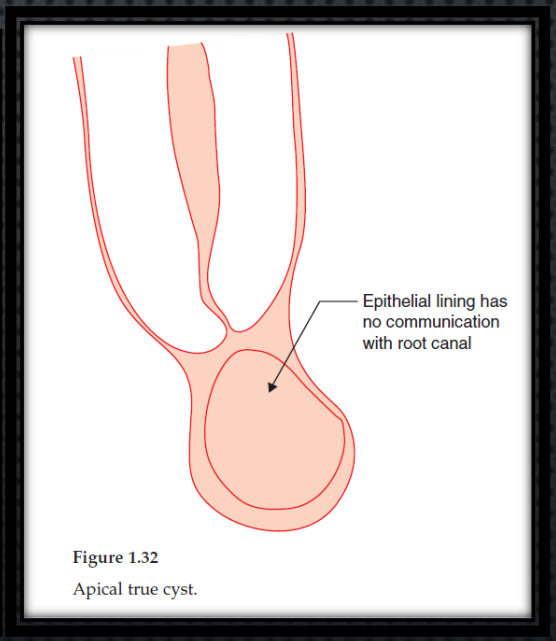


Figure 1.32
Apical true cyst.

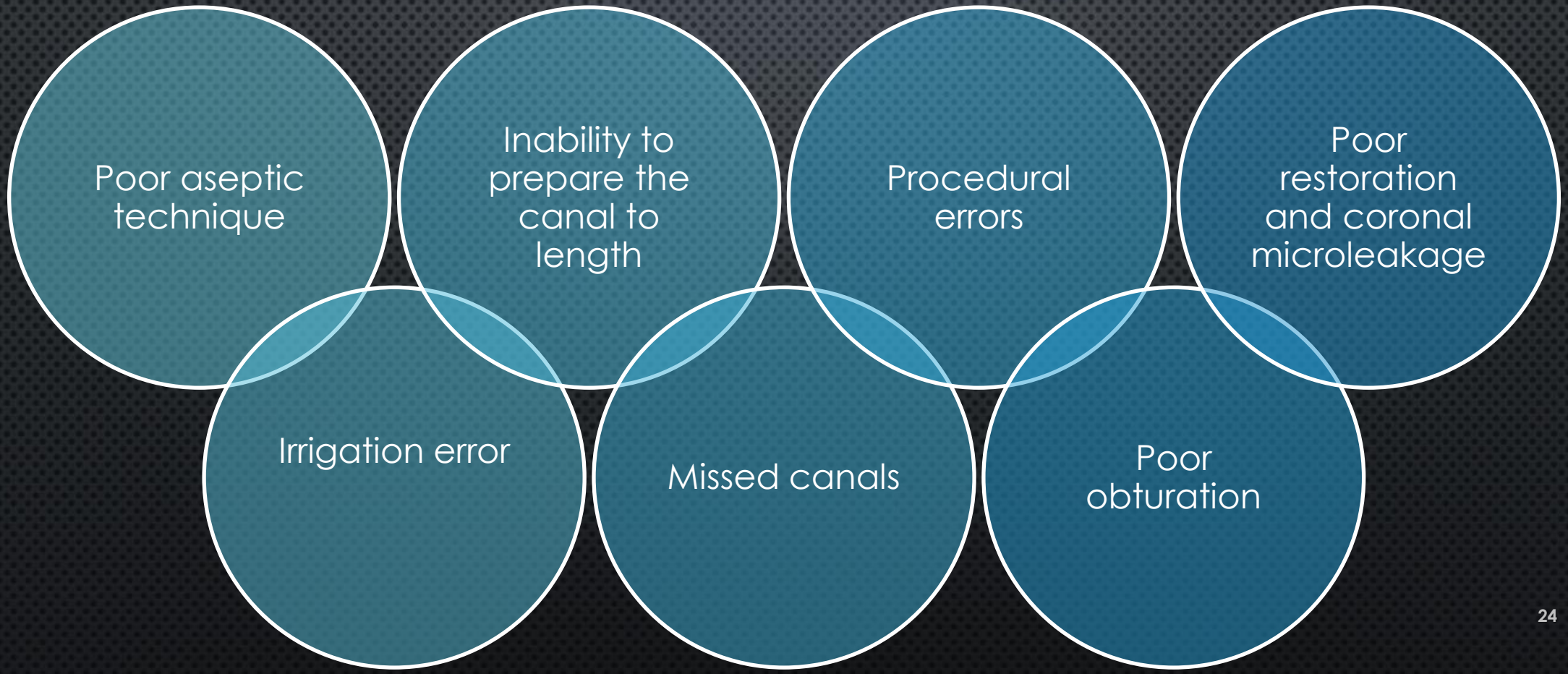
Successful nonsurgical management of a large radicular cyst: A case report with review of literature
Sweta Chaudhary1, Pranshu Tripathi1, Yogesh Upadhaya1, Priyank Seth2*International Journal of Contemporary Dental and Medical Reviews* (2015),

The recorded incidence of cysts among apical periodontitis lesions varies from 6% to 55%.

As orthograde root canal treatment removes much of the infectious material from the root canal and prevents reinfection by filling, a periapical pocket cyst may heal after such treatment .

But a true cyst is self-sustaining and larger compare to pocket cyst (Nair et al. 1993) by virtue of its tissue dynamics and independence of the presence or absence of irritants in the root canal

There are various technical failures that may predispose the root canal system to inadequate disinfection:

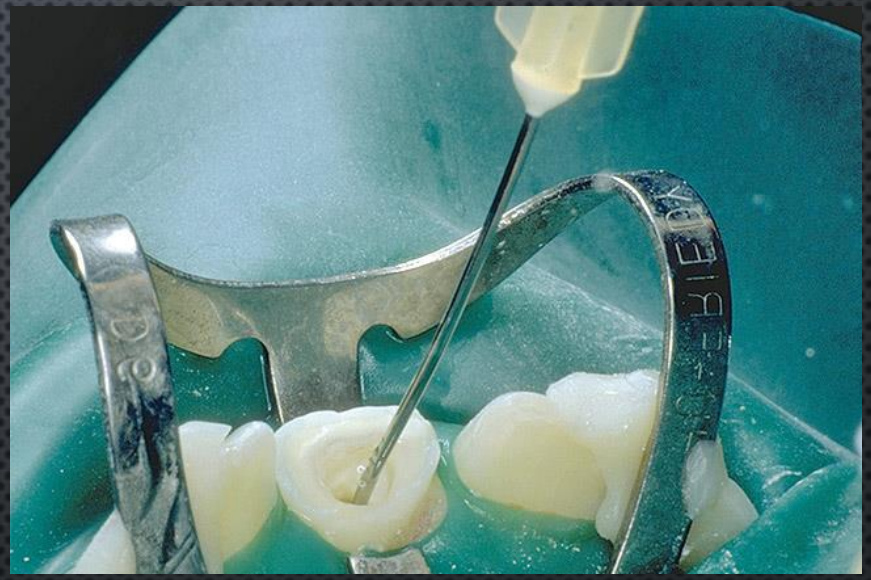


POOR ASEPTIC TECHNIQUE

Surveys carried out amongst dental practitioners show that the majority of root canal treatment is carried out without a rubber dam.

Practitioners that do not use a rubber dam concomitantly tend not to use biologically active irrigants.

The combined effect could have a significant bearing on the likelihood of success



Establishment and maintenance of asepsis in endodontics – a review of the literature

INABILITY TO PREPARE THE CANAL TO LENGTH

- Failure to achieve patency during preparation can result in inadequate penetration of irrigants.
- This could result in persistent infection and endodontic failure.
- There is an argument that if mechanical preparation, and consequently irrigant penetration, are 2–3 mm short of the constriction, the hypothetical length of canal that has not been disinfected could be as great as 6–7 mm

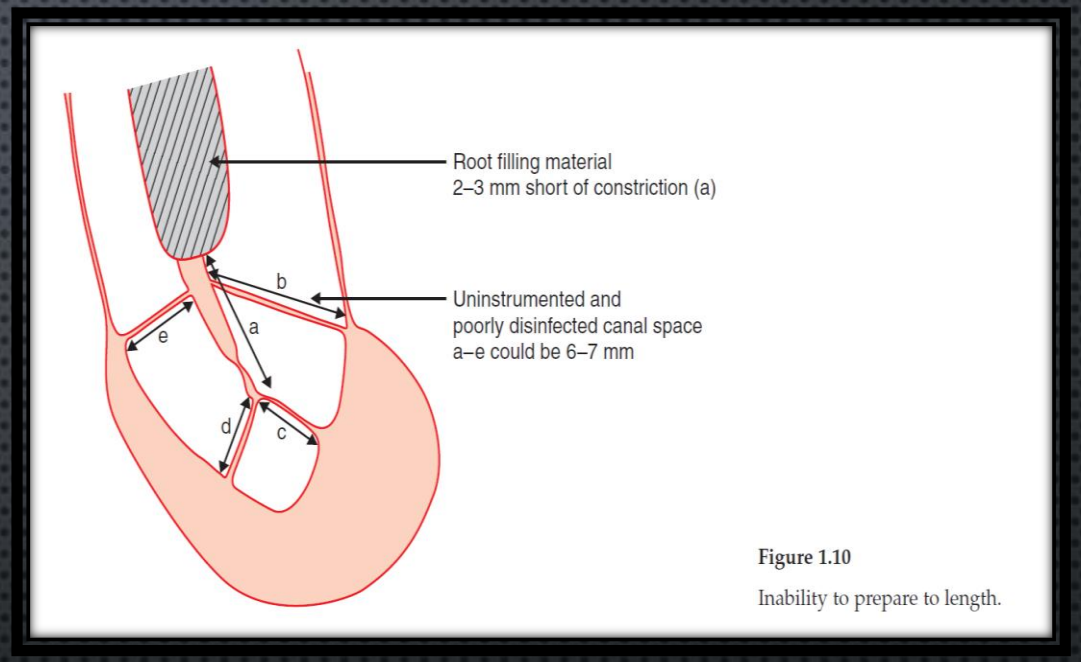


Figure 1.10

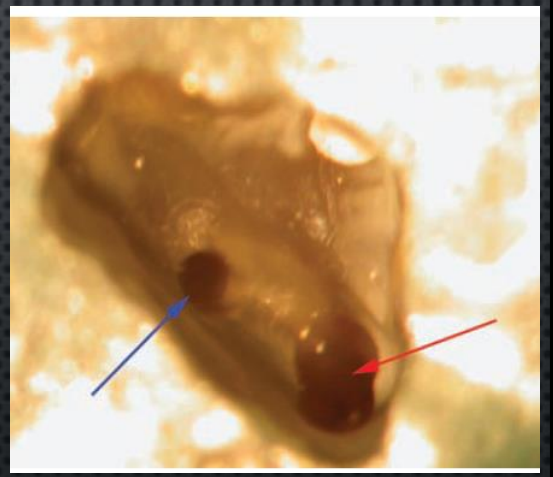
Inability to prepare to length.

Micro Computed Tomography Assessment of Apical Accessory Canal Morphologies

MISSED CANALS

Initially noninfected, untreated missed canals may function as a potentially vulnerable site for reinfection . Aberrant or unusual anatomy must therefore be considered in retreatment cases.

The frequency of post-treatment apical periodontitis in teeth with at least one untreated canal is 98%
Use of magnification and isolation and use proper radiographic method reduce these error.



Association between missed canals and apical periodontitis joe

PROCEDURAL ERRORS

- Procedural errors occurring during primary root canal treatment of an infected tooth may predispose the treatment to failure by making it more difficult to effectively disinfect the entire root canal system
- An artificially created deviation of the root canal wall that prevents the passage of an instrument to the apex of an otherwise patentcanal[1].
- This infected material may harbour bacteria that could result in persistent inflammation

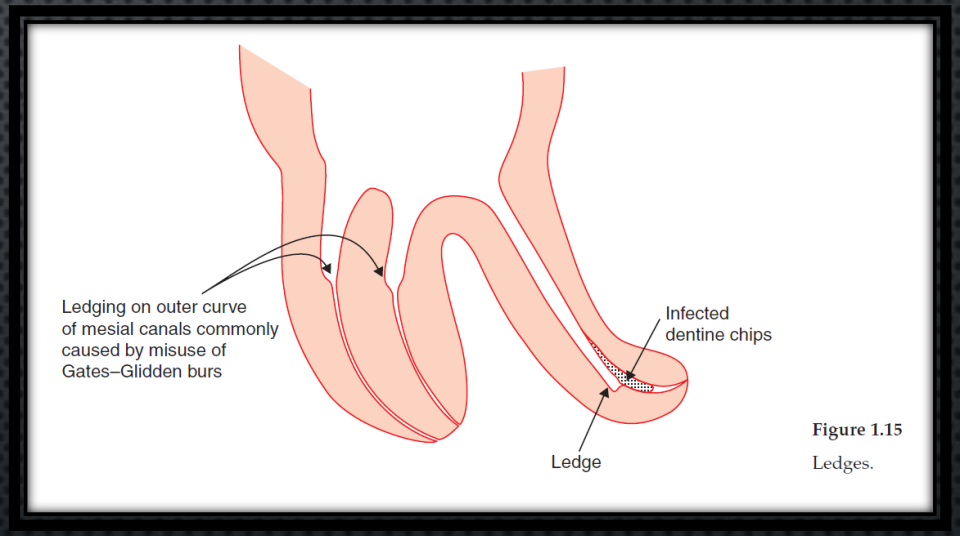


Figure 1.15
Ledges.

POOR OBTURATION & POOR CORONAL RESTORATION

In most cases, apical sealing is inadequate in overfilled root canals . Percolation of tissue fluids rich in glycoproteins into the root canal system can supply substrate to residual microorganisms, which can proliferate and reach sufficient number to induce or perpetuate a periradicular lesion.

Figure 4 Scanning electron micrograph of extruded gutta-percha cone in an overfilled tooth. Note the voids between the cone and the root canal walls (original magnification ×90).

Reasons for persistent and emerging post-treatment endodontic disease MARKUS HAAPASALO, YA SHEN & DOMENICO RICUCCI

In teeth with infected necrotic pulps overinstrumentation induces the displacement of infected dentine or debris into the periradicular tissues.

In this situation, microorganisms are physically protected from the host defence mechanisms and thereby can survive within the periradicular lesion and maintain periradicular inflammation.

The presence of infected dentine or cementum chips in the periradicular lesion has been associated with impaired healing (Yusuf 1982)

- For vital tooth obturation within 2-3 mm from apical constriction
- For non vital tooth obturation should at 0.5 mm from apical constriction acceptable

Recontamination of the root canal system by coronal leakage will occur through: sealer dissolution by saliva; percolation of saliva in the interface between sealer and root canal walls and/or between sealer and gutta-percha may reach the periradicular tissues via lateral canals or apical foraminas.

When the root canal filling is completed, a temporary coronal restoration is applied until the placement of the permanent restoration. Since temporary cements are water-soluble and have low resistance to compression, the temporary restoration should be replaced as soon as possible with the definitive restoration

Therefore, from a clinical standpoint, coronal exposure of the root canal obturation to saliva for a relatively short period of time (30 days or more) might be considered an indication for retreatment

CURRENT THREUPATIC OPTIONS FOR ENDODONTIC BIOFILM

INTRACANAL MEDICAMENTS

Ca(OH)2

2% Chlorhexidine with Ca(OH)2

Triple antibiotic paste

Comparison of Antimicrobial Effects of Triple Antibiotic Paste and Calcium Hydroxide Mixed with 2% Chlorhexidine as Intracanal Medicaments Against Enterococcus faecalis Biofilm

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[2] Associate Professor, Laser Research Center
Iran; Department of Endodontics, School of D
[3] Dentist, Private Practice, Tehran, Iran
[4] Postgraduate Student, Department of Endod

Abstract
Objectives
period nee
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canal syste
Materials
canals wer
canal prep
17% ethyl
Afterwards, the samples were sterilized with gamma ray and were placed inside microtubes

COUCLUSION

$Ca(OH)_2$/2% CHX paste can eliminate the *EF* biofilm from root canal walls in a shorter time compared to a TAP. The minimum time required by $Ca(OH)_2$/2% CHX paste and a TAP to eliminate *EF* from the root canal system is three days and seven days, respectively.

Journal of dentistryof Tehran university may2018

Antimicrobial Effects of Four Intracanal Medicaments on *Enterococcus Faecalis*: An *in Vitro* Study

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ABSTRACT

Introduction: The aim of this *in vitro* study was to evaluate the antimicrobial activity of four intracanal medicaments on *Enterococcus Faecalis* (*E. Faecalis*). **Methods and Materials:** Fifty extracted single-rooted human teeth were prepared with standard method. After contaminating the canals with *E. Faecalis*, the samples were divided into one control and four experimental groups (n=10). The teeth in each group were treated with one of the experimental medicaments, including calcium hydroxide (CH), 2% chlorhexidine gel (CHX), triple antibiotic paste (TAP) and nanosilver (NS). In control group, canals were filled with a neutral gel. Microbial samples were obtained from the roots after 7 days and optical density of the cultures was determined after 24 h of incubation. Optical density values were analyzed with one-way analysis of variance and Tukey's post hoc tests. **Results:** CHX gel and TAP were significantly more effective against *E. Faecalis* than CH, which was also significantly more efficient than NS and normal saline. In the paper cone samples, CHX gel was more effective than TAP; however, samples obtained with sizes 2 and 4 Gate Glidden drills, indicated that TAP was much more efficient than CHX.

IEJ july2014

Physical plasma is defined as a gas in which part of the particles are present in ionized form. This is achieved by heating a gas which leads to the dissociation of the molecular bonds and subsequently ionization of the free atoms. Thus, plasma consists of positively and negatively charged ions and negatively charged electrons. as well as radicals, neutral and excited atoms and molecules Plasma is effective for tooth disinfection. Scanning electron microscopy shows complete destruction of endodontic biofilms for a depth of 1 mm inside a root canal after plasma treatment for 5 min.

RESEARCH ARTICLE

Antibacterial efficacy of cold atmospheric plasma against *Enterococcus faecalis* planktonic cultures and biofilms *in vitro*

Felix Theinkom[1,2], Larissa Singer[1,2], Fabian Cieplik[2], Sylvia Cantzler[3], Hannes Weilemann[3], Maximilian Cantzler[3], Karl-Anton Hiller[2], Tim Maisch[1☯‡*], Julia L. Zimmermann[4☯‡]

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Abstract

Nosocomial infections have become a serious threat in our times and are getting more difficult to handle due to increasing development of resistances in bacteria. In this light, cold atmospheric plasma (CAP), which is known to effectively inactivate microorganisms, may be a promising alternative for application in the fields of dentistry and dermatology. CAPs are partly ionised gases, which operate at low temperature and are composed of electrons, ions, excited atoms and molecules, reactive oxygen and nitrogen species. In this study, the effect of CAP generated from ambient air was investigated against *Enterococcus faecalis*, grown on agar plates or as biofilms cultured for up to 72 h. CAP reduced the colony forming units (CFU) on agar plates by > 7 $\log_{10}$ steps. Treatment of 24 h old biofilms of *E. faecalis* resulted in CFU-reductions by ≥ $\log_{10}$ steps after CAP treatment UVC radiation served as positive

trometric measurements for release of nucleic acids. Thus, membrane damage seems not to be the primary mechanism of action for CAP towards *E. faecalis*. Overall, CAP showed pronounced antimicrobial efficacy against *E. faecalis* on agar plates as well as in biofilms similar to positive controls CHX or UVC.

Effect of various irrigating solution

One role of root canal irrigation is to help in the killing of bacteria and the removal of the bacterial biofilm from un instrumented surfaces. Antimicrobial irrigating solutions and other locally used disinfecting agents and medicaments play a key role in the eradication of microbes.

In case of persistent apical periodontitis, *E. faecalis* is a commonly isolated species.where its long-term survival in the root canal system is due to its ability to adhere to dentin and invade the dentinal tubules

Other irrigating solutions such as chlorhexidine (CHX)is less effective than NaOCl in eradicating *E. faecalis* biofilm,but CHX has substantive properties and is able to inhibit adherence of certain bacteria to dentin..

MTAD removes the smear layer safely; it is effective against *E. faecalis* and it can eliminate bacteria in human root canals that had been infected by saliva.

Tetraclean, which is mixture of doxycycline present at a lower concentration than MTAD, an acid, and detergents, has the ability to eliminate microorganisms and smear layer in dentinal tubules of infected root canals with a final 4-min rinse

An *in vitro* comparison of Antimicrobial Efficacy of Three Root Canal Irrigants—BioPure MTAD, 2% Chlorhexidine Gluconate and 5.25% Sodium Hypochlorite as a Final Rinse against *E. faecalis*

Vinod Agrawal, MS Rama Rao, Kanupriya Dhingra, V Rajesh Gopal, Abhijita Mohapatra, Abhilash Mohapatra

ABSTRACT

Aim: This study was conducted to evaluate the antimicrobial activity of 5.25% sodium hypochlorite (NaOCl), 2% chlorhexidine (CHX) and BioPure MTAD when used as a final rinse against *Enterococcus faecalis*.

Materials and methods: Sixty single-rooted premolars were biomechanically prepared, inoculated with *E. faecalis* and divided into various groups. These were then irrigated with the test irrigants and tested microbiologically for growth of *E. faecalis* immediately after irrigation and after 48 hours.

Results: Statistical analysis showed that there was a significant difference between the antibacterial activities of BioPure MTAD, 2% CHX and 5.25% NaOCl at 5 minutes; however, the

CONCLUSION

Within the limits of the present study, it can be concluded that the antimicrobial efficacy of BioPure MTAD is comparable to that of 5.25% NaOCl at both 5 minutes of contact time and 2 days after irrigation. The antimicrobial efficacy of BioPure MTAD is significantly greater than 2% CHX at 5 minutes of contact time. There is no significant difference in the antimicrobial efficacy of 5.25% NaOCl, 2% CHX and BioPure MTAD after 2 days of irrigation.

Antimicrobial activity is not the sole requirement of an endodontic irrigant. Root canal irrigants should also have

Journal of contemporary dental practice oct

Antibacterial Efficacy of Octenisept, Alexidine, Chlorhexidine, and Sodium Hypochlorite against *Enterococcus faecalis* Biofilms

Sundus Bukhary, BDS, MSc, and Hanan Balto, BDS, MSc

Abstract

Introduction: The purpose of this study was to evaluate the antibacterial effectiveness of Octenisept (OCT; Schülke & Mayr GmBH, Norderstedt, Germany), 1% alexidine (ALX) (Santa Cruz Biotechnology, Inc, Santa Cruz, CA), and 2% chlorhexidine (CHX) against *Enterococcus faecalis* biofilm using confocal laser scanning microscopy. **Methods:** Root dentin discs were prepared from extracted human teeth, sterilized, and inoculated with *E. faecalis* strain (ATCC 29212) to establish 3-week-old biofilm model. Infected dentin discs were exposed to OCT (n = 20), 1% ALX (n = 20), and 2% CHX (n = 20) for 10 minutes. Dentin discs (n = 15) exposed to 5.25% sodium hypochlorite (NaOCl) were

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Significance

study, the infected dentin discs were exposed to the irrigant solutions for 10 minutes.

In conclusion, the present study showed that 5.25% NaOCl had significantly greater antimicrobial activity against *E. faecalis* biofilms compared with OCT, CHX, and ALX. OCT was more effective than CHX and ALX.

attach to one another and form mature biofilms (2). Bacteria in mature biofilms have inherent resistance to antimicrobial agents, which makes it difficult to eradicate the biofilms from the root canal system (3).

The goal of root canal treatment is to prevent and treat apical periodontitis by elim-

JOE April 2017

- An ideal concentration for an effective action, although The proposed that from 0.5% to 5.25% concentration of NAOCL is the ideal concentration able to dissolve necrotic tissues as well as vital tissue, followed by ethylenediaminetetraacetic acid (EDTA) for removal of the smear layer can be recommended as the basic protocol

Podar et al. and Rôças et al suggested a volume of 15 mL for the reduction of the number of aerobic and anaerobic bacteria per root canal agitation with passive ultrasonic irrigation for temperature based increased dissolution and antimicrobial activity..

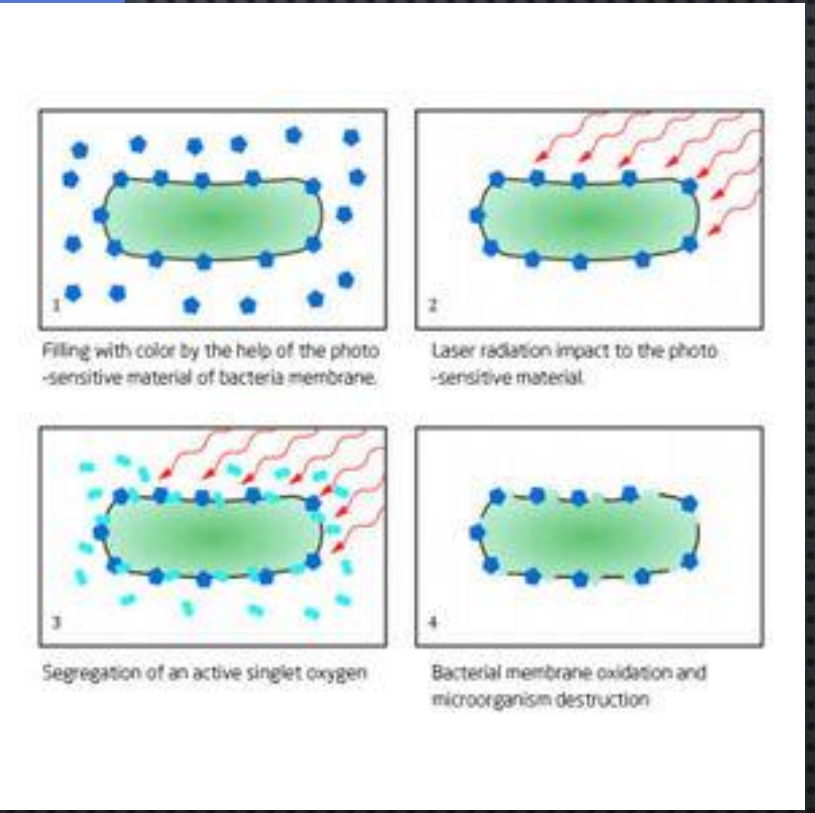
Disinfecting Effects of Rotary Instrumentation with Either 2.5% Sodium Hypochlorite or 2% Chlorhexidine as the Main Irrigant: A Randomized Clinical Study

Photodynamic therapy/ Light Activated Therapy is the latest method used to destruct endodontic biofilm.

PS molecules attaches to the membrane of the bacteria

Irradiation with light at a specific wavelength matched to the peak absorption

the PS leads to the production of singlet oxygen, which causes the bacterial cell wall to rupture killing the bacteria



Photodynamic therapy: An adjunct to conventional root canal disinfection strategies aus endo journal

Photodynamic Inactivation of *Enterococcus faecalis* in Dental Root Canals In Vitro

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Antonio Vera, DDS, MMSc,[2] **Apostolos G. Doukas**, PhD,[3] **Tom C. Pagonis**, DDS, MS,[2] **Ralph Kent**, ScD,[4]
Philip P. Stashenko, DMD, PhD,[5] **and Nikolaos S. Soukos**, DDS, PhD[1]*
[1]*Applied Molecular Photomedicine Laboratory, The Forsyth Institute, Boston, Massachusetts*

PDT on endodontic pathogens in planktonic as well as on E. faecalis biofilms in experimentally infected root canals of extracted teeth. MB alone exhibited 83.2% reduction of E. faecalis biofilm species. The combined effect of MB and red light lead to 97% eradication of E. faecalis biofilms. Their findings suggested that PDT has the potential to be used as an adjunctive antimicrobial procedure in endodontic treatment

A comparison between effect of photodynamic therapy by LED and calcium hydroxide therapy for root canal disinfection against *Enterococcus faecalis*: A randomized controlled trial

PAD was more effective.

Conclusion: PAD and calcium hydroxide therapy, as auxiliary methods adjunct to conventional root canal therapy, are both effective in root canal disinfection. In comparison with calcium hydroxide therapy, PAD leads to a greater reduction in enterococcus faecalis number in the infected root canals.

ABSTRACTS

RESEARCH SUMMARY

Photo-activated disinfection bacteria

An alternative regimen for root canal disinfection

S. J. Bonsor, R. Nichol, T. M. S. Reid and G. J. Pearson *Br Dent J* 2006; 201: 101–105

Objective
To compare the effect of a combination of 20% citric acid solution and photo-activated disinfection with the use of 20% citric acid and 2.25% sodium hypochlorite solutions on bacterial load on the dentine walls in prepared canals *in vivo*.

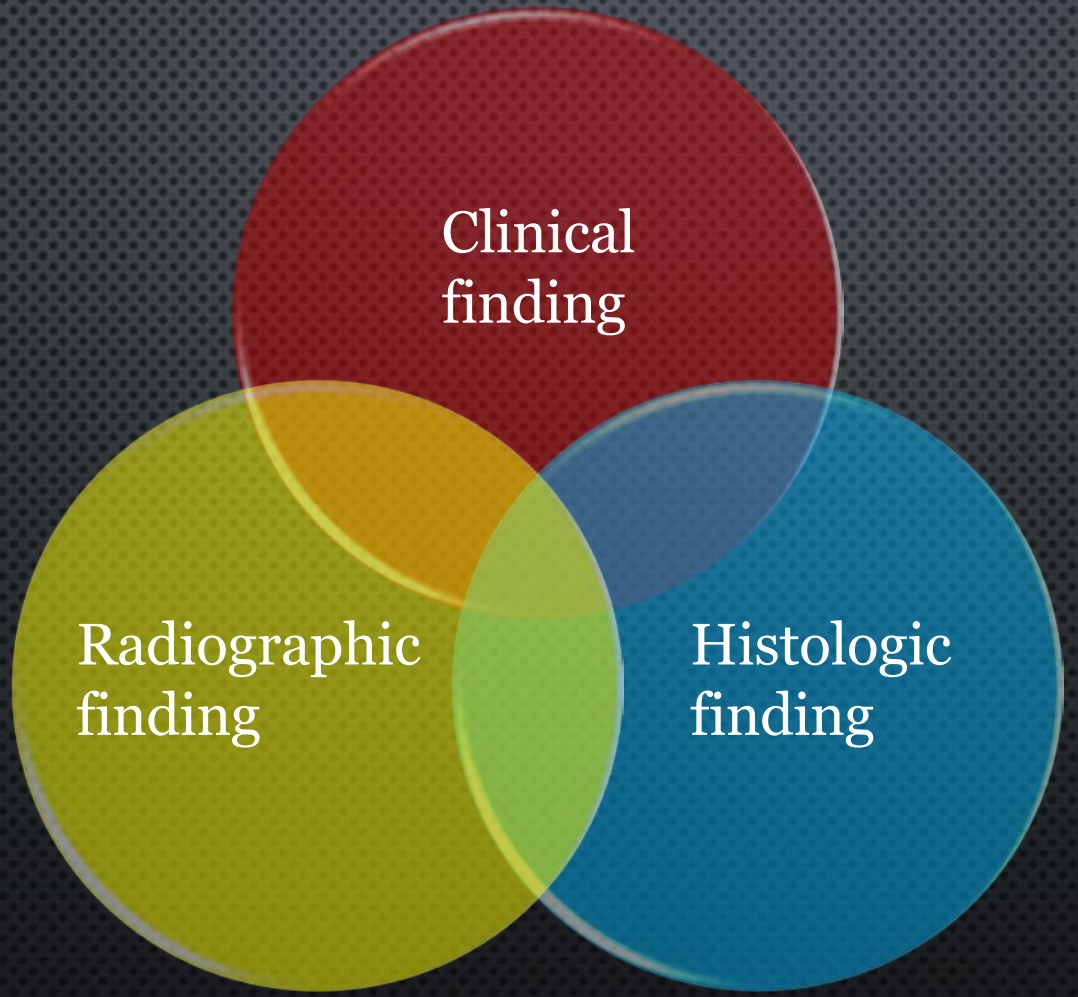
Subjects and methods
Sixty-four randomly selected cases were evaluated and allocated to one of two groups. In Group 1, after gaining access to the root c bacterial load on the canal walls was sampled using endodontic A further sample was taken after apex location and initial wider the canal had been completed and the photo-activated disinfec process carried out. A final sample was taken after completion c canal preparation using citric acid and sodium hypochlorite sol Group 2, the initial sample was taken as described previously. A sample was taken after conventional preparation using 20% cit and sodium hypochlorite solutions as co-irrigants. A final samp then taken after a subsequent PAD treatment. All samples were

COMMENT
In photo-activated disinfection (PAD) bacteria become photo-sensitised by absorbing a solution of tolonium chloride. The solution is activated by low power laser (635nm) light releasing active oxygen species causing disruption of the bacterial membranes.
This paper describes the application of PAD in endodontics.
Patients requiring root canal treatment were divided into two

subsequent photo-activated disinfection three of these four canals were free of culturable bacteria.

Conclusion Results indicate that the use of a chelating agent acting as a cleaner and disrupter of the biofilm and photo-activated disinfection to kill bacteria is an effective alternative to the use of hypochlorite as a root canal cleaning system.

METHOD OF EVALUATION



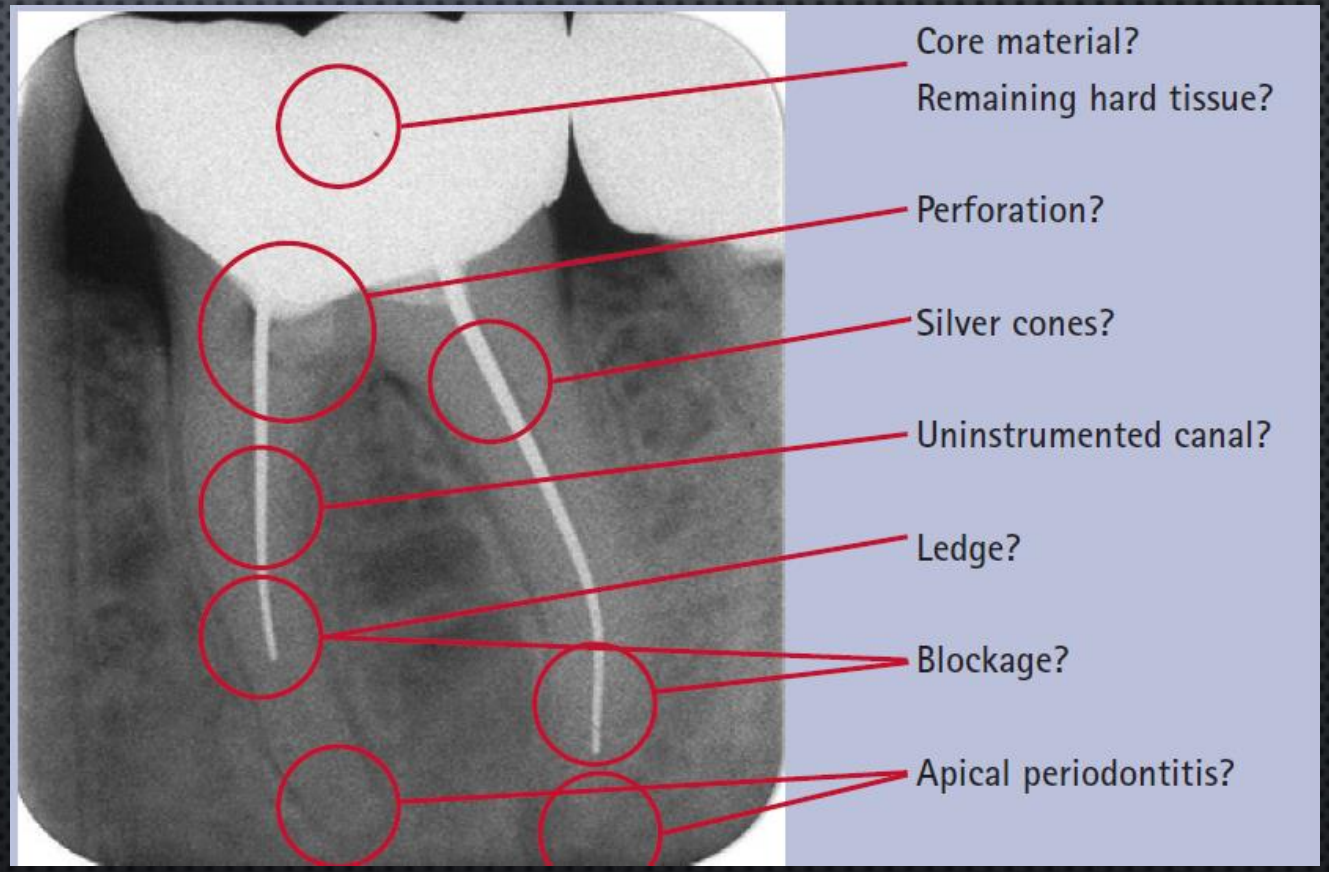
	Clinical	Radiological
Success	• There is no tenderness to palpation or percussion • Normal mobility and function • No sinus tract or periodontal defect • No signs of inflammation • No pain or discomfort	• Contours, width and structure of periodontal ligament space are normal • The periodontal ligament contours are widened around excess filling material
Mixed	• Sporadic or vague symptoms that are most often not reproducible • Feeling of pressure or tightness • Slight discomfort when chewing or pressing on tooth with finger or tongue	• The periapical area has not changed in size • The periodontal ligament space does not look completely normal
Failure	• Persistent symptoms • Recurrent sinus tract, swelling or pain • Pain on percussion or palpation • Mobility on function that is not normal	• The periapical area has not changed in size or has enlarged • The appearance of new periapical or lateral radiolucency • Maximum review time 4 years

RADIOGRAPHIC TECHNIQUE

- Standardized radiographs taken using a paralleling device and developed to a high quality are used to assess the quality of the previous root filling..
- It is sometimes helpful to take radiograph from different angles to ascertain whether canals have been missed.
- The CBCT allows the clinician to determine the true size, extent, and position of periapical and resorptive lesions Gives added information about tooth fractures, missed canals, root canal anatomy, and the nature of the alveolar bone topography around teeth.

- It also provides the relationship of adjacent anatomic structures such as the maxillary sinus and inferior alveolar nerve to the root apices

Before starting retreatment the teeth,should also be checked for potential treatment challenges and problems that might occur during treatment



HISTOLOGIC EXAMINATION

- Routine histologic evaluation of periapical tissues on patients is impractical.
- Thus, clinical findings (signs and symptoms) as well as radiographic findings are the only means of assessing success and failure.

WHEN TO EVALUATE

The European Society of Endodontics Guidelines indicate that root-filled teeth should be reviewed radiographically at 1 year and then subsequently as required for up to 4 years to assess whether treatment has been successful.

- Suggested period : 6 months – 4 years

INDICATIONS

- Periapical radiolucencies even after 4 years
- Tenderness to percussion
- Apical pain to pressure
- Fistula formation
- Swelling of soft tissue
- Incomplete root canal filling – for prosthetic restoration even being asymptomatic

CONTRAINDICATIONS

- Vertical fracture
- Poor periodontal status
- Non restorable teeth
- Access is difficult
- Patients with TMJ dislocation problems
- Resorption
- Anatomical limitations

TREATMENT PLAN

- The patient harbouring true endodontic posttreatment disease has following basic options for treatment :
  - Do nothing
  - Extract the tooth
  - Nonsurgical retreatment

CRITICAL STEPS IN NON-SURGICAL RETREATMENT

- Access to the root canal:
  - access opening through crowns
  - removal of crowns, bridges, posts
- Access to the apical area:
  - removal of root filling material
  - removal of separated instruments
- Reshaping the root canal
- Antimicrobial treatment

NONSURGICAL ENDODONTIC RETREATMENT

- Primary goal: regain access to the periapical area (endotreated tooth)
- Principals of endodontic therapy followed :
  - Coronal access needs to be completed
  - All previous root-filling materials need to be removed
  - Canal obstructions must be managed
  - Impediments to achieving full working length must be overcome
- Cleaning and shaping procedures : for effective obturation and case completion

NONSURGICAL ENDODONTIC RETREATMENT : CORONAL DISASSEMBLY

- Retreatment access is called coronal disassembly
- Removal of the coronal restoration includes
  - Full coverage restoration
  - Core build-up material
  - Post placed into the canal
- Advised to remove the existing coronal restoration if it has
  - Poor marginal adapatation
  - Secondary caries
  - To avoid procedural errors
  - To maintain form, function and esthetics

- Re-access to the pulp chamber through the existing restoration
  - If it is judged to be functionally designed, well fitting and esthetically pleasing.

❖ Factors influencing restorative removal

- Preparation type
- Restoration design and strength
- Restorative material used
- Cementing agents
- Removal device

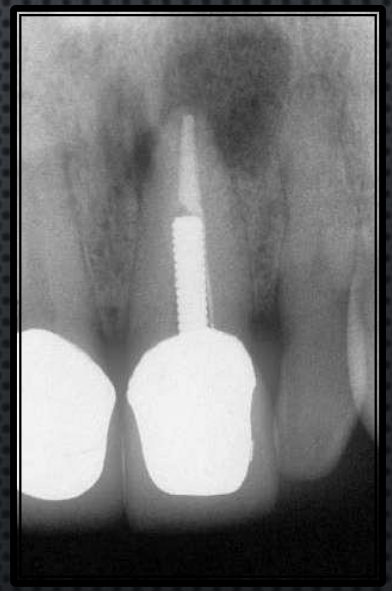
- **Coronal disassembly devices**:

- Grasping instruments
- Percussive instruments
- Active instruments

POST REMOVAL

- It is common to encounter a post in a root canal treated tooth

- When endodontic treatment fails to achieve healing, the need may arise to remove a post in order to gain access and allow retreatment



- **Steps**:
  - Core restorative material is removed
  - A less aggressive instrument, such as a tapered bur in a slow-speed handpiece or a tapered, midsized ultrasonic tip, should be used to remove the last of the embedding core material.
    - Magnification and illumination
  - When minimal restorative material is remaining, smaller sized ultrasonic instrument should be used

- **More post that is left, the more options for removal**
- **More tooth structure that is left, the more options for restoration**

- TECHNIQUES FOR POST REMOVAL :
  - Rotosonic vibration
  - Ultrasonic vibration
  - Mechanical devices

ROTOSONIC VIBRATION

- Rotosonics is a method to potentially loosen and remove a fully exposed post.
- The regular tip **Roto-pro Bur** is a high-speed, friction grip bur whose six sides utilize six edges which when rotated in one revolution produce six vibrations per revolution.
- Rotated at 200,000 rpm, it produces 1.2 million vibrations per minute.
- The bur is kept in intimate contact with the obstruction and is generally moved CCW around the post.

MECHANICAL DEVICES

- If retention reduction does not remove the post, some form of vice is needed to pull the post from its preparation.
  - Gonon post removing system
    - Effective instrument for removing parallel or tapered, nonactive preformed posts
  - Kit utilizes a hollow trephine bur aligned with the long axis of the post and placed over its exposed end

FRACTURED POST IN A LOWER INCISOR

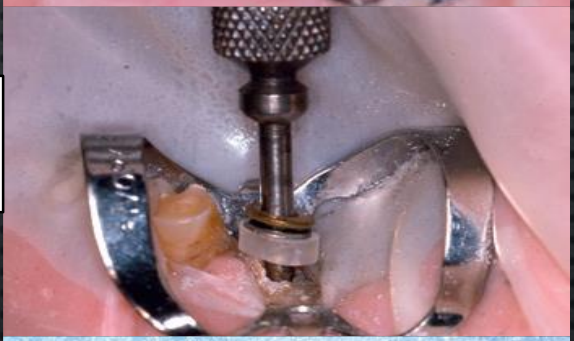
Tooth isolated with rubber dam

Ultrasonic exposure of the post

Domer bur creating a shape that the trephine bur can engage

Trephine bur milling the post

Extraction device tapping a thread onto the post



Vice applied. Turning the screw on the vice opens the jaws, creating the extraction force.

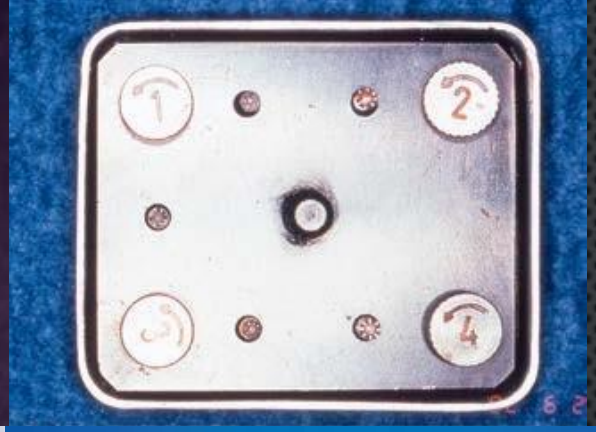
Post removed

- This method is effective because
  - All the force is applied to the bond between the tooth and the post, ideally in the long axis of the root.

- **Drawbacks**:
  - Size of the vice that can make access in the molar region and between crowded lower incisors difficult.
  - If the extraction force applied is not directed in the long axis of the root, root fracture may occur

- OTHER POST REMOVAL SYSTEMS (PRS) :

- Thomas Screw Post Removal Kit
- Ruddle Post Removal System
- Universal Post Remover
- JS Post Extractor
- Post Puller (Eggler Post Remover)



GUTTA PERCHA REMOVAL

- Initially removed from the canal in the coronal one third, then the middle one third and finally eliminated from apical one third.
- Following methods or combination of methods are used.
  - File and chemical removal
  - Ultrasonic removal
  - Heat removal
  - Heat and instrument removal
  - Combination of paper points and gutta-percha solvent
  - Rotary instruments

FILE AND CHEMICAL REMOVAL

- It is best used to remove gutta-percha from small and/or more curved canals.
- Solvents

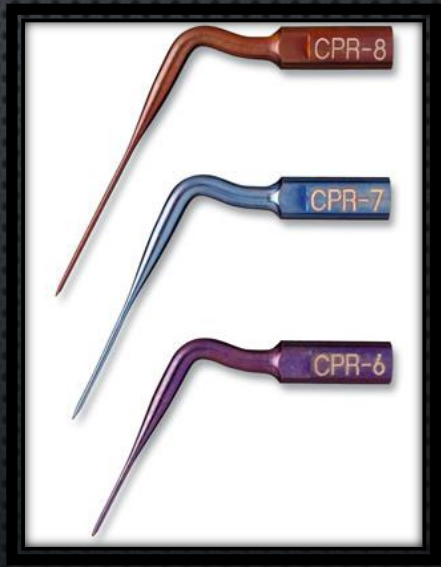
- Chloroform
- Eucalyptol oil
- Halothane
- Turpentine
- Xylene

- TECHNIQUE :-

- Filling the pulp chamber with solvent
- Selecting an appropriately sized K-type file
- Size 10 or 15 stainless steel file is used to “pick” into the gutta-percha occupying the coronal one-third of the canal.
- Frequent irrigation with solvent in combination with a “watch-winding” motion creates a pilot hole and sufficient space for the serial use of larger files to remove gutta-percha in this specific region of the canal.

ULTRASONIC REMOVAL

- THE PIEZOELECTRIC ULTRASONIC EFFECT REPRESENTS A USEFUL TECHNOLOGY TO RAPIDLY REMOVE GUTTA-PERCHA.
- SPECIALLY DESIGNED ULTRASONIC INSTRUMENTS MAY BE CARRIED INTO SHAPED CANALS
- THAT WILL DISPLACE GUTTA-PERCHA CORONALLY INTO THE PULP CHAMBER



HEAT REMOVAL OF GUTTA-PERCHA

- A POWER SOURCE IN CONJUNCTION WITH SPECIFIC ELECTRIC HEAT CARRIER INSTRUMENTS MAY BE USED TO THERMO-SOFTEN AND REMOVE INCREMENTS OF GUTTA-PERCHA FROM ROOT CANAL SYSTEMS.
- TECHNIQUE :-
  - Guiding a heated plugger into the most coronal aspect of the gutta-percha
  - The heated plugger is then deactivated and withdrawn
  - Resulting in the removal of an attached portion of gutta-percha

HEAT AND INSTRUMENT REMOVAL

- A hot instrument is plunged into the gutta-percha
- It is Immediately withdrawn in order to only heat-soften the material.
- A size 35, 40, or 45 Hedstrom file is then selected and quickly and gently screwed into the thermo-softened mass.
- In poorly obturated canals, removing the file may eliminate the entire gutta-percha mass in one motion.
- This technique is recommended in canals where gutta-percha extends beyond the apical foramen.

COMBINATION OF PAPER POINTS AND GUTTA-PERCHA SOLVENT

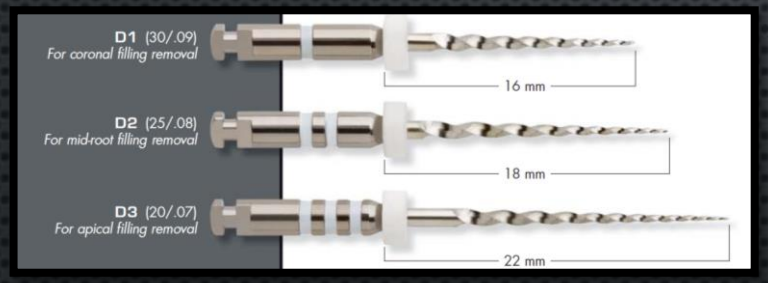
- In this technique, the canal is first flushed with solvent
- The solution is then absorbed and removed with appropriately sized paper points.
- Paper points aid in removal of gutta-percha by drawing dissolved materials into and then out of the shaped canal.

Rotary instruments

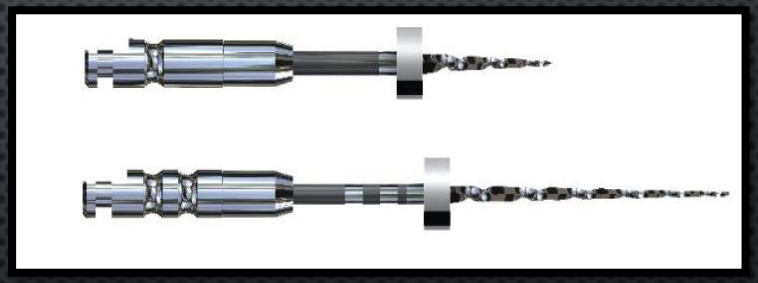
It is the most efficient method for removing gutta-percha from a previously treated root canal

FILE SYSTEM :

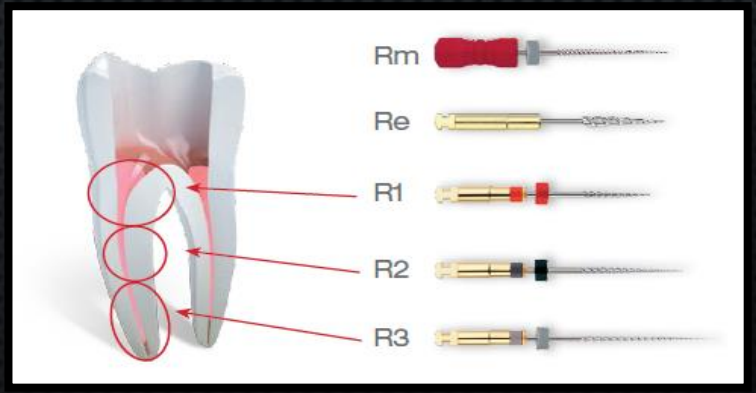
PROTAPER UNIVERSAL



FKG D-RACE



HERO SHAPERS R-ENDO



ENDOSTAR RE ENDO

PASTE REMOVAL

- When evaluating a paste case for retreatment, it is useful to clinically understand that the coronal portion of the paste in the canal is most dense (the material is progressively less dense moving apically).

- **Ultrasonic energy**
  - To remove paste apical to a canal curvature, precurved file is attached to a specially designed adapter that mounts on and is activated by the ultrasonic hand piece.

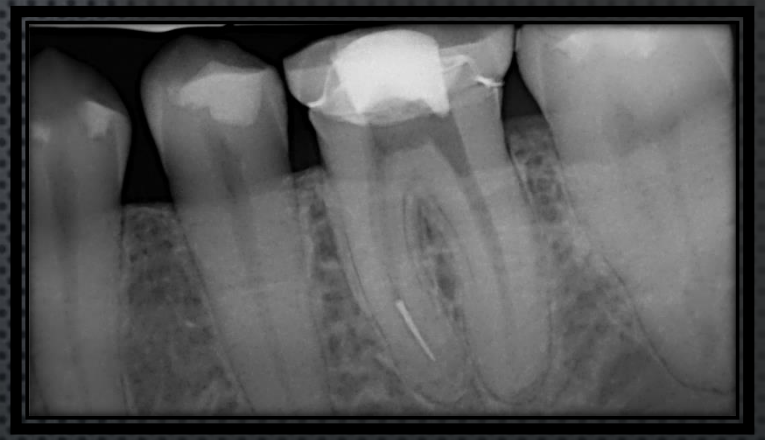
- **Rotary instruments**
  - Stainless steel O.O2 tapered hand files to negotiate through paste fillers.
  - These files can potentially create a pilot hole for safe ended, Ni Ti rotary instruments to follow.

- **Solvents and Hand Files**
  - Reagents like Endosolv ‘R’ and Endoslov ‘E’ can be helpful in chemically softening hard paste.
  - These reagents can be placed interappointment.

- MICRO DEBRIDERS
  - To precisely remove residual paste materials
  - Offset handles, 0.02 tapers with 16mm of efficient hedstrom type cutting blades.

- Solvents and paper points
  - After paste removal, paper point wicking in the presence of specific paste solvents is important

SEPARATED INSTRUMENT REMOVAL



- Incidence of hand instrument separation has been reported to be 0.25% and for rotary instruments it ranges from 1.68% to 2.4%.

- A common cause for instrument separation is improper use or Overuse and not discarding an instrument and replacing it with a new one when needed.

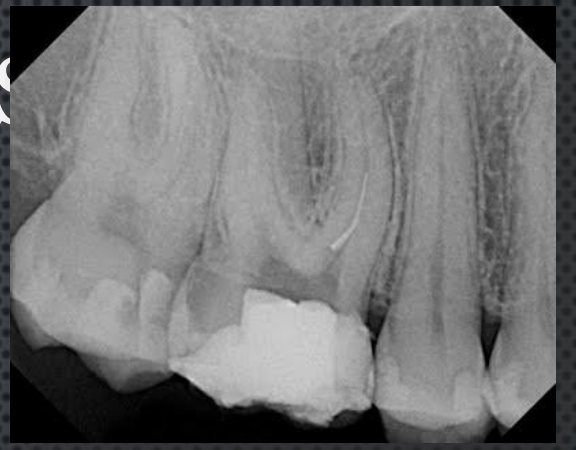
- List of guidelines for when to discard and replace instruments :

1. Flaws, such as shiny areas or unwinding, are detected on the flutes
2. Excessive use has caused instrument bending or crimping
    - NiTi instruments : tend to fracture without warning
    - Constant monitoring of usage is critical
3. Excessive bending or precurving has been necessary
4. Accidental bending occurs during file use.
5. Corrosion is noted on the instrument.
6. Compacting instruments have defective tips or have been excessively heated.

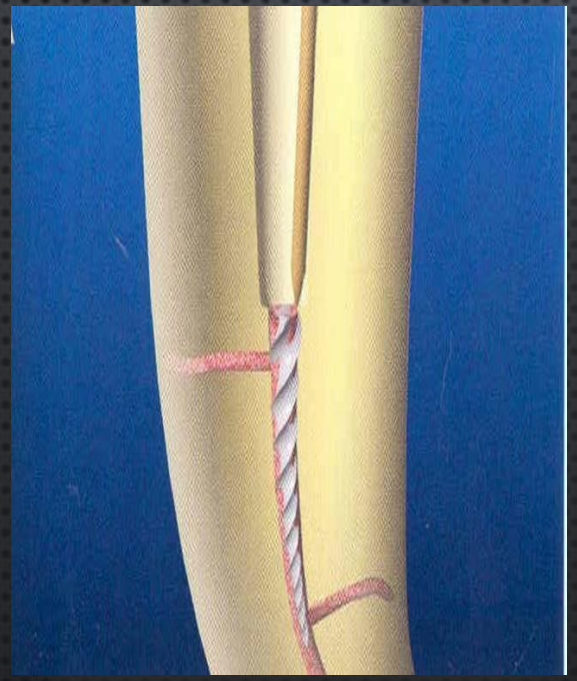
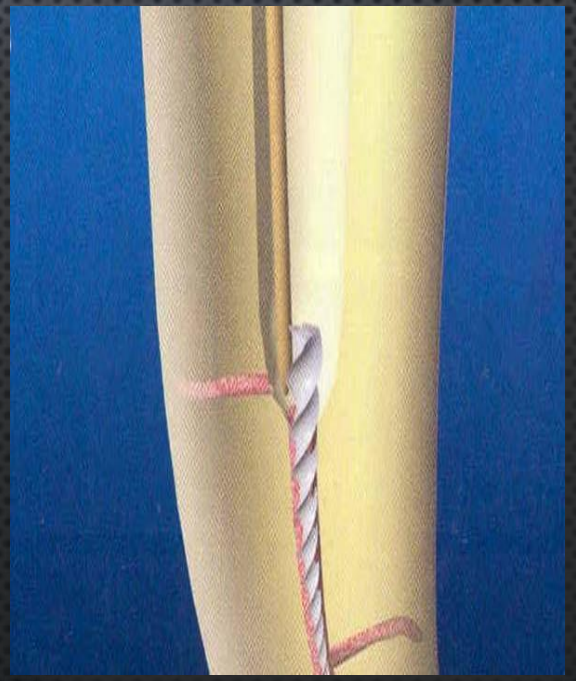
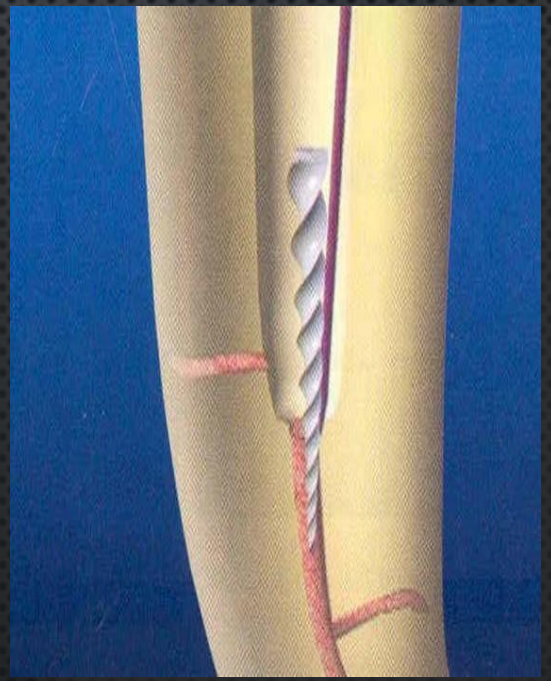
Factors influencing broken instrument removal :

1. Cross sectional diameter of the canal
2. Length of the canal
3. Root morphology – thickness of dentin and the depth of external concavities.
4. Curvature of the canal
   - Straight portion of canal : removed usually.
   - Around canal curvature : removal is possible if the access if established to its most coronal extent.
   - Apical to curvature : removal may not be possible.
5. Type of material that obstructs the canal
   - SS files do not fracture during removal
   - NiTi breaks again because of heat build up caused by ultrasonic devices.

TECHNIQUE FOR BROKEN INSTRUMENTS REMOVAL

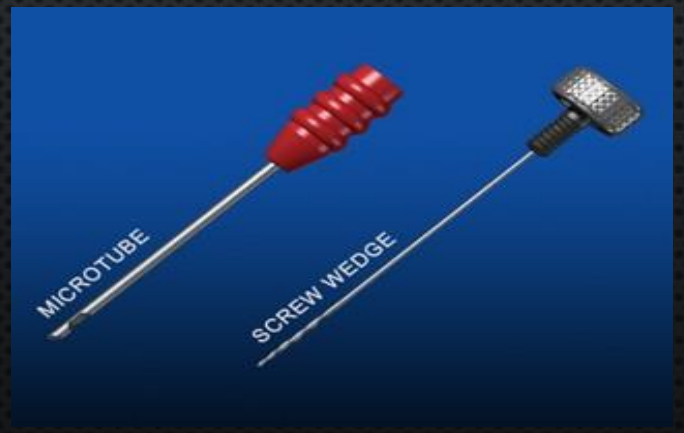


- Steps:
  1. Coronal access
     - Done with high speed, friction grip surgical length burs
  2. Radicular access
     - Hand files, and GG drills used
     - GG drills maximize visibility coronal to the obstruction
  3. Create staging platform
     - Modified GG is used.
     - This creates a small staging platform that facilitates the introduction of ultrasonic instruments.

MICROTUBE DEVICES

- Instrument Retrieval System (IRS)
- Small staging platform : Further reduced by ultrasonics until enough of the separated instrument is exposed to retrieve.
- Microtube is inserted into the canal and the long part of its beveled end is oriented to the outer wall of the canal to scoop up the head of the broken instrument.

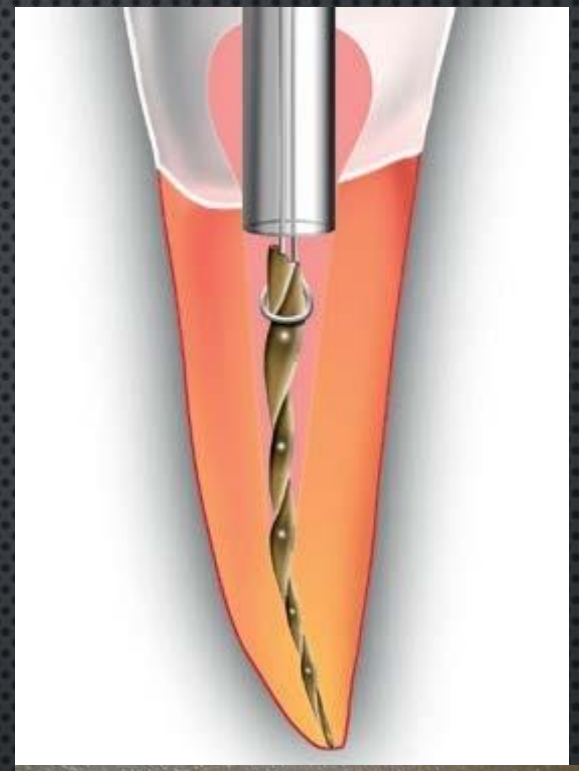


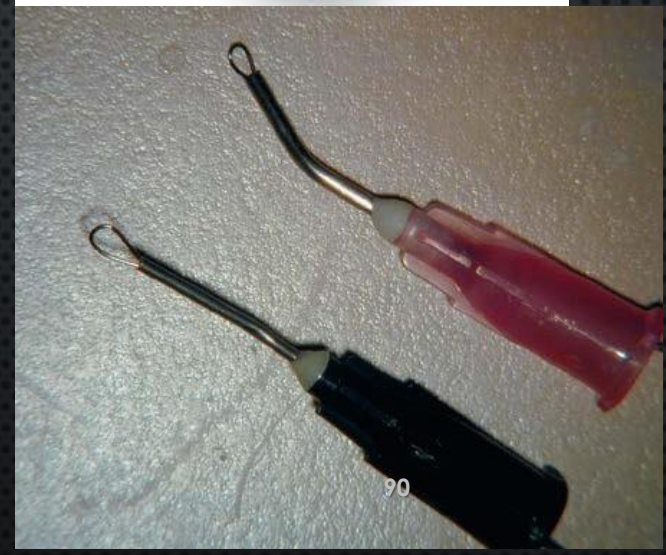
- THE INSERT WEDGE IS PLACED THROUGH OPEN END OF MICROTUBE AND PASSED DOWN ITS INTERNAL LUMEN UNTIL IT CONTACTS THE BROKEN OBSTRUCTION.

- The broken instrument is secured by turning the insert wedges handle screw in a clockwise rotation.

Wire Loop & Tube Removal Method :

- 25-gauge dental injection needle
- 0.14-mm-diameter steel ligature wire.
- Needle is cut to remove the beveled end
- Both ends of the wire are then passed through the needle from the injection end until they slide out of the hub end, creating a wire loop
- Once the loop has passed around the object to be retrieved, a small hemostat is used to pull the wire loop up and tighten it around the obstruction
- Complete assembly is withdrawn from the canal.





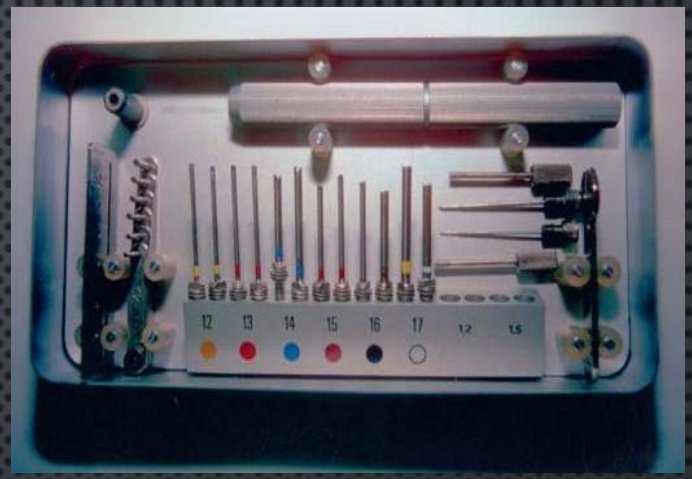
- OTHER METHODS:

- Endo Extractor (Brasseler USA)

- Masserann Kit (Medidenta International)

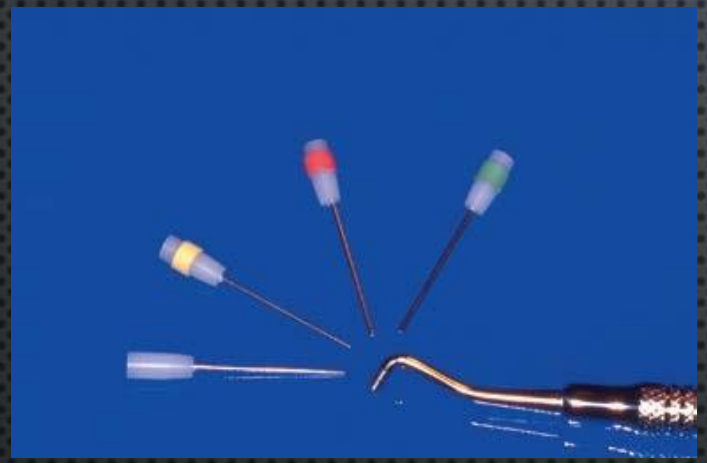
- Extractor System (Roydent)

- Separated Instrument Retrieval System (SIRS)



Specifically for use with Microscopes :

- Cancellier instrument (Sybron Endo)

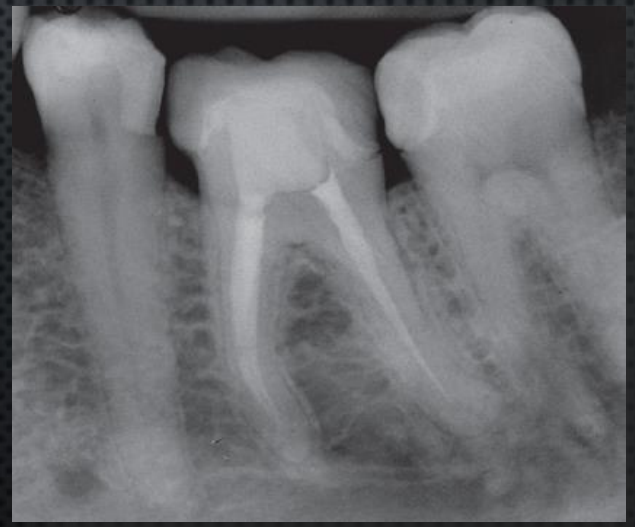


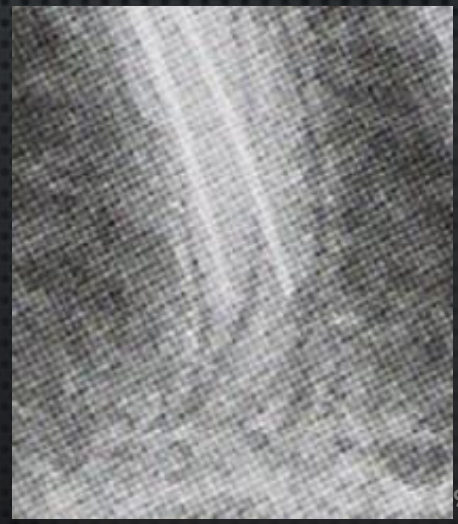
- Mounce extractor (Sybron Endo)

MANAGEMENT OF CANAL IMPEDIMENTS

- Iatrogenic mishaps resulting from
  - Vigorous instrumentation short of the appropriate working length
  - Failure to confirm apical patency regularly during instrumentation.

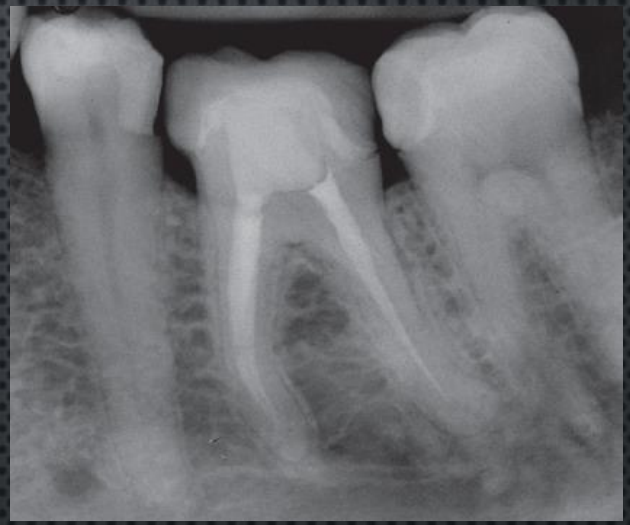
- Includes:
  - Blocked canals
  - Ledge Formation



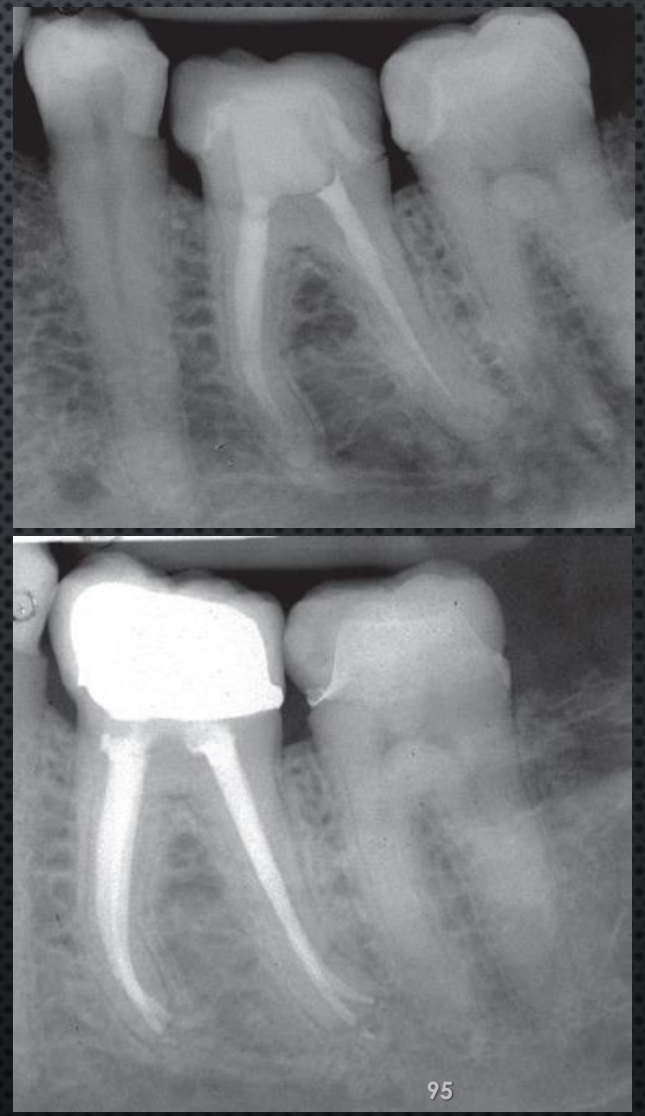


MANAGING BLOCKED CANALS

- Well -angulated radiographs
- Coronal portion of the canal should be enlarged
  - To enhance tactile sensation
  - Remove cervical and middle third obstructions in the canal space
- Canal should be flooded with irrigant, and instrumentation to the level of the impediment should be accomplished using non-end-cutting instruments
- Precurved #8 or #10 file used in pecking motion
- Determine if there are any “sticky” spots that could be the entrance to a blocked canal.



- Directional rubber stop should be used
- Very short amplitude, light pecking strokes to be used
- File's handle whose tip is engaged, should never be excessively rotated.
- Frequent evacuation of the irrigant and using a lubricant, such as RC prep.
- Risk of deviating from the original canal path, creating a ledge, and ultimately a false canal leading to zip perforation.
- Working radiograph taken when some apical progress made



LEDGE FORMATION

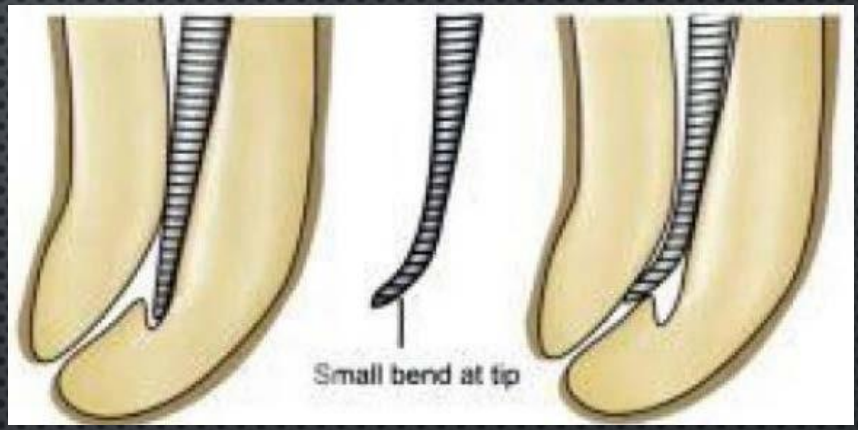
- An internal transportation of the canal is termed a “ledge” and is a result of over-enlarging a curved canal and working short of full canal length

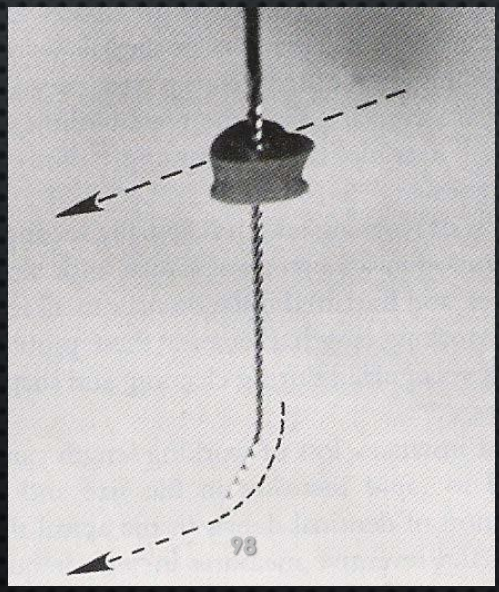
RECOGNITION OF A LEDGE :

- Root canal instrument can no longer be inserted into the canal to full working length.
- Loss of tactile sensation of the tip of the instrument binding in the lumen.
- Instrument point hitting against a solid wall
- Radiograph with instrument in place.

Management :

- Locating the ledge
- Irrigate, smaller instruments are preferred.
- No. 10 or 15 file with a curve at the tip can be used
- “Tear shaped” silicone stops can be used.
- If resistance is felt, retract slightly, rotate and advance again, until it bypasses and reach apically.
- Confirmed with a radiograph





- If ledge cannot be bypassed, then clean, shape and obturate till obstruction.

Perforation

Definition

An endodontic perforation is an artificial opening in the tooth or its root, created by the clinician during entry to the canal system or by a biologic event such as pathologic resorption or caries that results in a communication between the root canal and the periodontal tissues

FACTORS INFLUENCING REPAIR

Considerations influencing perforation repair:

1. Level
2. Location
3. Extend of perforation
4. Potential for successful management

- **Level**:
  - Coronal / furcation perforation : threaten sulcular epithelium
  - In general, more apical the perforation, more difficult to repair

- **Location**:
  - Can occur circumferentially on the buccal, lingual, mesial and distal aspects of roots.
  - Position is critical and may preclude surgical access if this approach is considered.

- **Extend & Size of Perforation**:
  - Size greatly affects the clinician's ability to establish a hermetic seal.
  - The area of a circular shaped perforation can be mathematically described as πr^2.
  - Therefore doubling the perforation size with any bur or instrument increases the surface area to seal **four-fold**.

- **TIME :**
  - Regardless of the cause, a perforation should be repaired as soon as possible to discourage further loss of attachment and prevent sulcular breakdown.
- **Esthetics**:
  - Perforations in the anterior region can definitely impact esthetics.
  - Tooth colored restoratives are chosen and selected from the best materials currently available in adhesive dentistry.

MANAGEMENT

- Difficulty of the repair : Level of perforation
  - Furcal floor of a multirooted tooth or in the coronal one third of a straight canal (access)
  - Considered to be easily accessible
  - Middle one third (strip or post perforations) : Difficulty increases
  - Apical one third (instrumentation errors)
    - Predictable repair
    - Frequently, apical surgery will be needed.

Barrier Materials For Perforation Repair

- Barriers help produce a “dry field” and also provide an internal matrix or “back stop” against which to condense restorative materials.

- Absorbable
  - Collagen materials (colla cote)
  - Calcium sulfate (cap set)

- Non-Absorbable
  - MTA
  - Other restoratives (amalgam, super EBA resin cement, composite restoratives, calcium phosphate cement)

CONCLUSION

- Posttreatment endodontic disease does not preclude saving the involved tooth.
- In fact, the majority of these teeth can be returned to health and long-term function by current retreatment procedures.
- In most instances the retreatment option provides the greatest advantage to the patient because there is no replacement that functions as well as a natural tooth.
- Armed with the information in the preceding section, appropriate armamentaria, and the desire to do what is best for the patient, the clinician will provide the foundation for long-term restorative success.

REFERENCES

- Advanced Endodontics: Clinical Retreatment and Surgery by John S. Rhodes
- Establishment and maintenance of asepsis in endodontics – a review of the literature
- Prevalence of Apical Periodontitis in Endodontically Treated Premolars and Molars with Untreated Canal: A Cone-beam Computed Tomography Study Bekir Karabucak, DMD, MS,* Alf Bunes, DMD, FC,* Christel Chehoud
- **Microleakage: Apical Seal *vs* Coronal Seal Harsh Amlani, Vivek Hegde**
- Irrigation in Endodontics: a Review Sarah Bukhari1 & Alaa Babaeer2

Thank you