**ABSTRACT**

It is usually believed that root canal therapy fails because of failure to follow treatment protocols. However, sometimes even after following the highest standards of treatment the outcome of the therapy is not good. The cause for this might be intra radicular or extra radicular. Clinicians mostly concern themselves with the root canal only and forget the periapical area. The aim of this review is to discuss the commonly neglected extra radicular causes of root canal therapy failure.

**Key words:** Cyst, extra radicular biofilm, root canal failure, systemic diseases

The most noteworthy mechanisms of host defense system evasion is the arrangement of the microbes into a biofilm. A biofilm can be defined as a microbial population attached to an organic or inorganic substrate, surrounded by microbial extracellular products, which form an intermicrobial matrix. Organized as biofilms, microorganisms show greater resistance to antimicrobial agents as compared with planktonic cells.

Periradicular biofilms in untreated teeth with lesions was found in some cases (4%). This indicated that the periapical biofilm does occur, but in a small number of cases, and therefore was responsible for a low percentage of failed treatments. The main consideration regarding periradicular biofilms is that the clinicians are unable to detect a biofilm in routine clinical case. Hypothetically, in a failed root canal treated tooth, the clinician could take a microbiological sample to check if the root canal is free of bacteria or if there are persistent microorganisms.

Even then if healing does not occur, then one may suspect the presence of extraradicular infection. However, it should be kept in mind that microorganisms may have been present within the root canal system, but have escaped detection in the samples. This is especially applicable in retreatment cases, where sampling from filled root canals is difficult to carry out.

It is proven that intracanal disinfection or antibiotics cannot effortlessly affect bacteria present outside the apical foramen. First, it is difficult maybe even impossible to clinically diagnose extraradicular infections. Second, most medicaments have ill effects on periapical cells and/or may have their effects neutralized after extrusion beyond the apex.

The advancement in techniques to non-surgically treat biofilms appears questionable. These stubborn infections, if present, must be treated by periradicular surgery.
NON-MICROBIAL FACTORS

Some cases can fail because of intrinsic or extrinsic non-microbial factors. In these cases, no microorganisms can be found, and failures have been attributed to a foreign body reaction in the periradicular tissues.

A study reported a therapy-resistant lesion, which is surgically removed and diagnosed as a periradicular cyst by light and electron microscopy. A large number of cholesterol crystals were observed in the connective tissue around the cystic epithelial lining. Since microorganisms were not detected, the investigators attributed the failure to a foreign body reaction against cholesterol crystals. Cholesterol crystals get precipitated and accumulate as they are released from disintegrating host cells, including erythrocytes, lymphocytes, plasma cells, and macrophages. These can be in large numbers in chronic periradicular lesions.

They may also originate from circulating plasma lipids. It has been demonstrated that cholesterol crystals can be an etiological factor in non-healing chronic inflammation. If giant cells are ineffective in removing crystals, they continue to accumulate and can maintain the periradicular lesion.

The question of whether the development or presence of a radicular cyst is the cause of endodontic treatment failure is still a controversial issue. Although it has been proved that the majority of periradicular cysts heal after conventional root canal therapy.

It has been suggested that true cysts, that contain cavities completely enclosed by epithelial lining, do not. This statement is based on the fact that true cysts are self-sustaining by virtue of their independence from the presence of irritants in the root canal. However, it has been revealed that the formation of the cyst cavity is originated from immunological reactions, which attack epithelium cells in proliferation. If the immunological theory is true, it is possible that true cysts can also heal since the cause of epithelial proliferation, i.e., the irritants within the root canal, are eliminated.

Despite a number of theories regarding the healing of different types of periradicular cysts, there is no significant scientific evidence that supports any theory. It is well known that cysts may become infected. Pocket cysts containing epithelium lined cavities that are continuous with the root canals (bay cyst) have a higher risk of becoming infected than true cysts.

Within the cyst cavity, microorganisms growing from the root canal system are combated by defense molecules (antibodies and components of the complement system) and by neutrophils that transmigrate through the epithelium into the cyst lumen. Because of the characteristics of the cyst cavity, the host defense mechanisms may not be effective in eliminating microorganisms. Persisting microorganisms and their products within the cyst lumen may maintain a periradicular inflammation in well-treated root canals. This also characterizes an extraradicular infection.

FOREIGN BODY REACTION

In addition to intrinsic causes, extrinsic factors might also be responsible for the endodontic failure. Some root filling materials contain insoluble substances, such as talc contaminated gutta-percha cones, which can evoke foreign body reactions when protruded into the periradicular tissues and cause failure. The cellulose present in paper points, cotton wool may also cause persistence of periradicular lesions if placed into the periradicular tissues. This component of plant cell walls is neither digested by man nor sullied by the defense cells. Therefore, cellulose can remain in the tissues for long periods of time and can cause a foreign body reaction.

Paper points or particles thereof can be dislodged or pushed into the periradicular tissues, inducing a foreign body giant cell response or sustain the periradicular lesion. Furthermore, paper points, cotton wool, and food may also carry microorganisms into the root canal and the periradicular tissues. The practice of leaving a tooth open to drainage has been considered as unscientific (Walker). Complications rarely occur if the clinical practice is based on the contemporary biological principles of endodontics. In contrast, complications arising from a tooth that has been left open to drain are usually difficult to treat.

PERIODONTAL INVOLVEMENT

The granulation tissue formed in the furcation region of posterior teeth may eventually involve the periapical tissues. Presence of a radicular lingual groove may also cause a persistent periodontal pocket. Recession of attachment apparatus may cause lateral canals in or near the furcation area to become exposed to oral fluids thus causing reinfection.

SYSTEMIC FACTORS

Presence of systemic disease does not necessarily mean that there is a cause and effect relationship with the local lesion. In the presence of systemic disease: Periapical reaction may be intensified.

Severe reaction may follow mechanical instrumentation, dispersion of microorganisms, and chemical irritation from sterilizing agents within the root canal. The lesion may persist and healing is impaired.

AGING

Seltzer et al., 1963 did a study of the distribution of endodontic treatment failures among various age groups. They found that occurred equally in both sexes. Among males, it occurred in the group between 51 and 60 years of age. Female had the greatest number of failures in the 30-40 years category. Largest number
of failures occurred in the upper teeth of patients aged 31 and 60 years. Thus prior to endodontic therapy medical and dental history must be taken. A clinical radiographic examination must be made and laboratory tests like cytologic or microbial examination may be prescribed.

**DIABETES**

Diabetes disturbs collagen metabolism in connective tissue. There is enhanced degradation of collagen precursors, procollagen, prior to their secretion by the cell. Accelerated collagen maturation and cross linking, enhanced extra cellular degradation due to increased collagenase activity. Glucose specifically simulates the catabolism of interstitial collagen. In an uncontrolled diabetes patient, the initial periapical lesion may increase in size, even with proper endodontic treatment. Thus, when diabetes is controlled therapeutically, healing of an endodontic lesion may occur.[16]

**THYROID DISEASE**

Thyroid disorder occurs most commonly in women between the ages of 30 and 50. The use of local anesthetics with epinephrine is contraindicated in hyperthyroidism as it potentiates the action of the thyroid gland. If profound anesthesia cannot be obtained, paraformaldehyde paste should be applied to dental pulp which leads to partial or total necrosis.[17]

**Anemia**

Healing is impeded or delayed in patients with anemia as nutrients are not brought into the damaged area because of inadequate blood supply thus causing inadequate formation of bone.[18]

**Leukemia**

Leukemic patients are susceptible to infection especially when the polymorph nuclear neutrophils count falls below 1000-2000/mm. For several days after chemotherapy, dental procedures are contraindicated. It enhances the proliferation of infected microorganisms. In leukemia, bone pain may mimic that of pulpitis. Alveolar bone resorption and cortical perforation may develop.[18]

**LIVER DISEASES AND BLEEDING DIATHESES**

Patients with liver diseases have low levels of vitamin K-dependent clotting factors such as prothrombin and Factors VII, IX, X. The two most common bleeding disorders are hemophilia, (deficiency of Factor VIII C) and von Willebrand’s disease (deficiency of von Willebrand’s factor) which are necessary for clot formation. Clinically, the patients bleed easily, especially in the presence of inflammation. Mandibular injections are hazardous in such patients. Intra ligamentary anesthesia may be preferable.

Endodontic procedures which may induce bleeding should not be performed without prior administration of whole blood, plasma, antifibrinolytic agents followed by locally applied agents to control hemorrhage. Care must be exercised in administering local anesthesia (LA), as injections may cause submucosal hemorrhage. Instead pulp necrosing agents such as paraformaldehyde paste, should be applied to the exposed pulp which leads to pulp necrosis. The necrotic pulp can then be extirpated. LA may be injected then directly into the pulp prior to endodontic therapy.[16]

**ENDODONTIC THERAPY**

Symptom-free pulp pathoses, regardless of the presence of radiographic periapical changes do not require endodontic therapy prior to the initiation of chemotherapy.

When symptoms are present, but there are no periapical lesions, endodontic therapy should be performed with appropriate antibiotic prophylaxis to alleviate the patient’s symptoms.[16]

**CONCLUSION**

The key area to be addressed in our daily practice lies in how skillfully we prevent a failure from occurring and if it does how we are able to identify and manage it. Although a multitude of treatment modalities exist, focus should be largely on the cognitive and psychomotor, problem-solving skills of the dentist which is time tested.

**REFERENCES**

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