Pediatric dentistry

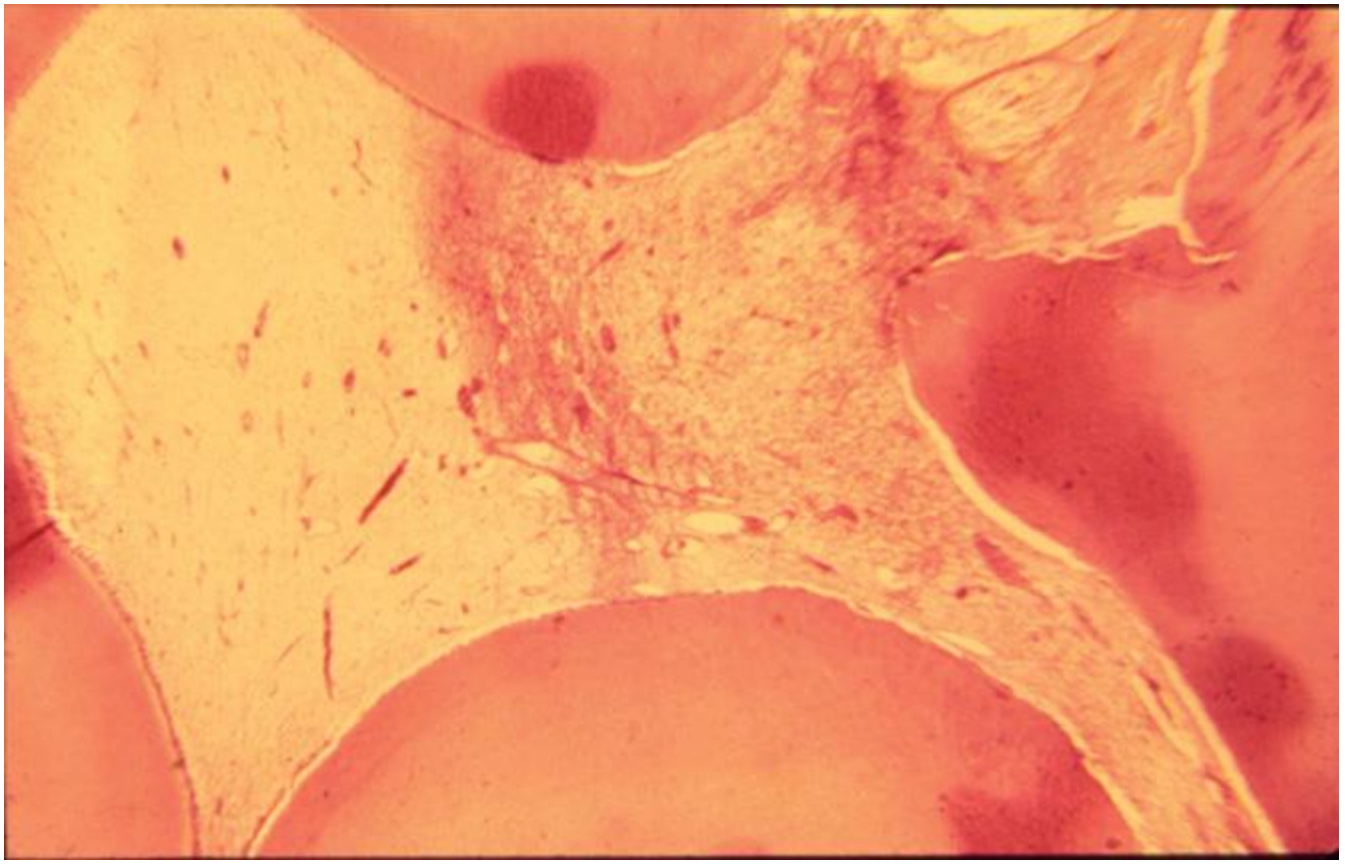
Treatment of Deep Caries, Vital Pulp Exposure, and Pulpless Teeth

Lecture 10

Dr. Mukhaled Louay Alfalluji
B.D.S. M.Sc.

PARTIAL PULPECTOMY

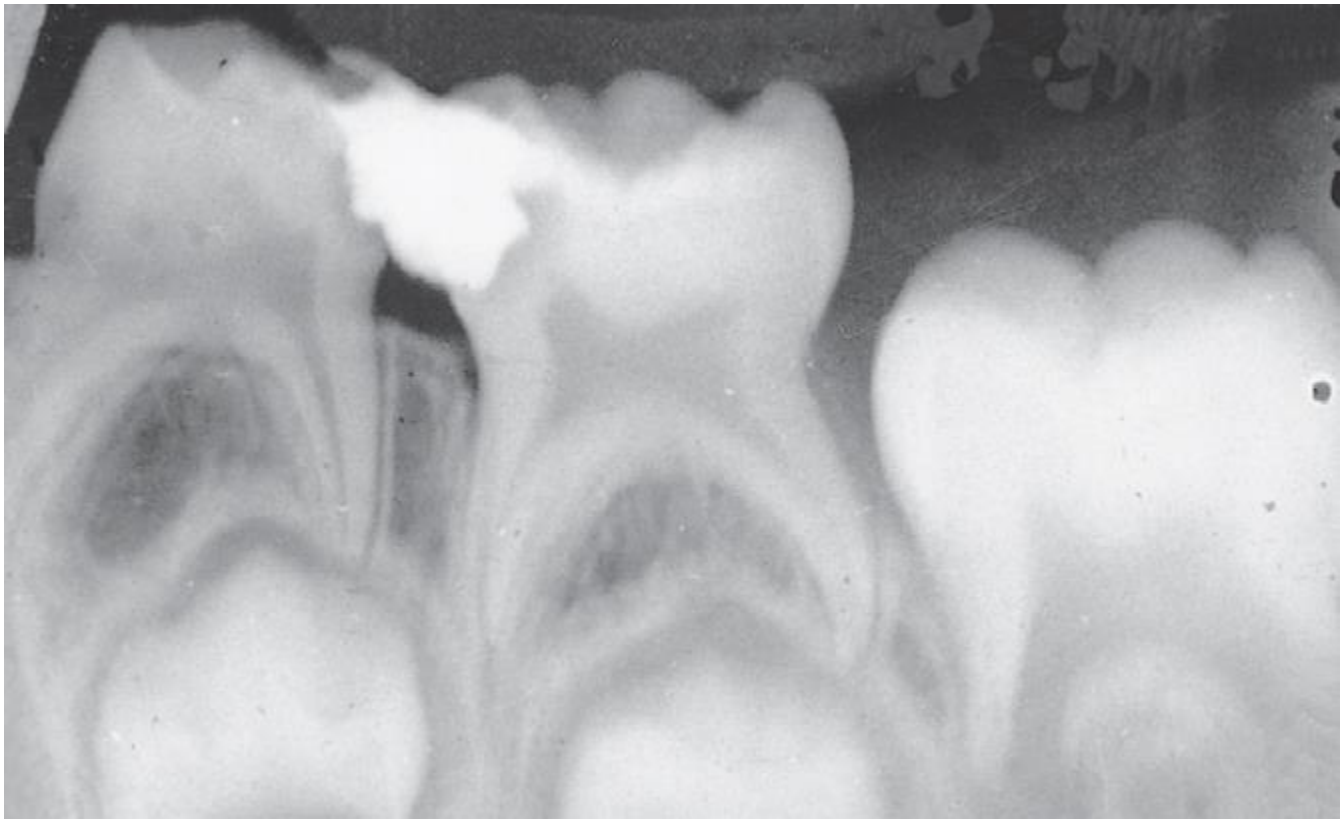
A partial pulpectomy may be performed on primary teeth when coronal pulp tissue and the tissue entering the pulp canals are vital but show clinical evidence of hyperemia. The tooth may or may not have a history of painful pulpitis, but the contents of the root canals should not show evidence of necrosis (suppuration). In addition, there should be no radiographic evidence of a thickened periodontal ligament or of radicular disease. If any of these conditions is present, a complete pulpectomy or an extraction should be performed.



The partial pulpectomy technique, which may be completed in one appointment, involves the removal of the coronal pulp as described for the pulpotomy technique. The pulp filaments from the root canals are removed with a fine barbed broach; considerable hemorrhage will occur at this point. A Hedstrom file will be helpful in the removal of remnants of the pulp tissue. The file removes tissue only as it is withdrawn and penetrates readily with a minimum of resistance. Care should be taken to avoid penetrating the apex of the tooth.

After the pulp tissue has been removed from the canals, a syringe is used to irrigate them with 3% hydrogen peroxide followed by sodium hypochlorite. The canals should then be dried with sterile paper points. When hemorrhaging is controlled and the canals remain dry, a thin mix of unreinforced zinc oxide–eugenol paste may be prepared (without setting accelerators), and paper points covered with the material are used to coat the root canal walls.

Small Kerr files may be used to file the paste into the walls. The excess thin paste may be removed with paper points and Hedstrom files. A thick mix of the treatment paste should then be prepared, rolled into a point, and carried into the canal. Root canal pluggers may be used to condense the filling material into the canals. An x-ray film may be necessary to allow evaluation of the success in filling the canals.



NONVITAL PULP THERAPY TECHNIQUE

COMPLETE PULPECTOMY

It is unwise to maintain untreated infected primary teeth in the mouth. They may be opened for drainage and often remain asymptomatic for an indefinite period. However, they are a source of infection and should be treated or removed.

The morphology of the root canals in primary teeth makes endodontic treatment difficult and often impractical. Mature first primary molar canals are often so small that they are inaccessible even to the smallest barbed broach. If the canal cannot be properly cleansed of necrotic material, sterilized, and adequately filled, endodontic therapy is more likely to fail.

Endodontic procedures for the treatment of primary teeth with necrotic pulps are indicated if the canals are accessible and if there is evidence of essentially normal supporting bone.

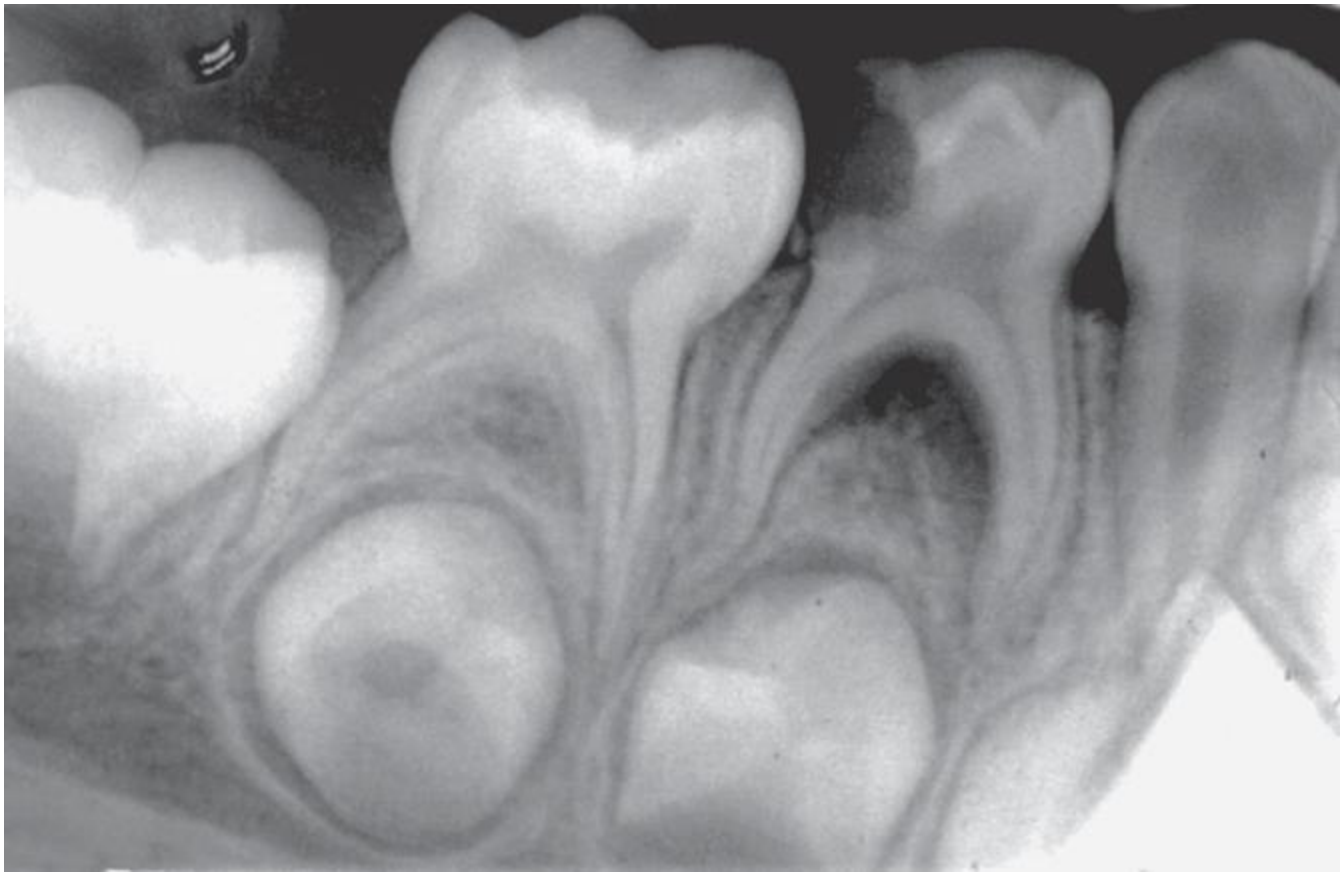
If the supporting bone is also compromised, the likelihood of successful endodontic therapy is lower. If the second primary molar is lost before the eruption of the first permanent molar, the dentist is confronted with the difficult problem of preventing the first permanent molar from drifting mesially during its eruption. Special effort should be made to treat and retain the second primary molar even if it has a necrotic pulp. Similarly, longer than normal retention of a second primary molar may be desired when the succedaneous second premolar is congenitally missing.

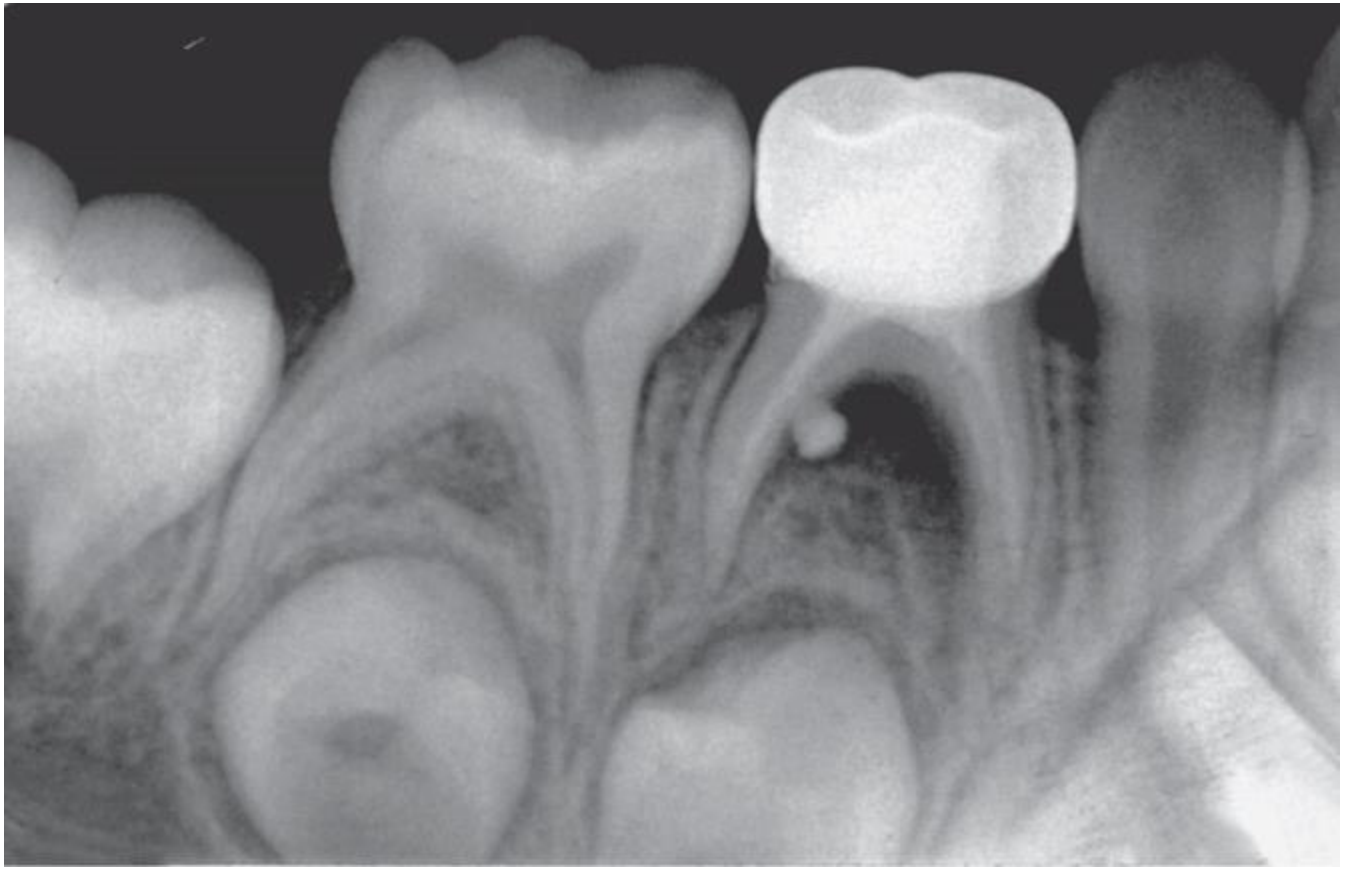
The rubber dam should be applied, and the roof of the pulp chamber should be removed to gain access to the root canals as described previously in the pulpotomy technique. The contents of the pulp chamber and all debris from the occlusal third of the canals should be removed, with care taken to avoid forcing any of the infected contents through the apical foramen. A pellet moistened with camphorated monochlorophenol (CMCP) or a 1:5 concentration of Buckley's formocresol, with excess moisture blotted, should be placed in the pulp chamber. The chamber may be sealed with zinc oxide–eugenol.

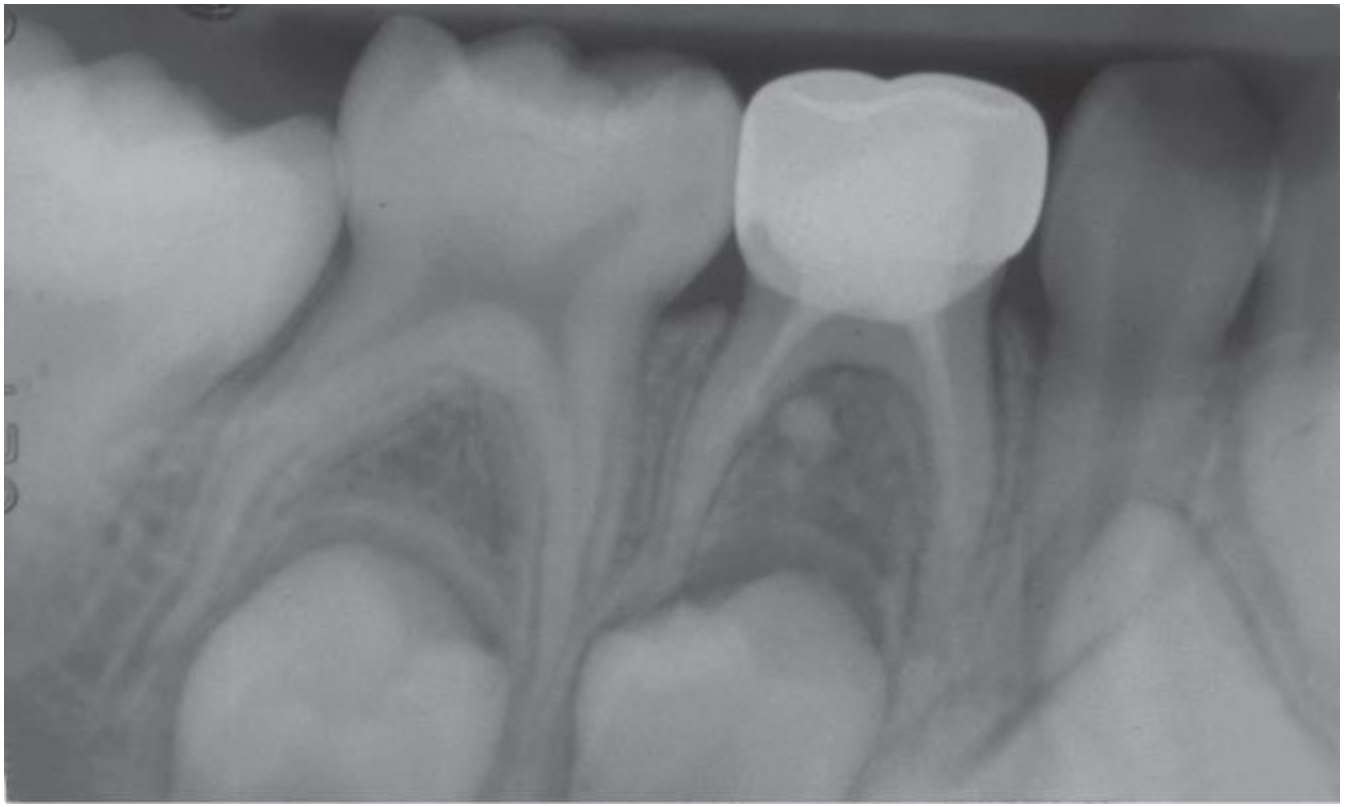
At the second appointment, several days later, the tooth should be isolated with a rubber dam and the treatment pellet removed. If the tooth has remained asymptomatic during the interval, the remaining contents of the canals should be removed using the technique described for the partial pulpectomy. The apex of each root should be penetrated slightly with the smallest file. A treatment pellet should again be placed in the pulp chamber and the seal completed with zinc oxide–eugenol.

After another few days the treatment pellet should be removed. If the tooth has remained asymptomatic, the canals may be prepared and filled as described for the partial pulpectomy. However, if the tooth has been painful and there is evidence of moisture in the canals when the treatment pellet is removed, the canals should again be mechanically cleansed and the treatment repeated.

Currently, pulpectomies in primary teeth are commonly completed in a single appointment. If the tooth has painful necrosis with purulence in the canals, however, completing the pulpectomy procedure over two or three visits should improve the likelihood of success.







REACTION OF THE PULP TO VARIOUS CAPPING MATERIALS

ZINC OXIDE–EUGENOL

Before calcium hydroxide came into common use, zinc oxide–eugenol was used more often than any other pulpcapping material. Many dentists have apparently had good clinical results with the use of zinc oxide–eugenol, but it is no longer recommended as a direct pulp-capping material.

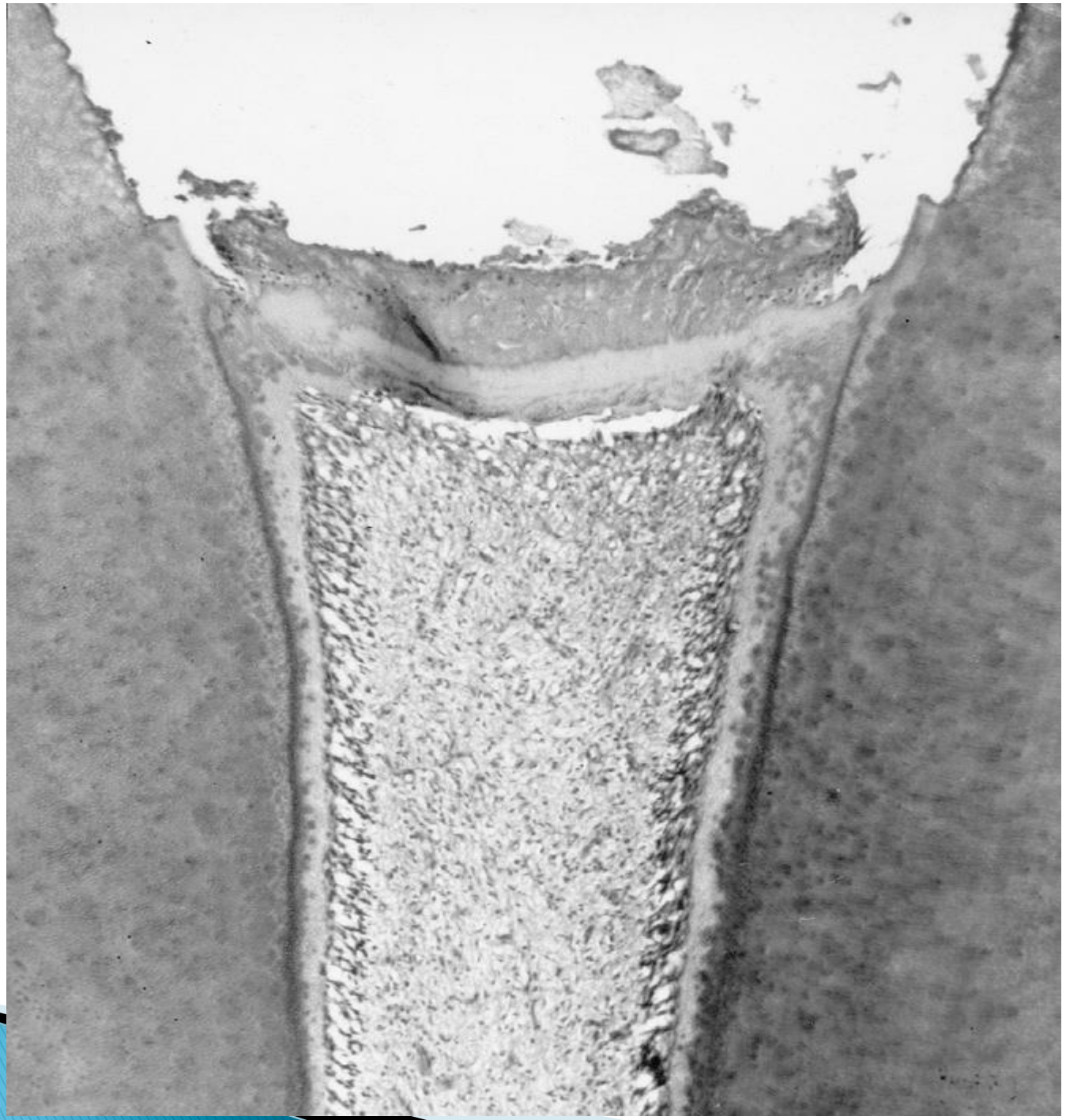
CALCIUM HYDROXIDE

Herman first introduced calcium hydroxide as a biologic dressing. Because of its alkalinity (pH of 12), it is so caustic that when it is placed in contact with vital pulp tissue the reaction produces a superficial necrosis of the pulp.

The irritant qualities seem to be related to its ability to stimulate development of a calcified barrier. The superficial necrotic area in the pulp that develops beneath the calcium hydroxide is demarcated from the healthy pulp tissue below by a new, deeply staining zone comprising basophilic elements of the calcium hydroxide dressing.

The original proteinate zone is still present. However, against this zone is a new area of coarse fibrous tissue likened to a primitive type of bone. On the periphery of the new fibrous tissue, cells resembling odontoblasts appear to be lining up. One month after the capping procedure, a calcified bridge is evident radiographically.

This bridge continues to increase in thickness during the next 12 months. The pulp tissue beneath the calcified bridge remains vital and is essentially free of inflammatory cells.



Investigators who evaluate experimental pulp-capping agents commonly compare their results with the agent being tested to the results they can obtain with calcium hydroxide under similar conditions. Thus calcium hydroxide currently serves as the standard or control material for experimentation related to pulp-capping agents.

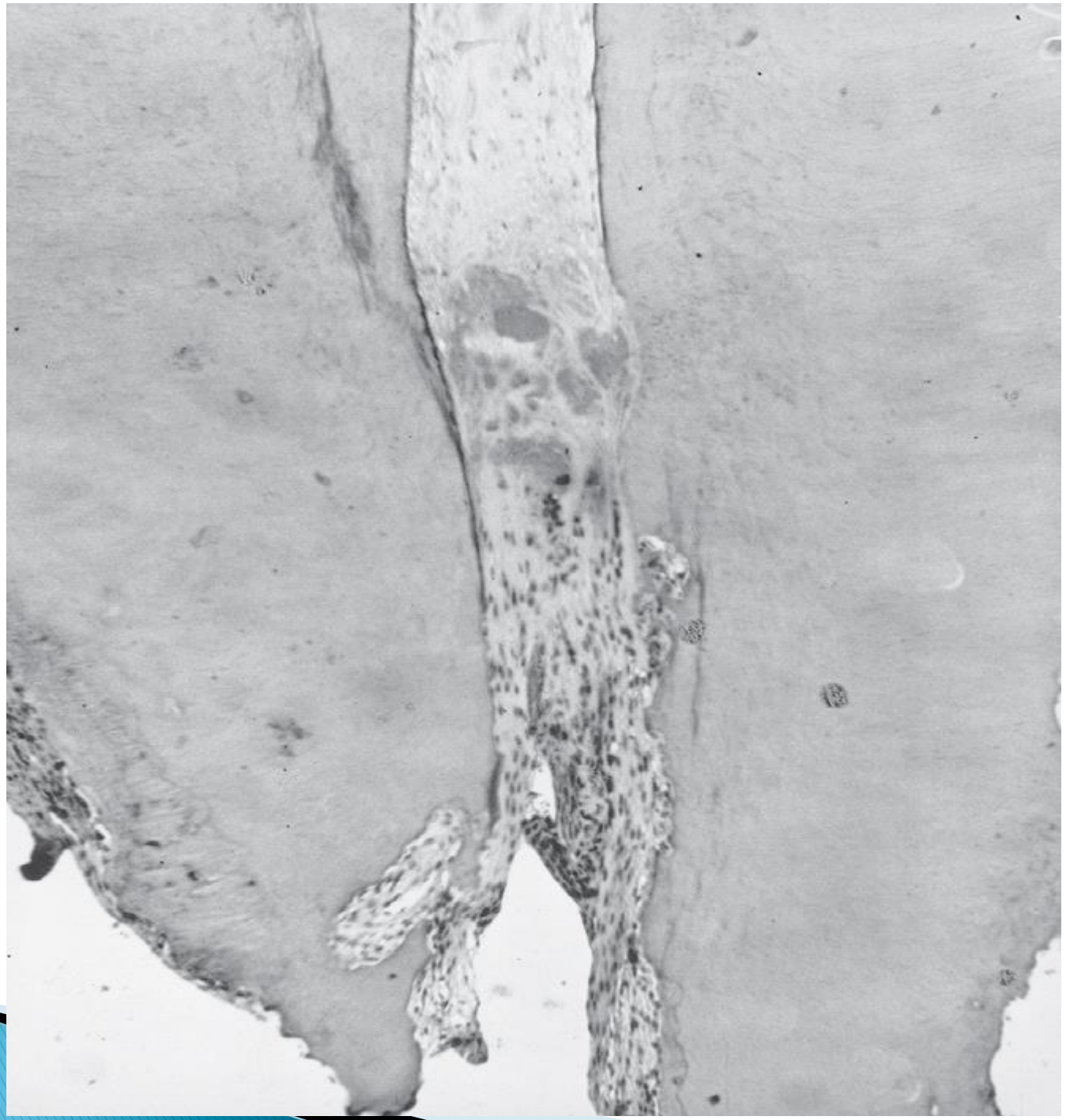
Drawbacks of calcium Hydroxides

1. Increase risk of resorption in deciduous teeth.
2. It may degrade and dissolved beneath restoration.
3. Interfacial failure during amalgam condensation.
4. Dentin bridges beneath $Ca(OH)_2$ are associated with tunnel defects.
5. Failure to provide a long-term seal against micro leakage when used as a pulp capping agent and this may lead to penetration of microorganism into pulpal tissue and induce pulpal irritation and potential pulpal death.

PREPARATIONS CONTAINING FORMALIN

The belief that exposing the pulp to formocresol or capping it with materials that contain formocresol will promote pulp healing or even maintain the pulp in a healthy state has not been adequately substantiated. Some studies have indicated that the formocresol pulpotomy technique may be applied to permanent teeth, but its use in permanent teeth remains an interim procedure to be followed by conventional endodontic therapy.

The clinical success experienced in the treatment of primary pulps with these materials is possibly related to the drug's germicidal action and fixation qualities rather than to its ability to promote healing.



GLUTARALDEHYDE

Glutaraldehyde has received attention as a potential pulp-capping agent for pulpotomy techniques in primary teeth. It is an excellent bactericidal agent and seems to offer some advantages compared with formocresol.

Berson and Good have reported that glutaraldehyde appears to be superior to formaldehyde preparations for pulp therapy in the following way:

1. Formaldehyde reactions are reversible, but glutaraldehyde reactions are not.
2. Formaldehyde is a small molecule that penetrates the apical foramen, whereas glutaraldehyde is a larger molecule that does not.
3. Formaldehyde requires a long reaction time and an excess of solution to fix tissue, whereas glutaraldehyde fixes tissue instantly and an excess of solution is unnecessary.

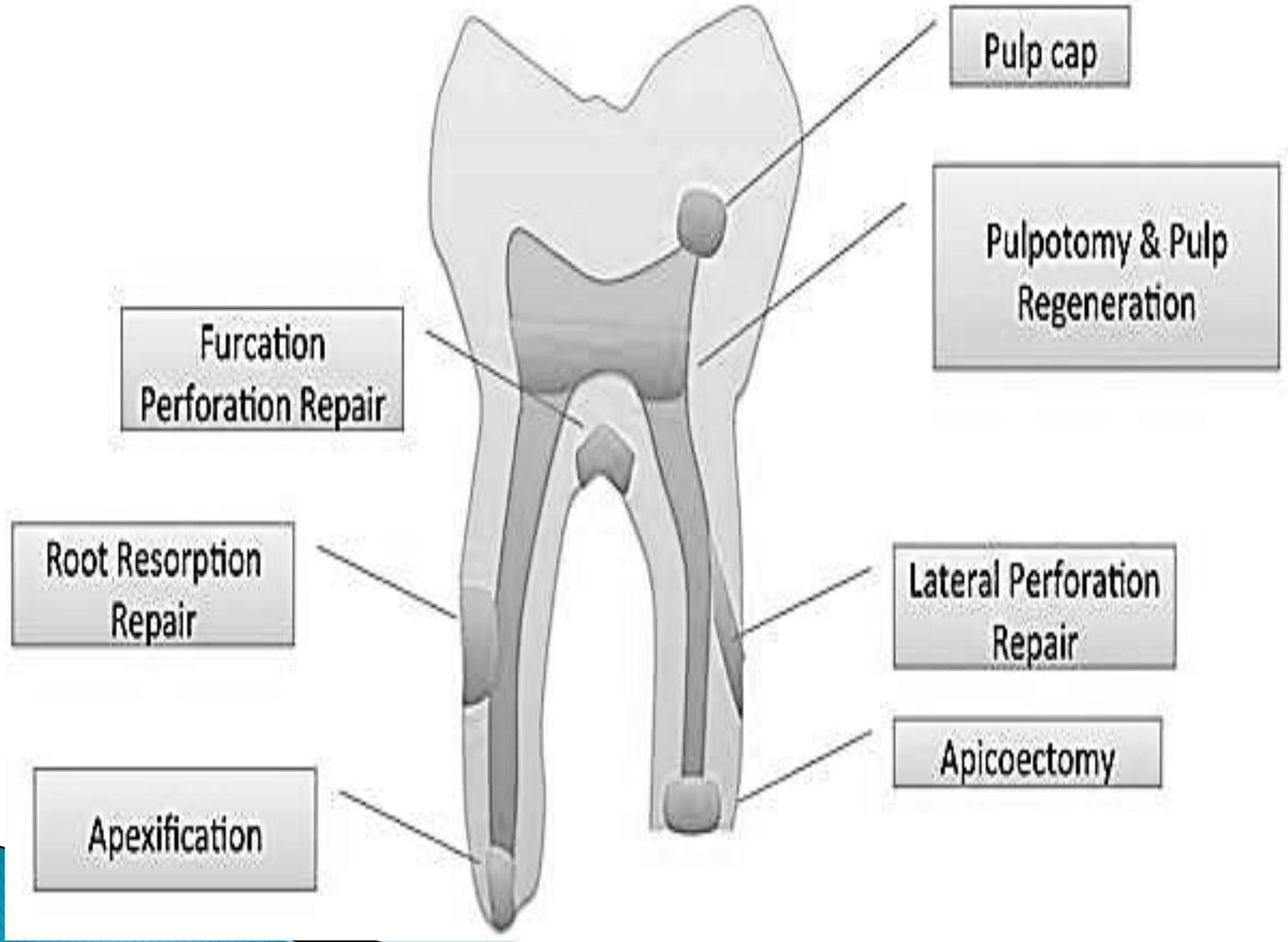
FERRIC SULFATE

Considerable interest and research have been devoted to investigating the effectiveness of ferric sulfate to treat the surface of the remaining pulp tissue after pulpotomy of primary teeth. Ferric sulfate agglutinates blood proteins and controls hemorrhage in the process without clot formation.

Mineral Trioxide Aggregate (MTA):

MTA is a new biocompatible pulp capping agent and excellent results have been reported with its use. MTA is a fine hydrophilic powder.

Mineral trioxide aggregate (MTA) is a new biocompatible material with numerous existing clinical applications in endodontics, which is first described in dental literatures in 1993


Pulp cap
Pulpotomy & Pulp Regeneration
Furcation Perforation Repair
Root Resorption Repair
Lateral Perforation Repair
Apicoectomy
Apexification

The material appears to be an improvement over other materials for some endodontic procedures that involve root repair and bone healing and one of its applications is using the material as pulp dressing following the amputation of coronal pulp in primary molars with carious pulp exposure.

MTA consists of tricalcium silicate, tricalcium aluminate, tricalcium oxide, silicate oxide and bismuth oxide. Bismuth oxide is added (17–18 wt%)to improve the properties and the radioopacity. MTA are of two type grey and white. the white and grey MTA differ mainly in their content of iron, aluminium and magnesium oxide. white MTA contains smaller particles with a narrower of size distribution than grey MTA.

Advantages of MTA:

1. MTA produced significantly more dentinal bridge in a shorter period of time.
2. Less pulpal inflammation seen.
3. Ability to set in moist environment.
4. It exhibits a superior marginal adaptation.
5. Non absorble.
6. It forms a reactionary layer at the dentine interface resembling hydroxyapatite in structure.
7. MTA induces pulpal cell proliferation and promotes hard tissue formation.

Disadvantages of MTA:

1. MTA takes longer time to set.
2. Expensive.
3. Difficult to store (hydrophilic).

Biodentine

Biodentine is conditioned in a capsule containing the good ratio of powder and liquid.

Powder:

Tri-calcium Silicate(C3S)	Main core material
Di-calcium Silicate (C2S)	Second core material
Calcium Carbonate and Oxide	Filler
Iron Oxide	Shade
Zirconium Oxide	Radio pacifier

Liquid

Calcium Chloride	Accelerator
Hydro soluble polymer	Water reducing agent

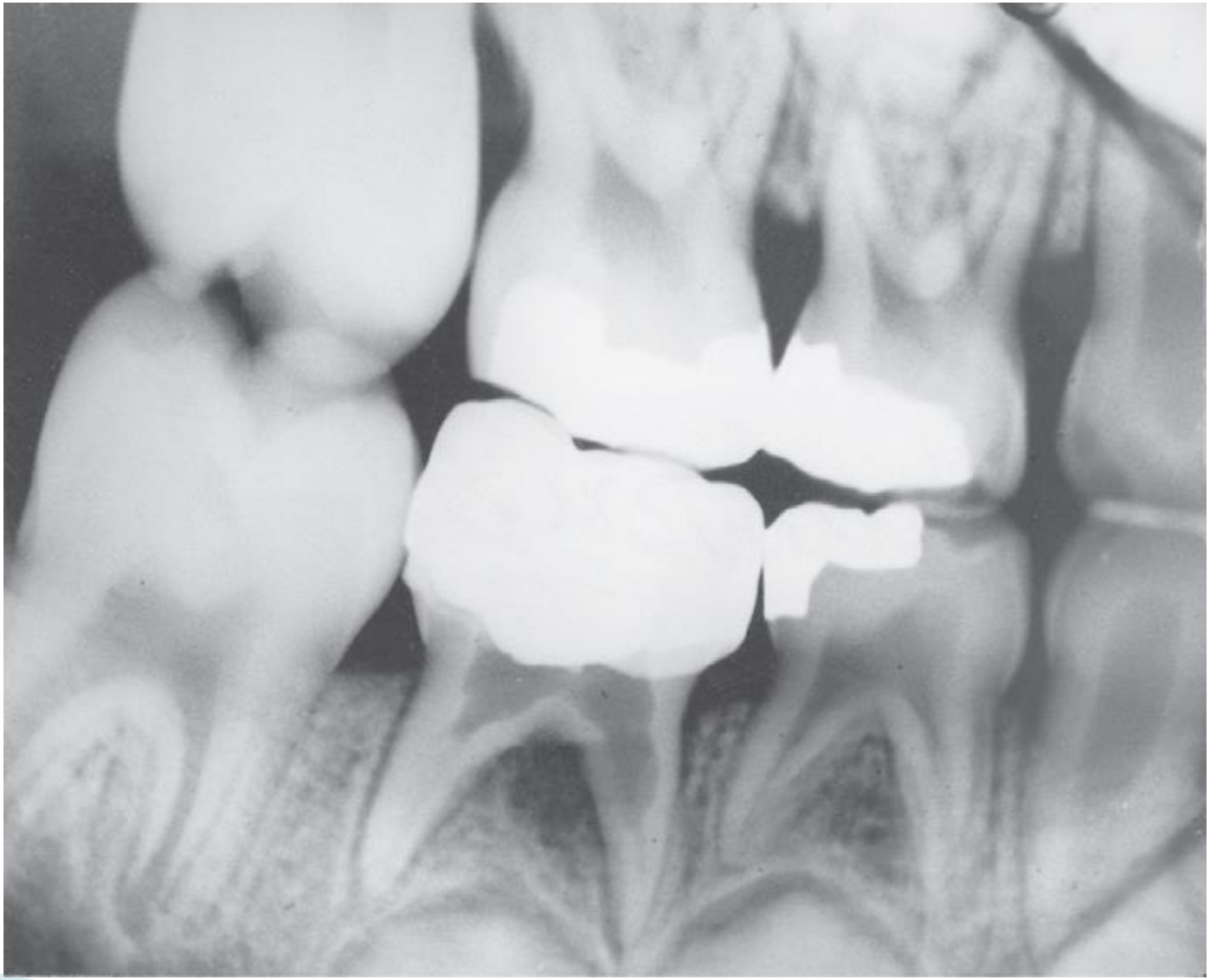
FAILURES AFTER VITAL PULP THERAPY

Failure in the formation of a calcified bridge across the vital pulp has often been related to

1. the age of the patient,
2. Degree of surgical trauma,
3. Sealing pressure,
4. Improper choice of capping material,
5. Low threshold of host resistance,
6. And presence of microorganisms with subsequent infection.

1. INTERNAL RESORPTION

Radiographic evidence of internal resorption occurring within the pulp canal several months after the pulpotomy procedure is the most frequently seen evidence of an abnormal response in primary teeth.



Internal resorption is a destructive process generally believed to be caused by odontoclastic activity, and it may progress slowly or rapidly. Occasionally, secondary repair of the resorbed dentinal area occurs.

No satisfactory explanation for the postpulpotomy type of internal resorption has been given. It has been demonstrated, however, that with a true carious exposure of the pulp, an inflammatory process of some degree will be present. The inflammation may be limited to the exposure site, or it may be diffuse throughout the coronal portion of the pulp.

Amputation of all the pulp that shows the inflammatory change may be difficult or impossible, and abnormal pulp tissue may be allowed to remain. If the inflammation extended to the entrance of the pulp canal, odontoclasts may have been attracted to the area.

Inflammatory cells drawn to the area as a result of the placement of an irritating capping material might well attract the odontoclastic cells and initiate the internal resorption. This may explain the occurrence of internal resorption even though the pulp is normal at the time of treatment.

Because the roots of primary teeth are undergoing normal physiologic resorption, vascularity of the apical region is increased. Odontoclastic activity is present in the area. This may predispose the tooth to internal resorption when an irritant in the form of a pulp-capping material is placed on the pulp.

2. ALVEOLAR ABSCESS

An alveolar abscess occasionally develops some months after pulp therapy has been completed. The tooth usually remains asymptomatic, and the child is unaware of the infection, which may be present in the bone surrounding the root apices or in the area of the root bifurcation. A fistulous opening may be present, which indicates the chronic condition of the infection. Primary teeth that show evidence of an alveolar abscess should be removed. Permanent teeth that have previously been treated by pulp capping or by pulpotomy and later show evidence of pulpal necrosis and apical infection may be considered for endodontic treatment.

EARLY EXFOLIATION OR OVERRETENTION OF PRIMARY TEETH WITH PULP TREATMENTS

Occasionally a pulpally treated tooth previously believed to be successfully managed will loosen and exfoliate (or require extraction) prematurely for no apparent reason. It is believed that such a condition results from low-grade, chronic, asymptomatic, localized infection. Usually, abnormal and incomplete root resorption patterns of the affected teeth are also observed. When this occurs, space management must be considered.

Another sequela requiring close observation is the tendency for primary teeth undergoing successful pulpotomies or pulpectomies to be overretained. This situation may have the untoward result of interfering with the normal eruption of permanent teeth and adversely affecting the developing occlusion. Close periodic observation of pulpally treated teeth is necessary to intercept such a developing problem. Extraction of the primary tooth is usually sufficient.