Internal resorption: A review & case report

RAHUL MARIA *
VIJAY MANTRI **
SHRADDHA KIOWLAL **

ABSTRACT
Internal resorption of teeth is an insidious process and is generally found in teeth with previous history of trauma. Tooth is asymptomatic. It is important to diagnose this condition and institute treatment as early as possible to improve the prognosis of such teeth. This paper presents a case having resorptive defect in the apical 1/3rd which was treated non surgically with thermoplastized gutta percha technique. A six-month follow up demonstrated clinically asymptomatic and adequately functional tooth, with radiographic signs of healing.

INTRODUCTION
Internal root resorption has been described as a resorptive defect of the internal aspect of the root following necrosis of odontoblasts as a result of chronic inflammation and bacterial invasion of the pulp tissue.¹

It is caused by transformation of normal pulp tissue into granulomatous tissue with giant cells, which resorb dentin. This transformation is thought to stem from chronic inflammation of the coronal pulp caused by continuous bacterial stimulation.² Trauma, caries and restorative procedures have been suggested to be contributing factors, but it also occurs as an idiopathic dystrophic changes.

Clinically, internal root resorption is usually asymptomatic and is detected coincidentally through routine radiographs. Internal resorption can be found in all areas of the root canal but is most commonly found in cervical region. Pain or discomfort may be the chief complain if the granulation tissue has been exposed to oral fluids. The granulation tissue can clinically manifest itself as a “pink spot” in cases in which crown dentin destruction is severe. Radiographically, the lesion appears as uniform, round to oval radiolucent enlargement of the pulp space. The margins are smooth and clearly defined with distortion of the original root canal outline.¹ ²

For internal resorption to take place, vital pulp tissue is required. Therefore non surgical root canal therapy is the treatment of choice to arrest the destruction process.

CLASSIFICATION
Classifications play an important role for the clinician in the process of diagnosis and treatment planning. Andreasen has made a unique contribution to the understanding of tooth resorption following dental trauma and his original classification remains the most widely accepted³ i.e.

<table>
<thead>
<tr>
<th>Tooth Resorption</th>
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<tbody>
<tr>
<td>Internal</td>
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<tr>
<td>- Inflammatory</td>
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<tr>
<td>- Replacement</td>
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<tr>
<td>External</td>
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<tr>
<td>- Surface</td>
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<tr>
<td>- Inflammatory</td>
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<td>- Replacement</td>
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Classification of tooth resorption proposed by Lindskog subdivides resorption into 3 broad groups namely

1. Trauma induced tooth resorption
   - Surface resorption
   - Transient apical internal resorption
   - Pressure
   - Orthodontic
   - Replacement resorption

2. Infection induced tooth resorption
   - Internal inflammatory (infective) resorption
   - External inflammatory resorption
   - Communicating internal-external inflammatory resorption
   - Apical
   - Interradicular

3. Hyperplastic invasive tooth resorption
   - Internal (invasive) replacement resorption
   - Invasive coronal resorption
   - Invasive cervical resorption
   - Invasive radicular resorption

**ETIOLOGY AND PREVALENCE**

Internal resorption is commonly termed to be “idiopathic”. Trauma and inflammation are considered to be possible causing factors. Resorption process can develop by shifting of pH-value to acid for example in irreversible pulpitis, so that the dentin and enamel substances are dissolved by chelation. The untreated internal resorption can progress into external or vice versa which causes fracture of the tooth. In case of tooth trauma, intrapulpal hemorrhage can develop. Formed blood clots are then organized and replaced by granular tissue which compresses dentin wall of the pulpal chamber or root canal (fig.1). With activation of non-differentiated mesenchymal cells of the pulpal tissue they differentiate into dentinoclasts, the cells responsible for resorption of the hard tooth structure.

The real clinical problem however is replacement resorption. This is the term coined by Andreasen and Hjorting-Hansen in the early 1960’s. Two types have been described – replacement and extra canal invasive. Replacement resorption is the deposition of a bone like tissue on a resorbed dentin surface. Extracanal invasive resorption usually begins in the periodontal ligament with soft tissue burrowing through cementum and then into dentin. Bone like material is then deposited on the exposed dentinal tubules and surface. However on histologic
studies these appear to be the same process. Internal resorption is rarely found in permanent dentition. Usually incisors and mandibular molars are involved.

Recently evidence of the existence of three cytokine like proteins involved in the regulation of osteoclast cell differentiation from hematopoietic precursors and from the upregulation of mature osteoclasts has become available which are as follows:

### Bone - formation and resorption.

<table>
<thead>
<tr>
<th>RANK(Receptor activator of nuclear factor kappa)</th>
<th>RANKL(Receptor activator of nuclear factor kappa B ligand)</th>
<th>OPG (osteoprotegerin)</th>
<th>Other Cytokines Hormones</th>
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<tbody>
<tr>
<td>It is characterized as a Type I membrane receptor that was originally identified in a dendritic cell cDNA library. The receptor is localized on osteoclasts and their hematopoietic precursors of the monocytes/macrophage lineage. <strong>RANK</strong> signaling pathways are implicated in differentiation, resorption and survival responses of osteoclasts.</td>
<td>Synonyms: ODF (osteoclast differentiating factor) OPG L (osteoprotegerin ligand), TRANCE (tumor necrosis related activation induced cytokine). It is Type II transmembrane protein expressed primarily in lymphoid tissue and T-cell lines. It is osteoclast differentiating factor in vivo and is absolutely required for osteoclastogenesis. Osteoclast precursors that express RANK recognize RANKL through cell to cell contact and differentiate into osteoclasts. <strong>RANKL</strong> immunoreactivity has been detected in odontoblasts, pulp fibroblasts and single odontoclasts, suggesting autocrine/paracrine role. PD L cells under mechanical stress upregulated osteoclastogenesis with increased expression of RANKL, m RNA and protein</td>
<td>Synonym: OCIF (osteoclastogenesis inhibiting factor). Is a secreted receptor from <strong>RANKL</strong>. It functions as decoy receptor which limits the biological actions of <strong>RANKL</strong>. It reduces concentration of available <strong>RANKL</strong> and inhibits its ability to stimulate osteoclast production. The inactivation of <strong>OPG</strong> plays an important role in the differentiation of osteoclasts. This helps to explain the mechanism of both inflammatory and non inflammatory resorption.</td>
<td>Besides <strong>RANK/RANKL</strong> system other cytokines such as IL-1alpha, IL-1beta, IL-6, IL-11, TNF-alpha, interferon-gamma and TGF-beta also involved in control of osteoclasts formation and bone resorption. Parathyroid hormone related protein promotes osteogenesis by inhibiting expression of <strong>OPG</strong> and by enhancing production of <strong>RANKL</strong> by osteoblasts.</td>
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</table>

### DIAGNOSIS

**Various diagnostic tools used for detection of internal resorption are:**

- Visual examination based on changed color in tooth crown
- Radiographic diagnosis
- Conventional and cone beam computed tomography
- Light microscopy
Electron microscopy

Teeth in which resorptive process reaches cervical area of the crown may have a pinkish color, known as ‘pink tooth’ resulting from granulation tissue ingrowth.4,6 (fig.2).

A radiograph of the affected tooth usually shows an oval enlargement (ballooning out) of the root canal space.7 The pulp chamber and canal cannot be followed through out the lesion. Radiograph performed at different angulation confirms that the resorptive lacunae is a continuation of the distorted border of the root canal.

Cone beam computed tomography (CBCT) is a relatively new three dimensional imaging technique requiring a significantly lower radiation dose than conventional computed tomography. With traditional computed tomography, a narrow fan shaped X-ray beam makes a series of rotations around the patient’s head as they are incrementally moved through the machine. The raw data from each rotation is then reconstructed to produce tomographic images. CBCT differs from conventional computed tomography imaging in that the whole volume of data is acquired in the course of a single sweep of the scanner.7, 8

Axial, transverse, and tangent slices, number of root surfaces, and actual root resorption extension can be analyzed.

Light microscope shows different levels of inflammation of the pulpal tissue with infiltration of predominant lymphocytes, macrophages and some leukocytes, dilated blood vessels and multinucleated dentinoclasts in resorptive lacunae on the pulpal-dentin surface.

Electron microscope shows the pulpal-dentin wall without odontoblasts. Dentinoclasts, large in number, have size of 50µm and with numerous philopods are turned towards dentin surface and attached to it.4

DIFFERENTIAL DIAGNOSIS: 6,9,10

INTERNAL RESORPTION

- Pinkish hue if resorptive process reaches cervical area.
- Internal replacement resorption is relatively rare and may appear clinically as a pink area in the crown (fig.3).

Radiographically:
- The margins are smooth and clearly defined. The walls of root canal system may appear to be balloon out.
- The pulp chamber and the canal cannot be followed through out the lesion (fig.4).

EXTERNAL ROOT RESORPTION

- Resorption of coronal dentin and enamel often creates a clinically obvious pinkish color in the tooth crown as highly vascular resorptive tissue becomes visible through thin residual enamel (cervical resorption).
- When tooth structure is replaced with bone that fuses with dentin, it is termed replacement resorption or ankylosis.

Radiographically:
- The border will be irregular and ill defined.
- If the lesion is superimposed on the root canal
Their distribution of the pulp canal is symmetrical but can be eccentric.

- The radiolucency is of uniform density.
- Lesion is within the confines of root canal on angled radiographs (fig.5).

- System, it should be possible to follow the canal walls unaltered through the area of defect.
- Their distribution is not symmetrical and can occur on any root surface.
- Their may be variations in the radiodensity of the body of lesion.
- Lesion shift on changing angulations.

### MANAGEMENT OF RESORPTION:

<table>
<thead>
<tr>
<th>Surface Resorption</th>
<th>Transient apical internal resorption</th>
<th>Pressure</th>
<th>Orthodontic</th>
<th>Replacement resorption</th>
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<tbody>
<tr>
<td>Monitor radiographically.</td>
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<td>Remove cause e.g. unerupted cuspid, neoplasm</td>
<td>Should stabilize on completion of orthodontic treatment</td>
<td>Mature tooth in normal occlusion; leave and monitor for ultimate implant replacement. In infra-occlusion; in selective cases surgical reposition and treat root surface with emdogain.</td>
</tr>
<tr>
<td>Endodontic treatment only if signs of infection.</td>
<td>Endodontic treatment only if signs of infection or ongoing discoloration.</td>
<td></td>
<td></td>
<td>Immature tooth in infra-occlusion; in selected cases surgically reposition and treat root surface with emdogain; or decoronate and submerge. Implant therapy, if necessary, when alveolar growth completed.</td>
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# Endodontology

## Internal Inflammatory (infective) root resorption

<table>
<thead>
<tr>
<th>Type</th>
<th>Treatment</th>
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<tbody>
<tr>
<td><strong>Apical</strong></td>
<td>• Endodontic treatment to the level of resorption.</td>
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<td></td>
<td>• Long term calcium hydroxide dressing before placement of root filling.</td>
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<tr>
<td><strong>Interradicular</strong></td>
<td>• Endodontic treatment and root canal filling (hot GP technique, Obtura etc)</td>
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## External inflammatory root resorption

<table>
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<tr>
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<tr>
<td>• Endodontic treatment and intracanal medication with either Ledermix paste followed by long term calcium hydroxide or calcium hydroxide alone. Root fill when resorption controlled.</td>
</tr>
<tr>
<td>• Prevention: following replantation of mature tooth pulp extripation and Ledermix paste dressing as soon as possible.</td>
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## Communicating internal-external inflammatory resorption

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>• Endodontic treatment to resorptive defect. Induce calcification by use calcium hydroxide alone or following careful topical application of 90% trichloracetic acid. ProRoot MTA may also be used.</td>
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## Internal replacement resorption

<table>
<thead>
<tr>
<th>Treatment</th>
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<tr>
<td>• Pulpectomy and root filling</td>
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## Invasive coronal resorption

<table>
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<tbody>
<tr>
<td>• Carefully apply 90% trichloracetic acid to resorptive tissues with glycerol.</td>
</tr>
<tr>
<td>• Curette, apply trichloracetic acid to affected resorptive tissue from defect. If pulp involvement, pulpectomy and root canal filling after intra-canal dressing with Ledermix paste. Orthodontic extrusion if necessary.</td>
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</table>

## Invasive cervical resorption

<table>
<thead>
<tr>
<th>Treatment</th>
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<tbody>
<tr>
<td>• Class 1, 2 - Topic application of 90% trichloracetic acid, curettage, and glass ionomer restoration.</td>
</tr>
<tr>
<td>• Class 3 - Topical application of 90% trichloracetic acid to resorptive tissue, curettage, elective pulpectomy and canal preparation to gain access to deeper and encircling infiltrating channels. Ledermix paste intracanal dressing, followed by root filling and final glass ionomer cement restoration. Adjunctive orthodontic extrusion if necessary. Alternative therapy: periodontal flap reflection, curettage, trichloracetic acid application to defect, endodontic therapy and restoration.</td>
</tr>
<tr>
<td>• Class 4 - Leave untreated and monitor or extract and implant.</td>
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DIFFERENT MATERIALS AVAILABLE

- MTA,
- Glass ionomer cement,
- Super EBA,
- Hydrophilic plastic polymer (2-hydroxyethyl methacrylate with barium salts),
- Zinc oxide eugenol and zinc acetate cement,
- Amalgam alloy and
- Thermoplasticized gutta-percha administered either by injection or condensation techniques.  

CASE REPORT

A 40 yr old male patient was referred to Department of Conservative Dentistry and Endodontics. Patient was asymptomatic. On taking case history it was revealed that the patient meet with an accident which lead to mandible fracture. A bone plate was inserted to stabilize the fragment.

On vitality testing 33, 34, 35 were found to be non vital. On radiographic evaluation a resorptive area was evident in the apical 1/3rd of the root canal of 35 (fig 7). Access opening was done working length was determined. Cleaning and Shaping was done followed by calcium hydroxide closed dressing given for 2 weeks with 35 which was changed after one week. On the next recall, the canal was dried coated with AH plus sealer, sectional obturation was done till resorptive area. The remaining canal was obturated with thermoplastized gutta percha technique (fig 6, 8).

A six-month follow up demonstrated clinically asymptomatic and adequately functional tooth, with radiographic signs of healing (fig 9).
DISCUSSION

The reciprocal activity between the newly formed granular tissue and dentinoclasts initiates and progresses the resorption process inside the endodontic space which could be compared to pathogenetic changes in the periapical region. The early diagnosis and therapy is very important in order to stop the resorption process. The success or failure of therapy should be followed clinically and by radiographic control. Naturally, if the resorption is stopped actually is not progressing, we believe that our treatment is successful. We saved a tooth and the objective of our therapy has been accomplished.  

The outcome of treatment of teeth with internal root resorption depends primarily on the size of the lesion. Large lesions cause a reduction in the resistance of the tooth to shear forces that may lead to tooth fracture. Therefore, it is imperative to initiate endodontic treatment as soon as possible to arrest the progression of the resorptive process and to prevent root or cervical crown fracture.

CONCLUSION

Root resorption is a complex process. At present the internal inflammatory resorption is amenable to treatment and can be controlled. However, internal replacement resorption is difficult to predict and control. Prevention should be the best approach. This is the area which requires further investigation.

REFERENCES


2. Maarte Meire, Roeland De Moor: Mineral Trioxide


