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Iatrogenic Factors and Oral Health

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Abstract

The periodontium must be in a state of health for the effective functioning of normal dentition. Etiology of diseases related to periodontium may be iatrogenic i.e. those diseases that result from careless procedure done by a physician or a dentist. This article discusses iatrogenic factors affecting oral health.

Keywords: *Iatrogenic, Periodontics, Non-surgical Periodontal Therapy, Surgical Periodontal Therapy*

Introduction

"To err is human"

"Iatrogenic" is derived from Greek Language where **"Iatros"** means Doctor/Healer **"Gennan"** means **"as a Result".**[1]A tradition of conservatism in medical practice has understandably grown up in the centuries since Hippocrates told his disciples "Primum non nocere" i.e. do no harm. Man has always been aware of the hazards of the doctor-patient relationship, as well as the benefits. Napoleon, when advised to consult his physician said, "I do not want two diseases - one nature-made, one doctor made".[2] Iatrogenic disease is defined as those diseases induced by physicians' activity, manner, or therapy[3]and this term is usually used for an infection or other complications of treatment while iatrogenic factors in dentistry is defined as inadequate or inappropriate dental procedures that contribute to deterioration of teeth or periodontal tissues.It can be due tocareless therapeutic procedures, injudicious use of instruments and chemicals, improper treatment planning and negligence which cause traumatic injuries to the periodontium.[4]

The etiology of periodontal disease can be iatrogenic in nature. If the procedure is not performed properly diagnostic procedures, restorations, endodontic therapy, fixed and removable prosthesis, orthodontic therapy and oral and maxillofacial surgical procedures have the potential to become iatrogenic.[5]

Iatrogenic factors related to periodontics:

1. **Iatrogenic Problems due to Non-surgical Periodontal Therapy**

a) Reaction to any medication /local anesthesia.

b) Post-operative bleeding.

c) Post-operative pain.

d) Post-operative swelling and bruising.

e) Post-operative infection.

f) Increased sensitivity to temperature

g) Apparent changes in appearance of teeth due to gum recession as result of decreased inflammation.

h) Tooth mobility/loss.

Pocket debridement in periodontal therapy by handinstrumentation (scaling and root planing, SRP) or ultrasonics is necessary for the treatment of periodontal disease. But it can cause many side effects. It can cause gingival recession resulting in exposure of root surface,inadvertently remove rootcementum and sometimes superficial parts of dentin also. Hence, a number of dentinal tubules will be exposed to theoral environment as treated root surfaces are normally left unprotected.[6]

Bergenholtz and Lindhe[7] found that the incidence of pulpal lesions did not increase when teeth where subjected to scaling and root planning as compared to untreated teeth subjected to periodontal breakdown.

Patients who have received pocket/root debridement in periodontal therapy frequently experience sensitivity of the treated teeth to evaporative, tactile, thermal, and osmotic stimuli.[8] Usually, the symptoms develop and peak during the first week, and then they

may subside or disappear within the subsequent weeks they are although uncomfortable.[9]

It has been observed that tissue trauma occurs during non-surgical periodontal therapy[10] which triggers local mechanoreceptors and nociceptors that gets activated and release chemicals such as prostaglandins, bradykinin, and histamine leading to perception of painin the central nervous system.Pihlstromet al[11] reported that patients experienced pain of significant duration and magnitude after scaling and root planning.

2. **Iatrogenic Problems Caused By Surgical Periodontal Therapy**

An iatrogenic problem related to periodontics is formation of periodontal abscess which is of 3 types :

a) Post-therapy periodontal abscess: When small fragments of calculus is forced into the deep- periodontal tissues.[12]

b) Post-surgery periodontal abscess: When there is inadequate removal ofsubgingival calculus or there is presence of foreign bodies in periodontal tissues.[13]

c) Post-antibiotic periodontal abscess: When systemic antibiotics are prescribed without subgingival debridement in patients with advanced periodontitis which causes formation of abscess.[14]

Another iatrogenic problem is gingival recession which may result due to periodontal therapy. Since it occurs primarily as an outcome of resolution of the inflammation in the periodontal tissues, it is seen both following non-surgical and surgical therapy.[15]

Iatrogenic factors related to Endodontics:

1. **Sodium hypochlorite extrusion:** Sodium hypochlorite (NaOCl) is the most widely used irrigant, with a concentration ranging from 0.5–5.25%.[16] It is bacteriocidal and has capacity to dissolve organic matter, dislodge debris from the root canal system and provide a degree of lubrication whilst shaping the canals during RCT.[17]Although, there is a risk that NaOCl can get extruded into the periradicular and soft tissues leading to anintense inflammatory response and extensive damage of tissue.[18]Sodium hypochloride extrusion occurs when there is over preparation of apical foramen, pre-existing open apex, poor working length control and absence of dedicated endodontic irrigation needle and syringe.

Prevention:

a) Irritating syringes are not jammed into the apical part of canal.

b) Irrigation should always be performed relatively passively without excessive hydraulic pressure.

c) Side vented needles should be used.

2. **Instrument separation:** It is during non-surgical root canal therapy an instrument will separate in a canal system,blocking access to the canal terminus. This instrument is usually some type of file or reamer**.**

Causes:

- Improper use
- Too much apical pressure during instrumentation
- Inadequate access cavity preparation
- Excessive or unnecessary force is applied to instrument
- Overused instrument

Prevention:

- Flaws such as shiny areas or unwinding, are detected on the flutes.
- Excessive use had caused instrument bending or crimping.
- Excessive bending occurs during file usage.
- The file knicks instead of curving.
- Corrosion is noted on the instrument.[19]

3. **Aspiration of instruments**:Foreign body aspiration is a possible complication of dental treatment that may result in a life-threatening situation. The foreign body is often spontaneously ejected from the airway, but in other cases, surgical intervention is needed. Items that are more commonly accidentally inspired or swallowed include teeth, restorations and restorative materials, implant parts, rubber dam retains, impression materials etc. It is important for the clinician to employ all the correct techniques to reduce the risk.

Prevention:

- Using rubber dam

- Tie floss with stainless steel crown

- Floss is tied to endodontic file to prevent aspiration

Management:

Aspiration is managed by performing Heimlich manoeuver which is a first aid procedure used to treat upper airway obstructions (or choking) by foreign objects and X-ray films should be taken to confirm the location of foreign objects in the respiratory tract.[20]

4. **Iatrogenic pulp exposure:**Vital tooth is asymptomatic with sound dentin at the periphery. It may be due to small mechanical or traumatic exposure of pulp.

Prevention: By taking proper radiograph.

Management: In **direct pulp capping**, the protective dressing is placed directly over an exposed **pulp**;

For root canal treatment the inflamed or infected pulp is removed and the inside of the tooth is carefully cleaned and disinfected, then filled and sealed with a rubber-like material called **gutta-percha**.[21]

Iatrogenic factors related to Oral &Maxillofacial surgery:

1. **Inadvertent removal of Wrong Tooth[22]:**

Causes:

- Use of different tooth numbering systems

- Differences in mounting of radiographs

Prevention:

- Focus attention on procedure.

- Check with the patient and the assistant to ensure that the correct tooth is being removed.

- Check, then recheck, images and records to confirm the correct tooth.

Management:

- The tooth should be replaced quickly into the tooth socket.

- Splinting is done.

- Endodontic treatment after successful reattachment.

2. **Mandibular angle fractures during third molar removal[23]:**

The magnitude of tooth impaction, deep vertical and horizontal impaction of third molars is considered to be a risk factor for iatrogenic mandibular fracture.

Causes:

- Type of tooth angulation, in cases of horizontal and distal 3rd molar angulation there are more chances of fracture.

- Length of roots,,

- Presence of a cyst or tumor around an impacted third molar,

- Systemic disease or medications that may impair bone strength,

Prevention: Can be prevented by taking proper history of the patient and taking radiograph.

3. **Luxation of an Adjacent Tooth during extraction[24]:**

Causes:

- Due to Inappropriate use of extraction instruments.

Prevention:

- Judicious use of force with elevators and forceps

- Other teeth should not be used as fulcrum for an elevator.

- Narrow forceps may be useful for the extraction of tooth that is crowded and has overlapping adjacent teeth (eg. Mandibular anterior crowding)

Management:

I. If an adjacent tooth is significantly luxated or partially avulsed

- Reposition in the tooth socket and left alone

- Occlusion should be checked

II. Luxated tooth is mobile

- The tooth should be stabilized with semi-rigid

fixation.

- For this a simple silk suture that crosses the occlusal table and is sutured to the adjacent gingiva is usually sufficient.

4. **Subcutaneous Emphysema[25]:**It is caused by entry of air into fascial spaces of face and neck, resulting in distention of overlying skin or mucosa and is characterized by air being forced underneath tissue, leading to swelling, crepitus on palpation, and with potential to spread along the fascial planes.

Causes:

- Crown preparation when osseous surgery is done with airotar instead of a micromotar.

- Endodontic therapy when air is used for drying the canal instead of paper points.

- Extractions and other oral surgery.

Prevention:

- Handpieces that exhaust air into the surgical field are not used.

- Air-cooled instruments used in surgical orofacial procedures should vent air away from the immediate area or recirculate air to reduce risk of introducing it into tissues**.**

Management:

- Handpieces that exhaust air into the surgical field are not used.

5. **TMJ injury due to extended period of mouth opening during surgical procedure[26]:**

Causes:

- Not using correct surgical technique.

- Failure to support mandible while removing mandibular third molars.

- Patient's protective mechanism for opening exceeded while under general anesthesia.

Prevention:

- Dentist should include examination of the temporomandibular region, evaluation of joint sounds, opening and excursive movements, and temporal/ masseter/ pterygoid muscle tenderness in all preoperative third molar extraction patients.

- A bite block should be used to stabilize the mandible upon surgical mobilization of the lower third molar teeth.

6. **Needle Breakage[27]:**

Causes:

- Size of the needle

- Previously bent needle

- Defective needles

Prevention:

- Use larger gauge needle[25 gauge is adequate]

- It should be kept in mind that Hub is the weakest part

- Needle should not be redirected , once it is inserted into the tissue

Management:

- By evaluating the broken needle in a 3D CT scan.

7. **Needle Aspiration[28]**

Causes:

- Improper fit of needle.

- Applying excessive pressure

Prevention:

- By using lower lock syringes instead of friction lock syringes

Iatrogenic problems related to Orthodontics

1. **Root Resorption[29]:**Some degree of external root resorption is inevitably associated with fixed appliance treatment, although the extent is unpredictable. Resorption may occur on the apical and lateral surface of the roots. Vertical loss of bone through periodontal disease creates a far greater loss of attachment and support than its equivalent loss around the apex of a tooth.

2. **White Spot Lesions:**White spot lesion is one of

the most prevalent iatrogenic side effect of orthodontic treatment.White spot lesions are subsurface enamel porosities caused by enamel demineralization.According to Ogaard et al. white spot lesions develop as a result of prolonged plaque accumulation on the enamel surfaces adjacent to orthodontic devices, commonly due to poor oral hygiene.

Prevention:

- By improving patient oral hygiene using mechanical plaque control methods
- By enhancing the enamel resistance to the microbial acid by using topical fluoride
- By additional methods using different mechanisms.

3. **Soft tissue injury:**

- Minor aphthous ulcerations, or canker sores, can develop around the miniscrew shaft or on the adjacent buccal mucosa in contact with the miniscrew head.
- Soft-tissue coverage of the miniscrew head and auxiliary.

Iatrogenic problems related to Prosthodontics[30]

1. Removable partial denture (RPD) is a denture for a partially edentulous patient who desires to have replacement of teeth for functional or aesthetic reasons but they favor plaque accumulation resulting in:

- Gingival inflammation
- Periodontal pocket formation
- Mobility of the abutment teeth.

2. **Denture Associated Mucosal Trauma** leads to keratotic,hyperplastic, inflammatory and ulcerative lesions.

3. **Traumatic Ulcers Due To Denture:** Because of realeff(resilient like effect)) , settling of mucosa after prosthesis may lead to pressure spots or ulcer. It can be prevented by removing sharp points in the denture.

Iatrogenic problems related to Paedodontics:

1. **Accidental swallowing of crown/ bands[31]:**Accidental swallowing of Stainless steel crown/ bands during a procedure

Prevention:

- Oral packing or tie floss to stainless steel crown

Bands could be secured by an adequate length of floss through the molar tubes and the free ends left outside the mouth, especially while banding the second molars.

2. **Removal of Premolar Bud:**Removal of premolar bud occurs during extraction of primary mutilated tooth in attempt to remove broken roots.It can be prevented by leaving small root portions as such, avoidingcryer's. If it comes out replace and suture it.

Iatrogenic problems related to Implant Surgery:

1. Sinus Perforation during implant placement[32]: Because of the close relationship between maxillary posterior teeth and the sinus cavity, a communication between the sinus and the mouth may result while implant placement. It occurs when indirect sinus lift perforation occurs.

Prevention: By Valsalva maneuver ***which is performed by moderately forceful attempted exhalation against a closed airway, usually done by closing one›s mouth, pinching one›s nose shut while pressing out as if blowing up a balloon.***

Management: By simple closure of sinus.

2.**Sinus membrane perforation:** It may occur when direct sinus lift sinus membrane perforation occurs.

Causes:

- Anatomical variations such as a maxillary sinus septum, spine, or sharp edge are present
- Very thin or thick maxillary sinus walls

Management:

- A pericol membrane is placed to close the area.

3. **Inferior alveolar nerve injury during implant placement[33]:**The mandibular nerve is a peripheral nerve which is the largest of the trigeminal branches and is the most common branch that is involved with neurosensory disturbances following dental implant surgery.

It can be prevented if

4. Implant size is proper

5. Accurate assessment of CBCT

Prevention:

• By proper planning before implant placement and proper skills.

Conclusion

Iatrogenic factors play a considerable role in dental diseases. When treating patients objectives of dentists must be clear, to avoid any undesirable outcomes of treatment.There is a need to increase awareness among dental practitioners about role of iatrogenic factors in order to get successful outcome of any dental therapy, which unfortunately is ignored for a long time.

Ethical Clearance- It is a review article.

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