**Microbiology in Endodontic Infections**

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**Objectives of endodontic infections Control are achieved by** :

1- complex cleaning and shaping to eliminate infections

2- complete optimal obturation of root canal in 3D to prevent re-infection

3- complete coronal seal after root canal obturation to prevent re-infection

All the three mentioned objectives must be achieved by you as biologist and endodontist to get the successful RCT you need , at the same time there are no clinical means are available to guide us in determining how objectives will be obtained yet ; therefore you must learn about those challenges in this lecture to collect more knowledge to achieve them by yourself as much as u can .

* 70% of endodontic bacterial species that are found in oral flora , are turning out frequently in infected root caal system .
* The bacterial organisms have the ability to survive I the host system for short period of time .

once they maximize their numbers or find their sufficient requirements to produce toxins , they tend to affect host system in more chronic pattern and for long time .

* The Endodontist is not that General dentist who does the conventional root canal treatment ,

The Endodontist is a Biologist Dentist who does the perfect RCT, in addition to his/her goals of endodontic infection control to minimize the bacterial invasion through root canal , lateral , accessory canal and apex , and to minimize its distribution into periapical tissues and bone .

* We watched a video about the role of polymorphocyte cells to attack bacteria cells immediately once it affects host cell , this video showed us How the PULP has this great self capacity to protect and recover itself effectively by its immune cells like neutrophils once bacteria affects the pulp zone , as long as our ability to control the process of infection as a dentist .
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* **The bacterial pathways to the pulp are :**

1- Caries , tooth surface loss , open cavity , cracks , attrition

2- indirect pulp exposure by cavity preparation

3- Dentinal tubules :

Bacteria distribute itself throughout Dentinal tubules to reach into pulp , but

* Not all tubules are invaded by bacteria
* Localized bacterial distribution within canal because most of nutrients are within canal
* Once the cementum is eroded so the bacterial distribution will be diffused to form apical periodontitis

4- Root surface resorption : the cementum is exposed , so bacterial invasion will be occurred within dentine , finally the chronic apical periodontitis will be formed due to cemetnum loss .

Where is the endodontic bacterial infections ?

1- They have the inflammatory nature

2- if the diversity of infection is increased , then the periapical lesion will be occurred

3- the condition of root canal infection guides the condition of apical lesion . so once the diversity and chronicity of root canal infection is occurred , this will lead to producing apical lesions .

4- the foci of bacterial infection is in “ Enemy Zone “ ;

Enemy zone is the critical zone of infection and necrosis .

Enemy zone is in Apical Area .

Enemy Zone is your destination during RCT to get good results .

5- bacterial distribution pattern in each tooth was unique

6- the distribution on infection apically is more then coronally

7- the middle third of root canal has less bacterial distribution

* Apical Periodontitis is “ the disease of endodontist “ , caused by bacterial infection in RCT .
* A Scenario that you should read it to be a biologist dentist :

Induce immune response

Release substances

Bacteria

1- Induce of destruction of canal tissue

2- induce clinical signs and symptoms

3- lead to environmental changes that provide nature for **bacteria**

Mediators

Mobile molecular phagocytes

Prevent bacteria to gain access to bone & avoid osteomylitis and systemic effects

- Clinical signs of active endodontic infection are pyrexia , trismus ,… , they all required Antibiotic Therapy .

- (8-16) patients died because of Dentoalveolar abscesses , they are all medically compromised .

- According to BILL BOOK , it is typed that “ 70-80 % cancer victims have root canal infections “ , this is totally WRONG .

- Possibility of secondary infections is still existed today if treatment is delayed or if it’s not good just .

- NO relation ever never between cancer and RC infection or RCT

- even when shows a lesion , the life expectancy for the tooth is fairly good

- Rule: if you want it to die , leave it or extract it

- Rule: if you want it to live , do proper RCT .

- The living Creatures are a testimony of their capacity to survive , they create a great evolutionary tree of life in RCT .

- Quote : The bacteria occupy on foot of human intestine are more than people on the planet .

- We don’t have that enough knowledge about bacterial behavior due to its genetic causes .

- Miller 1894 : the first biologist who described the morphotypes of bacteria in apical area in compared to other parts of root canal .

- Kakenashi 1965 : Japanese Biologist who showed the ultimate goal of pathogens .

- Until 1975 : the role of anaerobic bacteria in pulpal disease was unknown , they believed that they are easily eliminated by irrigation and shaping .

- After 1975 : the advancement of knowledge began , the culture techniques were developed .

- Sundqvist Study : he showed the pathogenesis of Anaerobes

- Dr Abu Tahun Study : used the similar cultures of sundqvist , he showed the Expanded Diversity of Microbes as found by sundqvist

- The primary endodontic infections differ then other infections in our body , they are not caused by one specific microorganism , they are caused by polymicrobial complexity and mixture of facultative anaerobic G+ strains dominated by obligate anaerobes .

- By Current cultures techniques , we can isolate up to 12 species (12 TAXA) using more sophisticated molecular techniques , while the actual estimated number of species in root canal is more than 90 species ( 90 Taxa )

- more than half of bacterial species are not cultivated yet

- (1-12) TAXA are cultivated

- 90 TAXA are undetected better

- Fungi , candida albicans , Archea , viruses caused opportunistic infections that lead to RCT Failure.

- Always , During RCT , “ don’t leave tooth open for sunshine “ .

- RULE : if you file root canal , don’t close

RULE : if you close , don’t file

* According to our dental school , the tooth should be kept closed throughout RCT , IF you leave it open , your RCT is failed either you prescribe Antibiotics or you don’t , you are the reason of your Failure darling.
* **Patterns of endodontic microbes :**

1- suspended ( planktonic state )

2- adhered ( sessite state ) or known as ( Biofilm ) : this type that we will challenge them while RCT , they are so difficult to be eliminated totally , Biofilms caused the big puzzle in dentistry .

* Irrigation studies (2006-2008) : planktonic are flooding in suspension and blocked by irrigation , the active dynamic irrigation is the perfect type to eliminate this flooding becteria and prevent dentine mud which is full of flooding bacterial and biofilms .
* **BIOFILMS :**

1- 99 % of oral flora bacteria live as biofilms communities

2- adhered difficult type

3- in sessite state

4- act as single large multicellular organisms that has great intelligence and huge resistance due to its genetic cause .

5- the ratio between biofilms VS planktonic was unknown

6- the relation between certain species of biofilms and certain clinical signs was unknown, also .

* **BIOFILMS TYPES :**

1**-** Intracanal ( dentinal ) biofilms

2- extra radicular biofilm : the type of biofilm that caused delayed healing , most critical type

3- periapical biofilm : common isolated

4- foreign body central biofilm :

* \*Caused by accumulation of actinomycosis
* \*related to intracanal and extraradicular
* related to refractory periapical periodondtitis
* 77 % is the prevalence of biofilms in periapical periodontitis
* The prevalence of biofilms in untreated teeth of PA Periodontistis will increased to 80 %
* The prevalence of biofilms in treated teeth will decrease little to 74 %
* So it clear that biofilms caused the most great challenge even after RCT
* If there are large majority of teeth we are treating so you will deal with more biofilms
* The cysts and wide lesion which are seen apically or radicularly , caused high challenge during RCT , because you are dealing with huge biofilms which they contained .

There is a study concluded that if we have a big size of lesion , there is enough time to organize much biofilms , so high prevalence of biofilms organization .

BUT there is No success rate about this previous study , you must know that :

The cause of wide lesion bacterial Biofilms is not in its size (lower success rate ) but in the high complexity it contains .

95 % of biofilms are in cysts

83 % of biofilms are in abscess

69.5 % of biofilms are in granuloma

* 6 % is prevalence of extraradicular biofilms , they are independent apical actinomycosis which persist the intraradicular eradication .
* Main cause of failure is extraradicular biofilms
* In endodontic we use formula called virulence soap which equal 1+1 >=2
* The synergism between biofilms follow virulence soap and the virulence soap is in the body of biofilms and it is theoretical term .
* Virulence soap in endo means that the communities of biofilms act like Teamwork
* Structural organisms of biofilms restrict the penetration of medicaments.
* Biofilms have 1000 time more resistance to phagocytes and antibiotics.

**BIOLFILMS REMOVED BY :**

1- Mechanical Removal by instruments and files but >40 % of root parts are not touched by instruments .

2- Dissolution of hypochlorite

3- Detachment by sonic and ultrasonic energy

* Disrupt matrix by 3D cleaning and shaping and move mass into dissolution to eliminate it from endodontic space .
* Multiple attached strategies of irrigation techniques are required instead of our traditional approach.
* New of Novel: Multisonic techniques: ( son endo ): is one new techniques to eradicate biofilms by disruption and movement of biofilm mass in root canal space .

Good Luck ☺ Shorooq krishan