

Internal root resorption

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Abstract

Root resorption is a process that leads to the loss of hard tissues of the tooth. It can either be physiologic or pathologic in origin. Depending on the site of the lesion it can be internal root resorption (IRR) or external root resorption (ERR). In this article internal root resorption is mainly focused. IRR is an asymptomatic condition that represents clinically with the classic sign of 'pink tooth'. Due to its asymptomatic nature patients often delay treatment unless the esthetic reason is of concern. IRR can seldom be confused with ERR, here the advanced newer technology, CBCT can be of greater help to rule out the differential diagnosis. The treatment is often root canal treatment and is comparatively less invasive.

Keywords: Internal root resorption, Pink tooth.

Introduction

According to the Glossary of the American Association of Endodontists, resorption is defined as a condition associated with either a physiologic or a pathologic process resulting in the loss of dentin, cementum, or bone.¹ This is facilitated by the action of polynuclear giant cells. Depending on the tissue resorbed, these cells are called osteoclasts, cementoclasts or dentinoclasts. It is a dental complication that might lead to tooth extraction.²

Physiologic resorption is a natural process seen in deciduous dentition and is desirable so as to facilitate eruption of the successors. It is caused due to the pressure exerted by the underlying permanent tooth. Whereas, pathologic resorption is a multifactorial pathology that leads to undesirable resorption and often causes premature loss of the affected tooth when the condition goes unidentified or if the necessary treatment is neglected. Pathologic process can affect both deciduous and permanent dentition.³

Pathologic root resorption may occur following various injuries these can be mechanical or chemical. Depending on the location of the lesion root resorption is broadly divided into two categories, internal root resorption (IRR) and external root resorption (ERR). In some cases, the two types of resorption may occur simultaneously.²

This review article focuses mainly on internal root resorption (IRR). IRR is an inflammatory process that is initiated within the canal space and is generally confined within this space. This leads to loss of dentin. In advanced IRR cases, the lesion might progress so as to involve the external surface of the tooth structure leading to the simultaneous loss of the cementum along with dentin.⁴

The diagnosis of these lesions is quite challenging to establish. The conventional X-ray is often inadequate as the IRR radiolucencies are not detected at the early stage either due to their smaller dimensions, or due to

this 2-dimensional method. Cone beam computed tomography (CBCT) aids as a powerful tool in accurate early diagnosis of these lesion.⁴

Also the introduction of newer materials in the market have facilitated the approach of remineralization and healing.

Etiology

Root resorption may occur after various injuries, including mechanical, chemical, or thermal insult to the pulp. IRR is established after necrosis of odontoblasts takes place. It is associated with chronic partial pulp inflammation and partial pulp necrosis. The etiological factors responsible for this may be caries, incomplete removal of the pulp, trauma, cracked tooth, pulp capping with calcium hydroxide or pulpotomy, or extreme heat production during cavity cutting. These factors stimulate the pulp tissue, and initiate inflammatory processes. Following this, some undifferentiated cells of the pulp convert themselves to osteoclasts or macrophages, which results in IRR. In a study that included 27 patients, trauma was seen in 43% of the cases, followed by carious lesions in 25% of the cases⁵. This suggested trauma to be most common factor responsible for resorption.

Classification

IRR are generally categorized into two types: internal inflammatory root resorption and internal replacement root resorption.

1. Inflammatory resorption: In this type of IRR, when there is a resorptive process in progress with relation to the intracanal dentin the defect that is created is occupied by the granulation tissue. This granulation tissue is a reactionary response to the inflammation.
2. Replacement resorption: In this type of IRR, when there is a resorptive process in progress that creates a defect in the intracanal dentin, there is a

concomitant deposition of the bone or cementum like tissues in some regions of the defect. This results in the irregular enlargement of the pulp space that later becomes partially or fully obliterated.⁴ It results from a low grade intensity of pulpal irritation such as chronic irreversible pulpitis or partial necrosis that is usually localized to a small area in the root canal.⁶

Pathophysiology

IRR usually occurs as a result of a continuous chronic inflammatory process. The progress of this lesion is dependent on two things: presence of vital pulp tissue at or below the resorption area, and partially or completely necrotic pulp, coronal to the site of resorption. This allows a constant entry of microorganisms and its antigens into the root canal. Microbial stimulus is an essential factor for the persistence of resorption.

It is believed that the receptor activator of nuclear factor kappa beta ligand (RANKL) and osteoprotegerin (OPG) signalling pathways play a major role in the modulation of clastic activity by multinuclear odontoclast cells that are involved in inflammatory root resorption, a process similar to bone resorption by osteoclasts.⁷

The resorptive process is carried out by the clastic cells. According to the type of tissues resorbed these are odontoclasts, osteoclasts and cementoclasts. Odontoclasts are morphologically similar to osteoclasts. They also have similar enzymatic properties and resorption patterns. However, odontoclasts are smaller in size and form smaller resorption lacunae than osteoclasts. It is not known whether the osteoclasts and tooth resorbing cells are the same cell, but a number of similarities do exist between them.

The intensity of the stimuli and inflammatory process also determine the extent of progression. The origin of clastic cells is related to the viable blood

supply. The necrotic tissue provides a stimulus for the formation of these cells. The vascular changes that occur in the pulp produce hyperaemia. This causes an increased oxygen tension and results in low pH levels, thus attracts numerous macrophages to the site. Thereby resorptive process is initiated. Following the resorptive activity, the connective tissue may undergo metaplasia to form granulation tissue.

Necrosis of the entire pulp tissue occurs as infection progresses and restrains the resorptive process which acts as a protective mechanism. Whereas, collateral blood supply to the resorption site through an accessory canal from the periodontal ligament maintain the resorptive process.⁶

Clinical signs and symptoms

IRR is asymptomatic and hence is detected coincidentally in the routine check up radiographs.

The inflamed connective tissue filling the IRR defects degenerates, undergoes necrosis, and triggers an apical periodontitis. The tooth may then become symptomatic and periradicular abscesses may occur. Perforation of the root is usually followed by the development of a sinus tract, which confirms the presence of an infection of the root canal, mostly by Gram-negative, strict anaerobes species. Unless the lesion has advanced significantly to involve the periodontal ligaments, the condition might go unnoticed.^{4,8}

However, according to the location and wideness of the lesion the clinical signs of IRR may vary. If the lesion is located in the coronal part of the canal, an affected tooth may clinically be observed as "pinkspot". Pink spot is the pinkish discoloration that the affected tooth exhibits which is related to the highly vascularised connective tissue adjacent to the resorbing cells. When the lesion further progresses untreated and leads to pulpal necrosis, this color turns grey/dark grey.⁹



Fig. 1: Pink tooth of mummery. (a) Pink spot seen in the initial stage; (b) A complete pinkish grey discoloration seen in a more advance stage

When the resorbing cells are cut off from the blood supply and nutrients, the development of the complete pulp necrosis occurs and the growth of resorption stops. This can happen if the pulp chamber is sealed.⁹

When such a tooth is checked for its vitality, the response to vitality tests, thermal and electrical, is

positive until the lesion grows significantly in size resulting in a perforation.

Radiographically, IRR is characterized by the radiographic appearance of an oval shape enlargement within the pulp chamber or the root canal. At times an overall widening of the canal space is seen. Whereas, it can also be seen that the resorption area is filled with

deposition of metaplastic hard tissue that looks radiopaque like bone or cementum. This radiopaque material is due to replacement resorption that has an aspect of enlargement of the pulp chamber with a fuzzy appearance of the canal space. When IRR is suspected, it is recommended to take several shots under different angles of incidence.¹⁰

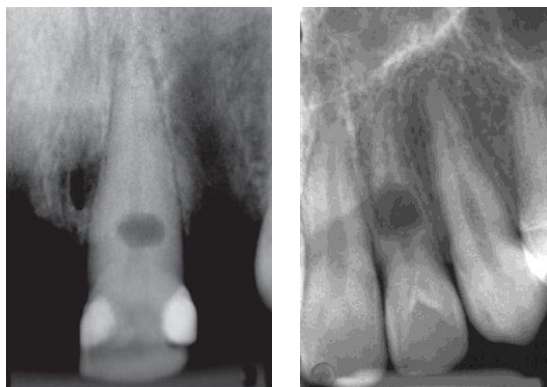


Fig. 2: Radiograph showing internal root resorption. (a) radiolucent oval shape with relation with root canal suggestive of IRR; (b) An extensive radiolucency starting from inside the tooth and extending to the outer surface of the tooth suggesting a pathological perforation caused by the severe IRR

However an accurate early diagnosis of the IRR is difficult by examination of just a conventional X-ray. But it is essential for an appropriate treatment to be planned. The comparatively newer imaging option, cone beam computed tomography (CBCT) has been successfully used to evaluate the true nature and severity of resorption lesions. It has a high accuracy in detecting root lesions at the earliest stages. CBCT gives a 3-dimensional appreciation of the resorption lesion. It provides axial, coronal and parasagittal views of the anatomy. This gives a clear idea of the size and the location of resorptive lesion with high sensitivity and an accurate specificity.⁴

Treatment

In an order to cease the resorptive process, it is necessary to get rid of the causative factor. In IRR it is often any source that is causing inflammation and resulting into formation of granulation tissue. To facilitate this root canal treatment (RCT) is the only option.

While performing RCT a special effort has to be made to get rid of the granulation tissue that is difficult to remove from the nooks of the resorptive defects created in the canal. Here, copious use of irrigants such as sodium hypochloride (NaOCl) should be done in conjunction with ultrasonic activator; so that it activates the irrigant and enhances its potential to dissolve the

tissue. Thus complete chemomechanical debridement can be achieved.

Interappointment dressing of calcium hydroxide (CaOH₂) is of a great help as it maximizes the effect of the disinfection procedure, maintains the alkalinity, and necrotizes the residual pulp tissue. But a complete removal of CaOH₂ from the canal is also important as any remnants of it would affect the bonding efficacy of the restorative materials to the dentin. Also, long standing CaOH₂ dressings should be avoided, since it causes the tooth to become weaker and brittle.⁹

While obturating, the internal resorptive defect can be restored with conventional gutta-percha cone and sealer method. Here, hot flowable gutta percha can be used so that it flows into the nooks of the defect and seal the cavity and the canal completely.

If a resorptive cavity is communicating to the external surface, the use of bioactive materials such as mineral trioxide aggregate (MTA) or newer developed material like Biodentin can be used.⁴

Overall, the prognosis of IRR depends on the extent of the lesion. Prognosis is better when the defect walls lies within the canal space; whereas the prognosis decreases when the cavity wall extends externally. In pathologic perforation caused by severe internal root resorption, the prognosis is so poor that extraction is the only valid treatment protocol.

Conclusion

IRR is an asymptomatic condition so a patient won't report to the clinic with the specific complaint of the particular tooth. It is detected by chance in routine radiographs hence it is important that a practitioner carefully examines any routine radiographs that are taken. Once a lesion is suspected it is advisable to rule out the exact condition by taking x-rays at various angulations. CBCT can be of great help in giving the exact idea of the lesions location and its extent. Early diagnosis and treatment are necessary in order to stop the further resorptive process. Accurate diagnosis, prompt treatment planning, through debridement, and advanced restorative materials together aids for a better outcome and makes rehabilitation of the resorbed teeth possible.

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