

# Pediatric dentistry

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

### Lecture 9

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# DIAGNOSTIC AIDS IN THE SELECTION OF TEETH FOR VITAL PULP THERAPY

## HISTORY OF PAIN

The history of either **presence** or **absence** of pain may **not** be as reliable in the **differential diagnosis** of the condition of the **exposed** primary pulp as it is in permanent teeth. **Degeneration** of primary pulp even to the point of abscess formation **without** the child's recalling **pain** or **discomfort** is **not uncommon**.

A toothache coincident with or immediately after a meal may not indicate extensive pulpal inflammation. The pain may be caused by an accumulation of food within a carious lesion, by pressure, or by a chemical irritation to vital pulp protected by only a thin layer of intact dentin.

A **spontaneous** toothache of more than momentary duration occurring **at any time** usually **means** that **pulpal disease** has **progressed** too far for treatment with even a pulpotomy.



## CLINICAL SIGNS AND SYMPTOMS

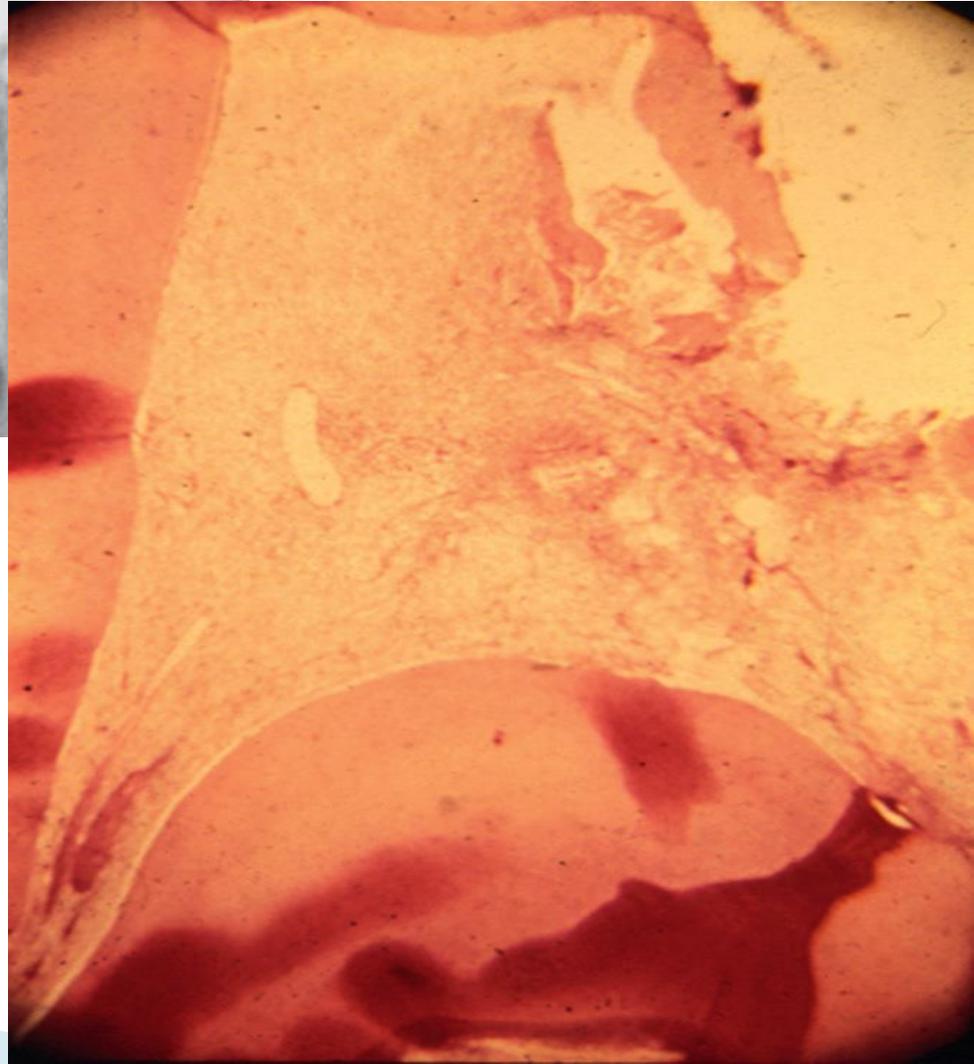
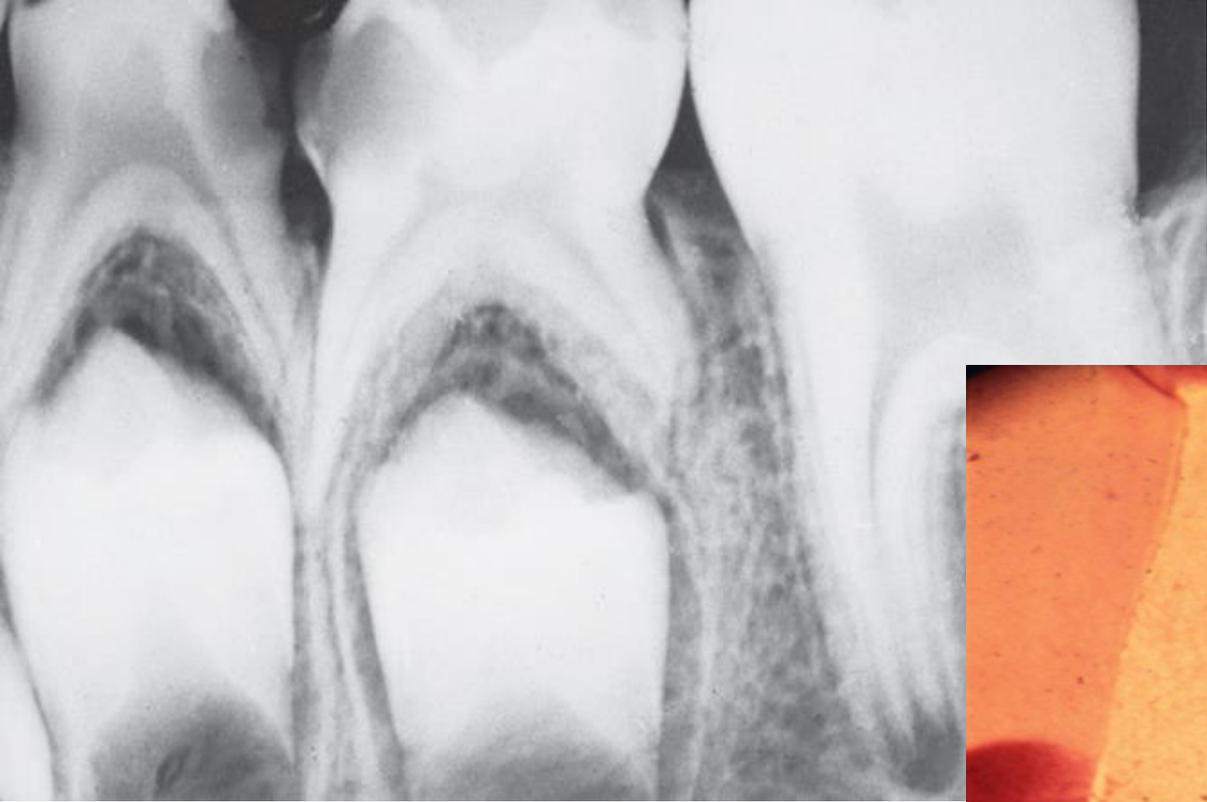
A gingival abscess or a draining fistula associated with a tooth with a deep carious lesion is an obvious clinical sign of an irreversibly diseased pulp. Such infections can be resolved only by successful endodontic therapy or extraction of the tooth.

**Abnormal** tooth **mobility** is another clinical sign that may **indicate** a **severely diseased pulp**. When such a tooth is evaluated for mobility, the manipulation may elicit localized pain in the area, but this is not always the case.

If **pain** is **absent** or **minimal** during manipulation of the diseased mobile tooth, the **pulp** is probably in a more **advanced** and **chronic degenerative** condition. **Pathologic mobility** must be **distinguished** from **normal mobility** in primary teeth near exfoliation.



**Sensitivity** to **percussion** or **pressure** is a clinical symptom suggestive of at least some degree of **pulpal disease**, but the degenerative stage of the pulp is probably of the **acute inflammatory** type. Tooth **mobility** or **sensitivity** to percussion or pressure may be a clinical signal of **other dental problems** as well, such as a **high restoration** or advanced **periodontal** disease.



## RADIOGRAPHIC INTERPRETATION

A recent x-ray film must be available to examine for evidence of periradicular or periapical changes, such as **thickening** of the periodontal ligament or **rarefaction** of the supporting bone. These conditions almost always rule out treatment other than an **endodontic** procedure or **extraction** of the tooth.



Radiographic interpretation is **more difficult** in **children** than in adults. The **permanent** teeth may have **incompletely** formed root ends, giving an impression of **periapical radiolucency**, and the **roots** of the **primary** teeth undergoing even normal physiologic **resorption** often present a **misleading picture** or one **suggestive** of **pathologic change**.

The proximity of carious lesions to the pulp **cannot** always be **determined accurately** in the **x-ray** film. What often appears to be an intact barrier of secondary dentin protecting the pulp may actually be a perforated mass of irregularly calcified and carious material. The pulp beneath this material may have extensive inflammation.



Radiographic evidence of **calcified masses** within the pulp chamber is diagnostically important. If the **irritation** to the pulp is relatively **mild** and **chronic**, the pulp will **respond** with inflammation and will attempt to eliminate the irritation by **blocking** with **irregular dentin** the tubules through which the irritating factors are transmitted.



If the irritation is **intense** and **acute** and if the carious lesion is **developing rapidly**, the **defense** mechanism may **not** have a **chance** to **lay down** the **reparative dentin barrier**, and the disease process may reach the pulp. In this instance the **pulp** may **attempt** to **form** a **barrier** at some **distance** from the **exposure site**. These calcified masses are sometimes evident in the **pulp horn** or even in the region of the **pulp canal entrance**.

## PULP TESTING

The **value** of the electric pulp test in determining the condition of the pulp of primary teeth is **questionable**, although it will give an **indication** of whether the pulp is **vital**. The test does not provide reliable evidence of the degree of inflammation of the pulp. A complicating factor is the occasional **positive** response to the test in a tooth with a **necrotic** pulp if the **content** of the canals is **liquid**.

The reliability of the pulp test for the young child can also be questioned sometimes because of the **child's apprehension associated** with the **test** itself. Thermal tests have reliability problems in the primary dentition, too. The lack of reliability is possibly related to the young child's inability to understand the tests.



Several methods have been developed and advocated as noninvasive techniques for recording the blood flow in human dental pulp. Two of these methods include the use of a **laser Doppler flowmeter** and **transmitted light photoplethysmography**.



A distinct **advantage** of this technique is its **noninvasive nature**, particularly in comparison to **electric pulp testing**. Not only is there **inaccuracy** in the response of the pulp to electric stimuli, but the electric pulp tester may elicit **pain**.



## **PHYSICAL CONDITION OF THE PATIENT**

Although the local observations are of extreme importance in the selection of cases for vital pulp therapy, the dentist must also consider the physical condition of the patient.

In seriously **ill children**, **extraction** of the involved tooth after proper premedication with antibiotics, rather than pulp therapy, should be the **treatment of choice**.



Children with **conditions** that render them **susceptible** to subacute **bacterial endocarditis** or those with **nephritis, leukemia, solid tumors, idiopathic cyclic neutropenia**, or **any condition** that **causes cyclic or chronic depression** of **granulocyte** and **polymorphonuclear leukocyte** counts **should not** be **subjected** to the possibility of an **acute infection** resulting from **failed pulp therapy**.

# TREATMENT OF THE DEEP CARIOUS LESION

Children and young adults who have **not received early** and **adequate dental care** and optimal systemic **fluoride** and do **not** have adequate **oral hygiene** often develop deep carious lesions in the primary and permanent teeth. Many of the lesions appear radiographically to be dangerously close to the pulp or to actually involve the dental pulp.

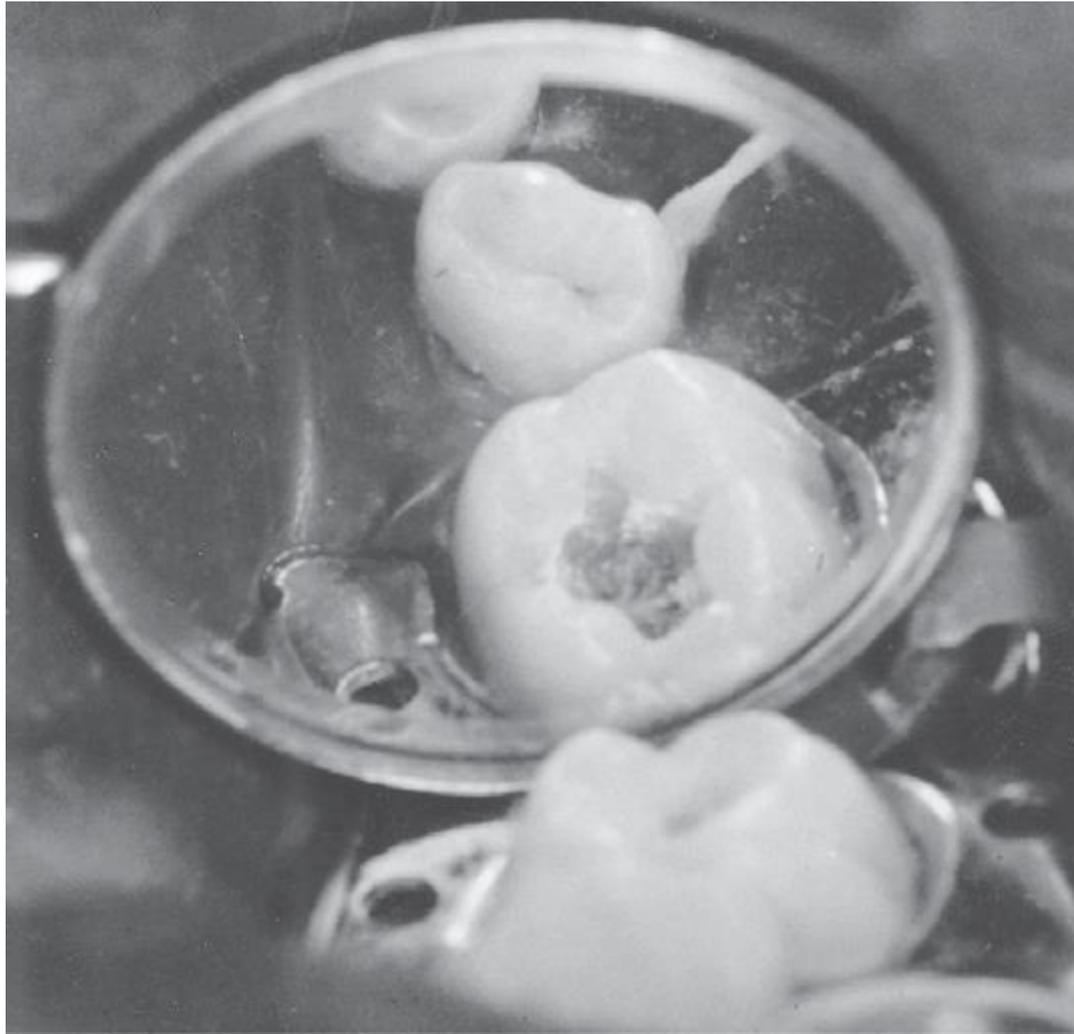


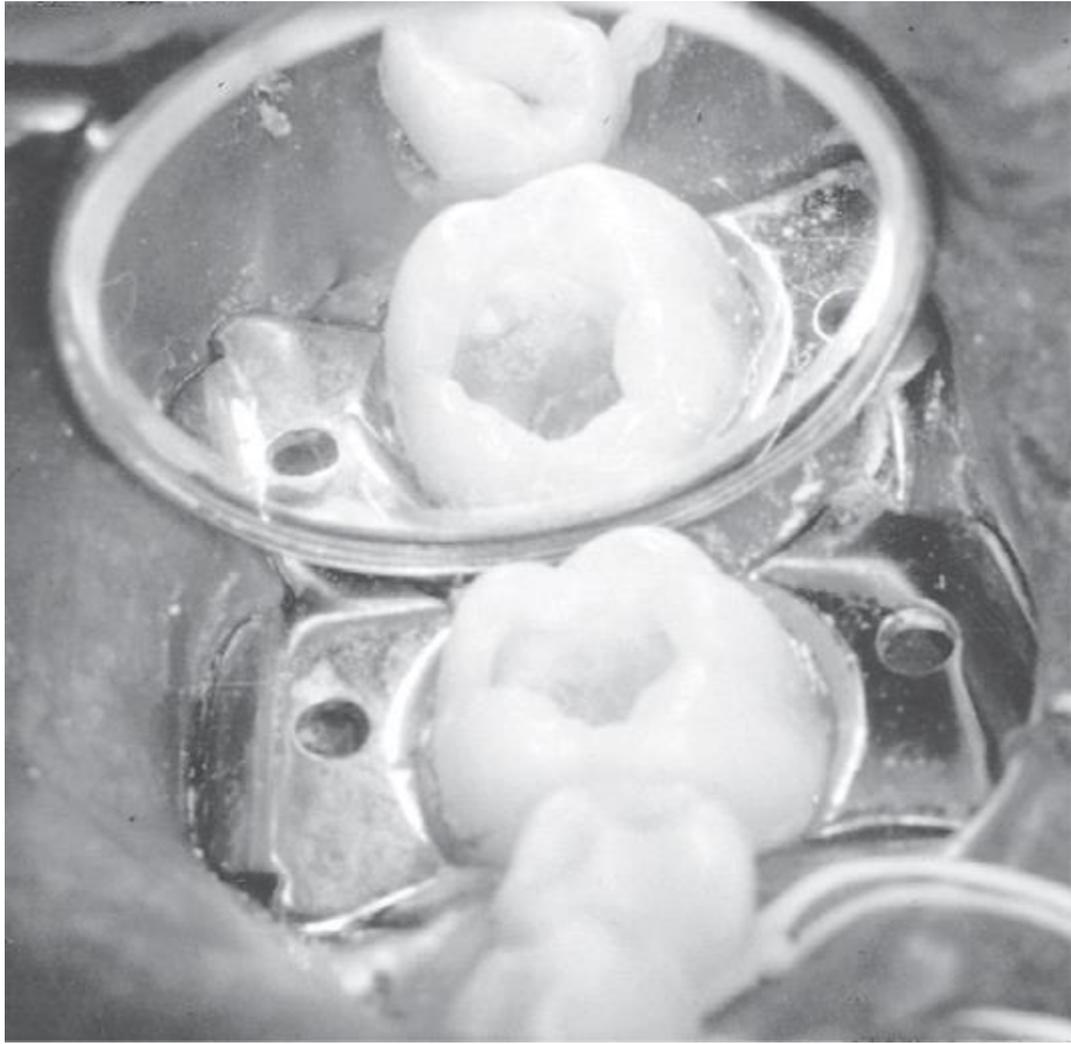
# INDIRECT PULP TREATMENT (GROSS CARRIES REMOVAL OR INDIRECT PULP THERAPY)

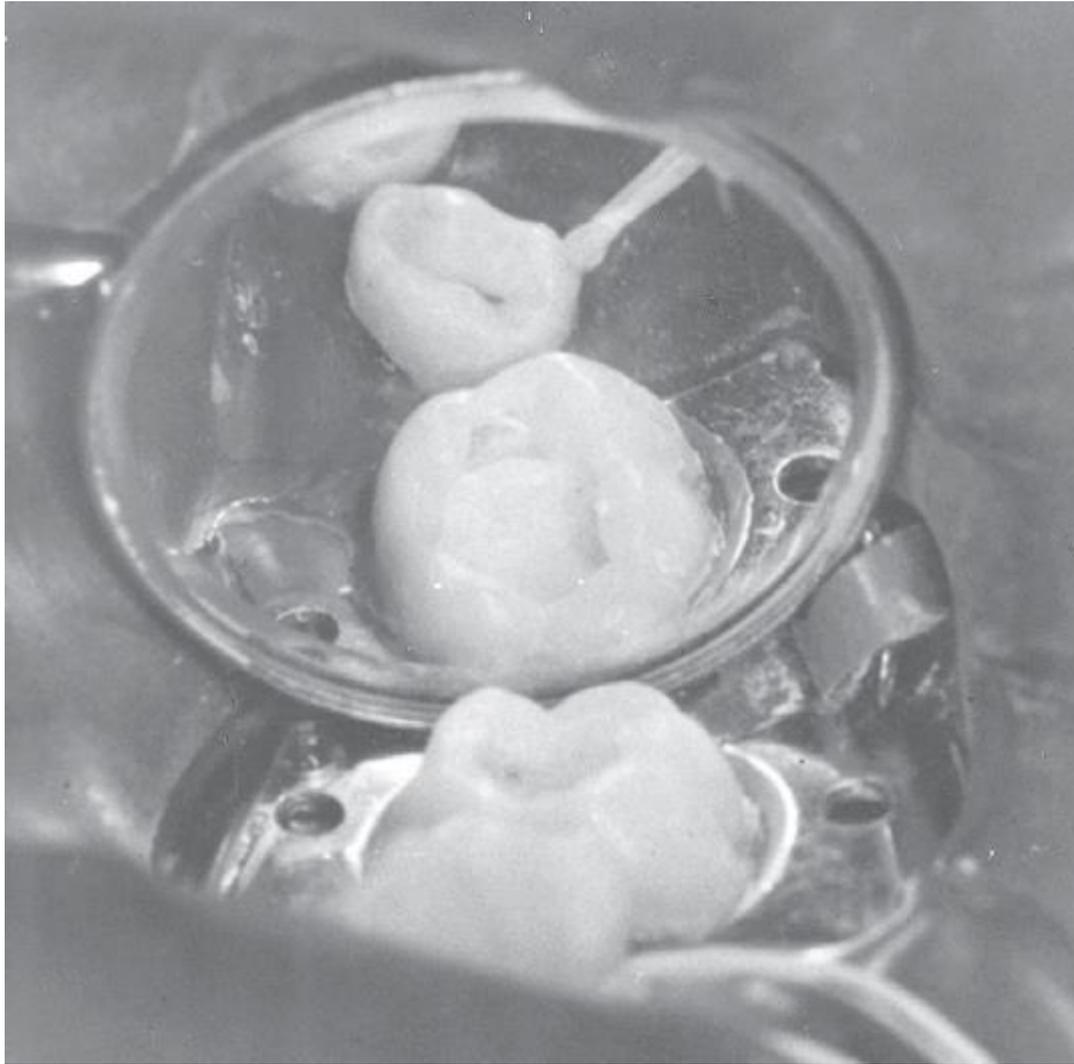
The procedure in which only the gross caries is removed from the lesion and the cavity is sealed for a time with a biocompatible material is referred to as **indirect pulp treatment**.

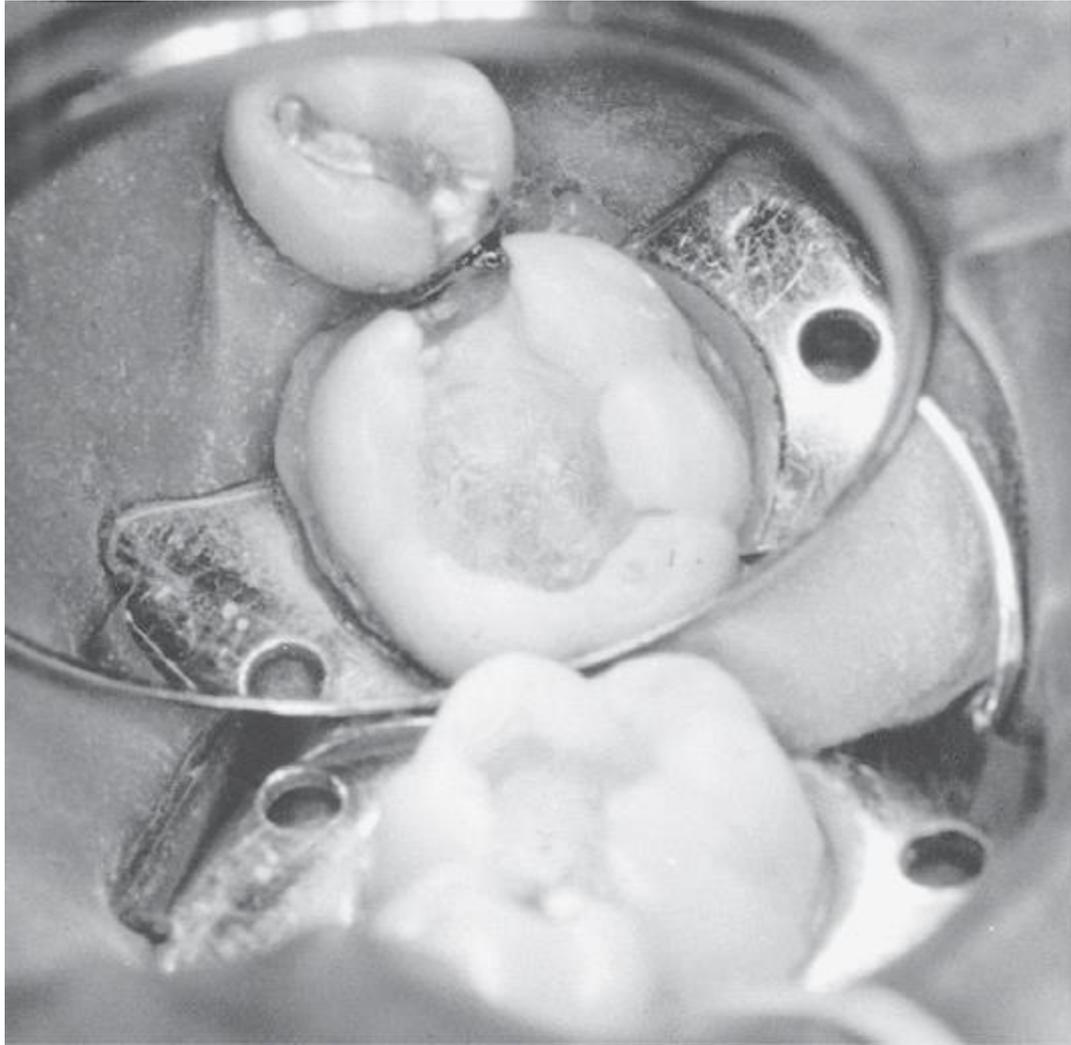


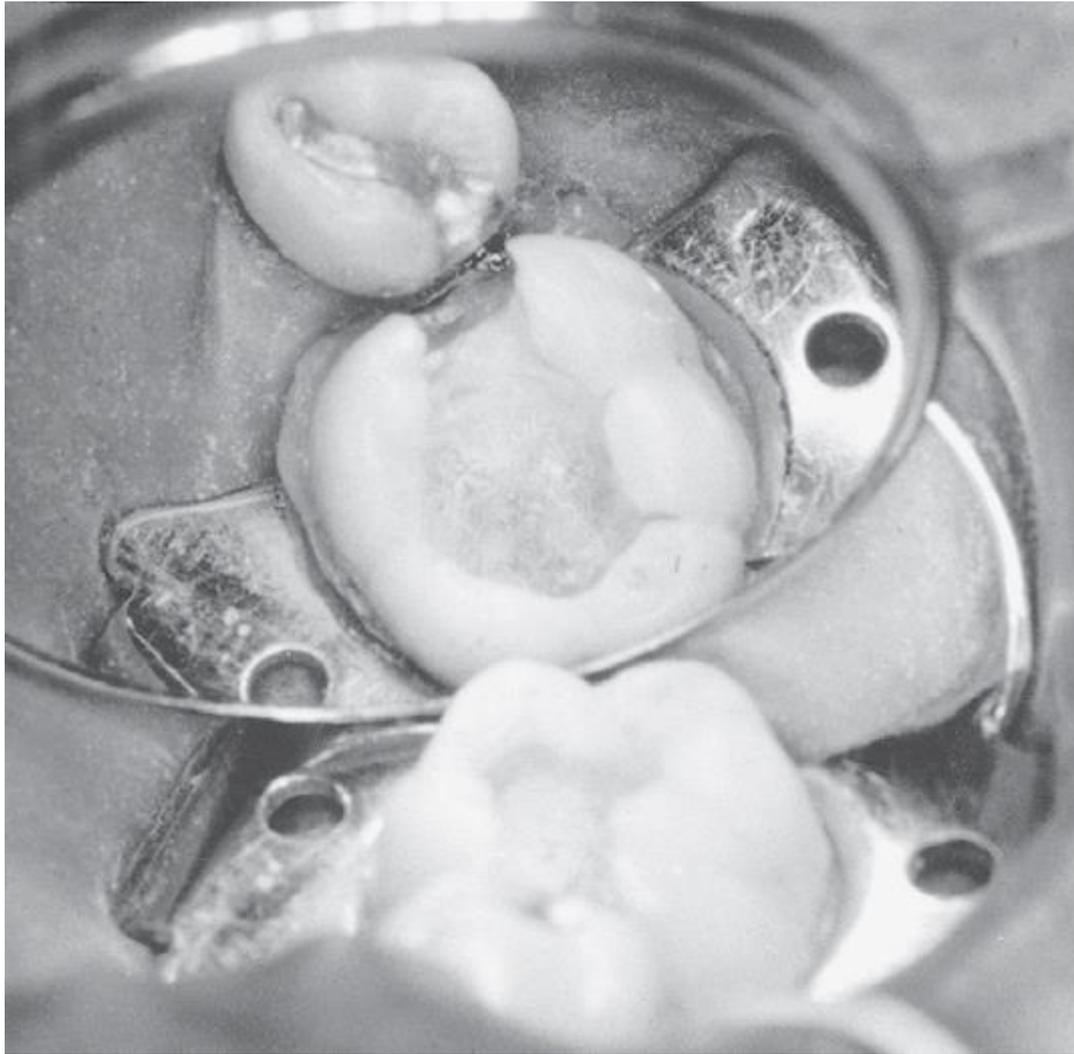
The clinical procedure involves removing the gross caries but allowing sufficient caries to remain over the pulp horn to avoid exposure of the pulp. The walls of the cavity are extended to sound tooth structure because the presence of carious enamel and dentin at the margins of the cavity will prevent the establishment of an adequate seal (extremely important) during the period of repair. The remaining thin layer of caries in the base of the cavity is covered with a radiopaque biocompatible base material and sealed with a durable interim restoration.





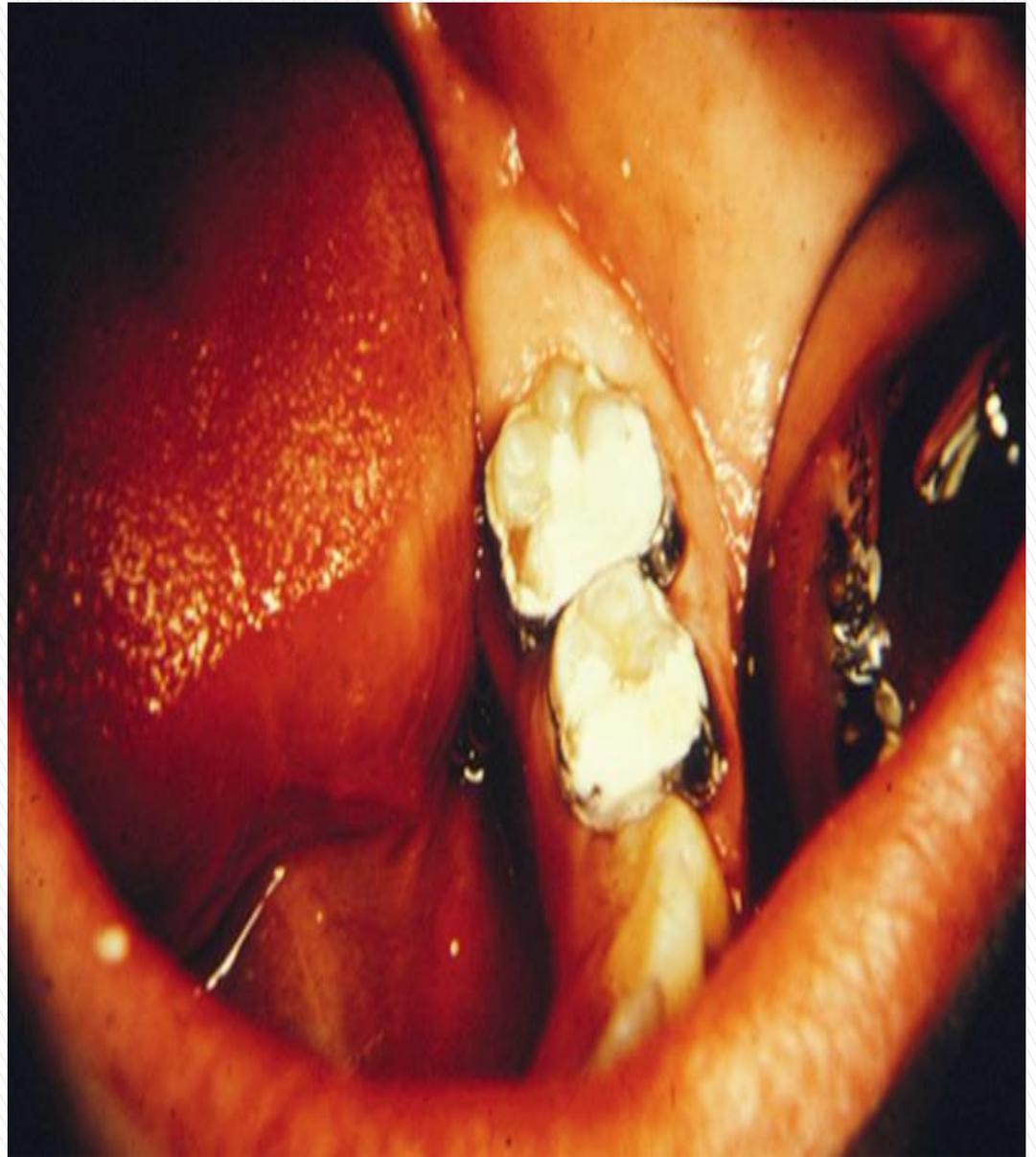








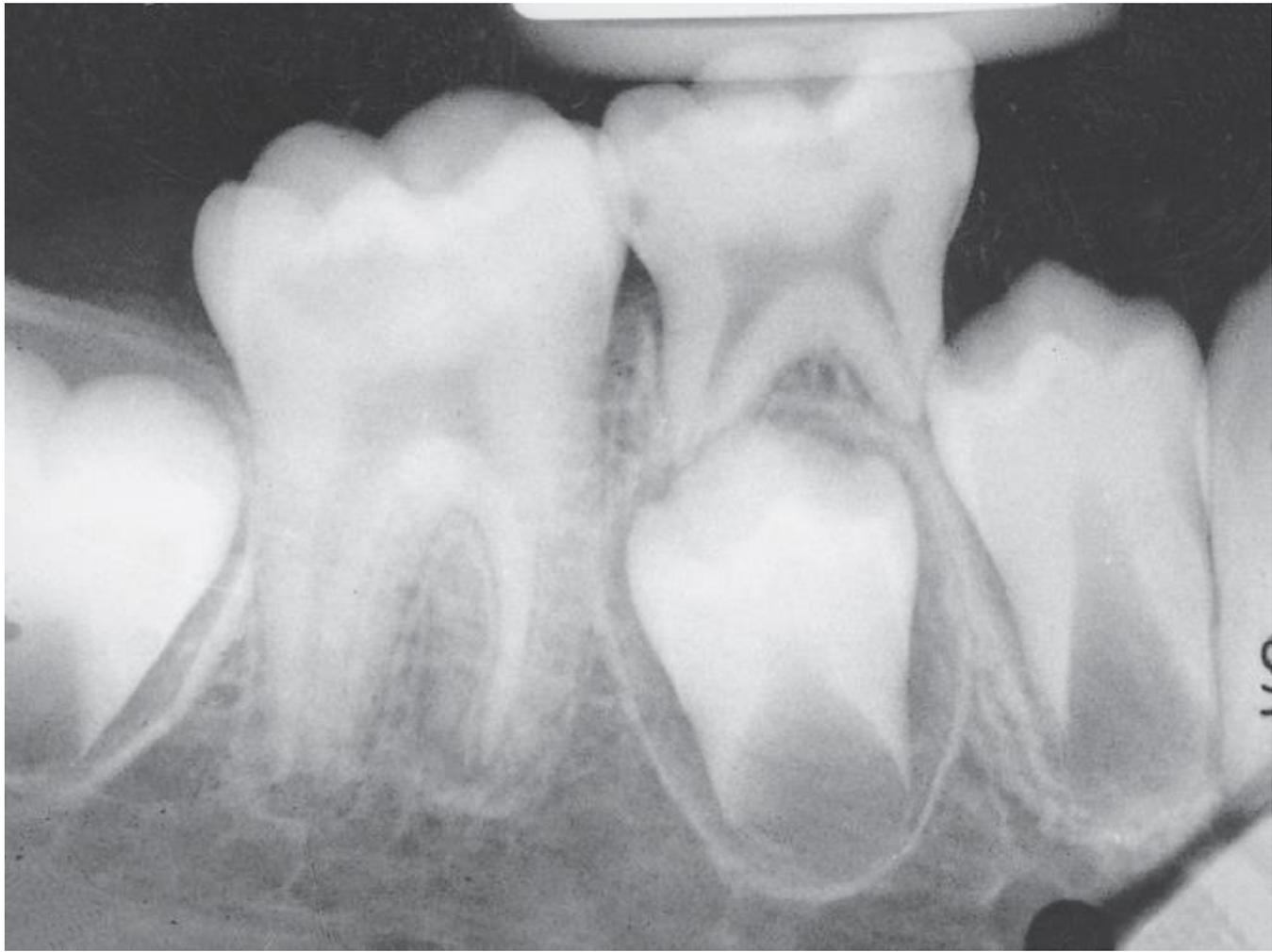
Some interim restorative materials may also serve as the base material. It is sometimes helpful to adapt and cement a preformed stainless steel band to the tooth to support the interim restoration

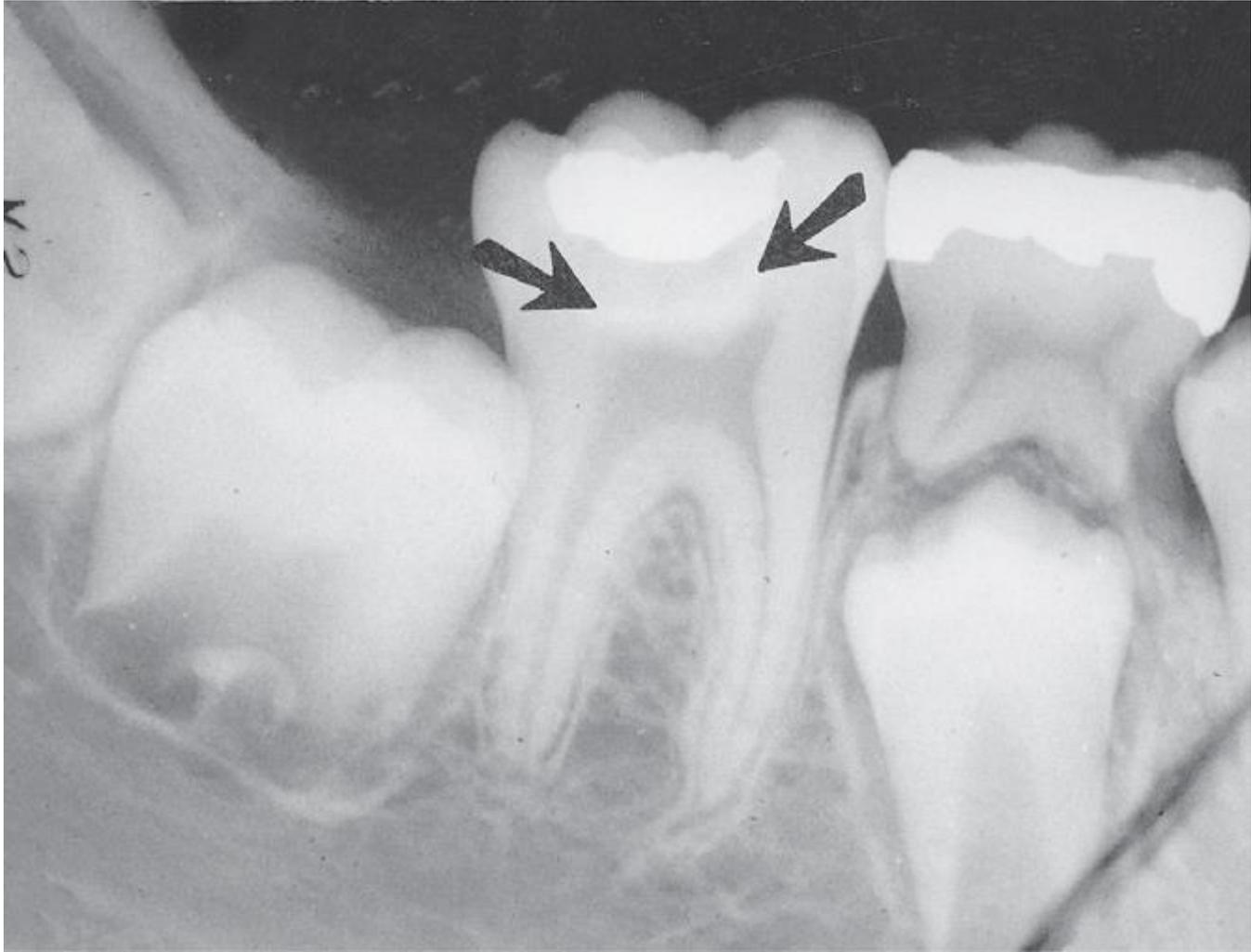


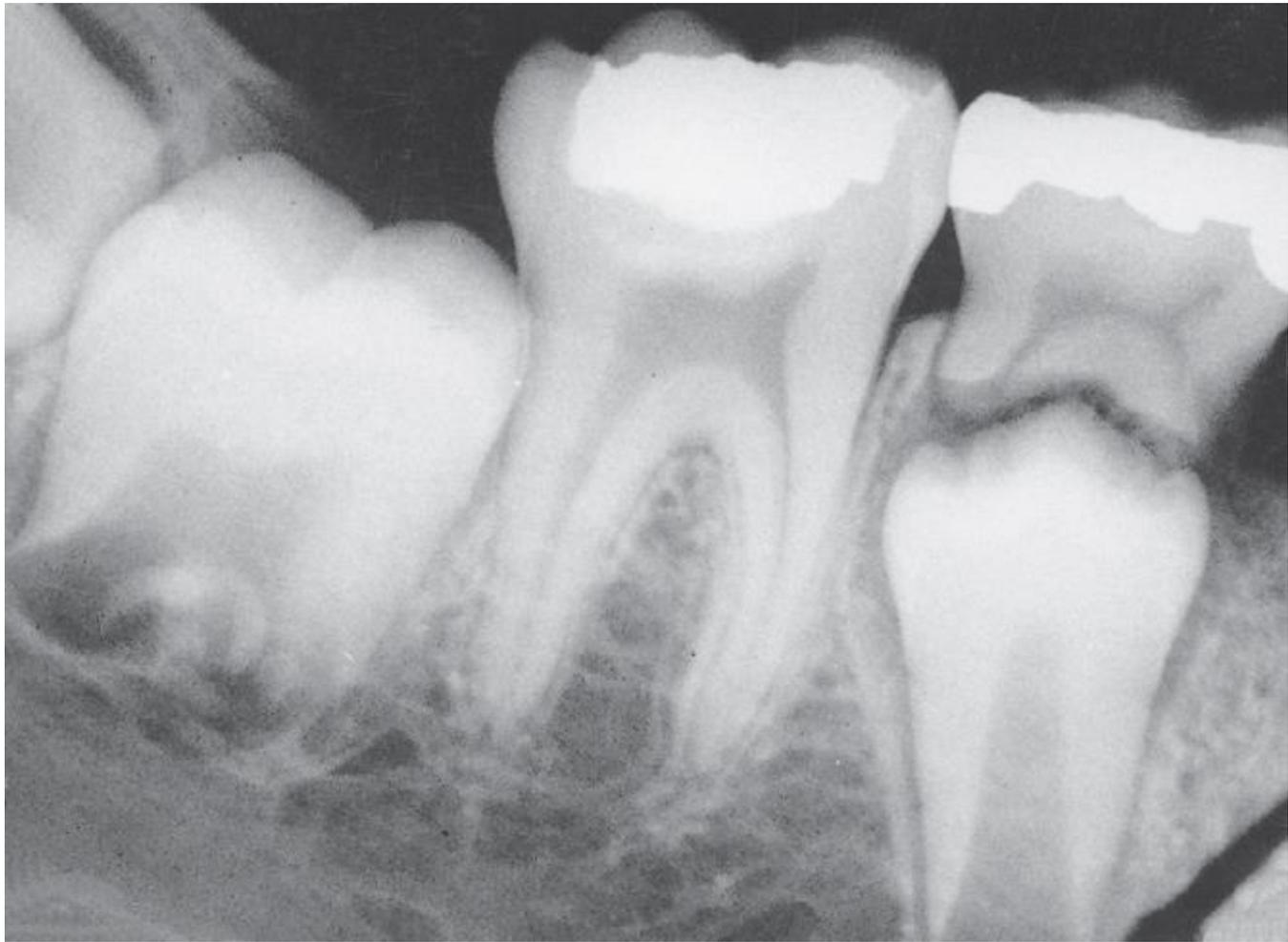
The treated teeth should not be reentered to complete the removal of caries for at least 6 to 8 weeks. During this time the caries process in the deeper layer is arrested.

At the **conclusion** of the minimum 6- to 8-week waiting period, the tooth is reentered. Careful removal of the remaining carious material, now somewhat **sclerotic**, may reveal a sound base of dentin without an exposure of the pulp. If a sound layer of dentin covers the pulp, the tooth is restored in the conventional manner.









Indirect pulp therapy has been proved to be a **valuable therapeutic procedure** in treating **asymptomatic** teeth with **deep carious** lesions. The procedure **reduces** the **risk** of **direct** pulp exposure and **preserves pulp vitality**. One may question the need to reenter the tooth if it has been properly selected and monitored, if a durable restoration is placed initially, and if no adverse signs or symptoms develop. Most clinicians are successfully practicing indirect pulp treatment without reentry after the initial caries excavation. The inexperienced dentist, however, may want to consider performing the treatment in two appointments until confidence in proper case selection has been achieved.

# VITAL PULP EXPOSURE

Although the routine practice of indirect pulp therapy in properly selected teeth will significantly reduce the number of direct pulp exposures encountered, all dentists who treat severe caries in children will be faced with treatment decisions related to the management of vital pulp exposures.

# SIZE OF THE EXPOSURE AND PULPAL HEMORRHAGE

The size of the exposure, the appearance of the pulp, and the amount of bleeding are valuable observations in diagnosing the condition of the primary pulp. For this reason the use of a rubber dam to isolate the tooth is extremely important; in addition, with the rubber dam the area can be kept clean and the work can be done more efficiently.

The most **favorable** condition for vital pulp therapy is the **small pinpoint exposure surrounded by sound dentin**. However, a true carious exposure, even of pinpoint size, will be accompanied by inflammation of the pulp, the degree of which is usually directly related to the size of the exposure.



A **large exposure—the** type that is encountered when a mass of leathery dentin is removed—is often associated with a watery exudate or pus at the exposure site. **These conditions** are **indicative of advanced pulp degeneration** and often of **internal resorption** in the pulp canal.



In addition, **excessive hemorrhage** at the point of carious exposure or during pulp amputation is invariably **associated** with **hyperemia** and **generalized inflammation** of the pulp. When a generalized inflammation of the pulp is observed, **endodontic** therapy or **extraction** of the tooth is the **treatment of choice**.



# DENTAL HEMOGRAM

Investigate the value of a white blood cell differential count (hemogram) of the dental pulp as a diagnostic aid in **determining pathologic** or **degenerative changes** in the pulp. The first drop of blood from an exposed pulp was used for making the hemogram.



The use of the dental hemogram is not a practical diagnostic method in the routine clinical management of vital pulp exposures.



# VITAL PULP THERAPY TECHNIQUES

generally agreed that the prognosis after any type of pulp therapy improves in the absence of contamination by pathogenic microorganisms. Thus **biocompatible neutralization** of any **existing pulpal contamination** and **prevention** of **future contamination** (e.g., microleakage) are worthy **goals** in **vital pulp therapy**. If the treatment material in direct contact with the pulp also has some inherent quality that promotes, stimulates, or accelerates a true tissue healing response, so much the better; however, it is recognized that vital pulp tissue can recover from a variety of insults spontaneously in a favorable environment.

# DIRECT PULP CAPPING

The pulp-capping procedure has been widely practiced for years and is still the favorite method of many dentists for treating vital pulp exposures. Although pulp capping has been condemned by some, others report that, if the teeth are carefully selected, excellent results are obtained.

It is generally agreed that pulp-capping procedures should be limited to **small exposures** that have been produced accidentally by **trauma** or **during cavity preparation** or to **true pinpoint carious exposures** that are **surrounded by sound dentin**.



Pulp capping should be considered only for teeth in which there is an **absence of pain**, with the possible **exception** of **discomfort** caused by the **intake** of **food**. In addition, there should be either **no bleeding** at the exposure site, as is often the case in a mechanical exposure, or **bleeding** in an amount that would be **considered normal** in the absence of a hyperemic or inflamed pulp.

All pulp treatment procedures should be carried out under clean conditions using sterile instruments. Use of the rubber dam will help keep the pulp free of external contamination. All peripheral carious tissue should be excavated before excavation is begun on the portion of the carious dentin most likely to result in pulp exposure. Thus most of the bacterially infected tissue will have been removed before actual pulp exposure occurs.



**Calcium hydroxide** remains the standard material for pulp capping normal vital pulp tissue. The possibility of its stimulating the repair reaction is good. A hard-setting calcium hydroxide capping material should be used. If the **tooth** is **small** (such as a first primary molar), the hard-setting calcium hydroxide may also be **used** as the **base for the restoration**.

In addition, the use of mineral trioxide aggregate and Biodentine have shown promise.

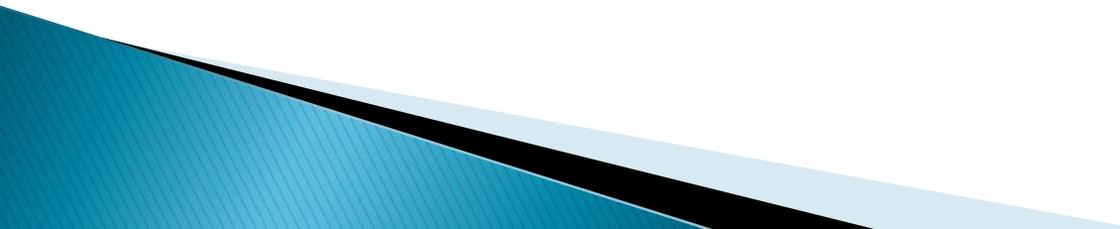
# PULPOTOMY

The removal of the coronal portion of the pulp is an accepted procedure for treating both primary and permanent teeth with carious pulp exposures. The justification for this procedure is that the coronal pulp tissue, which is adjacent to the carious exposure, usually contains microorganisms and shows evidence of inflammation and degenerative change.



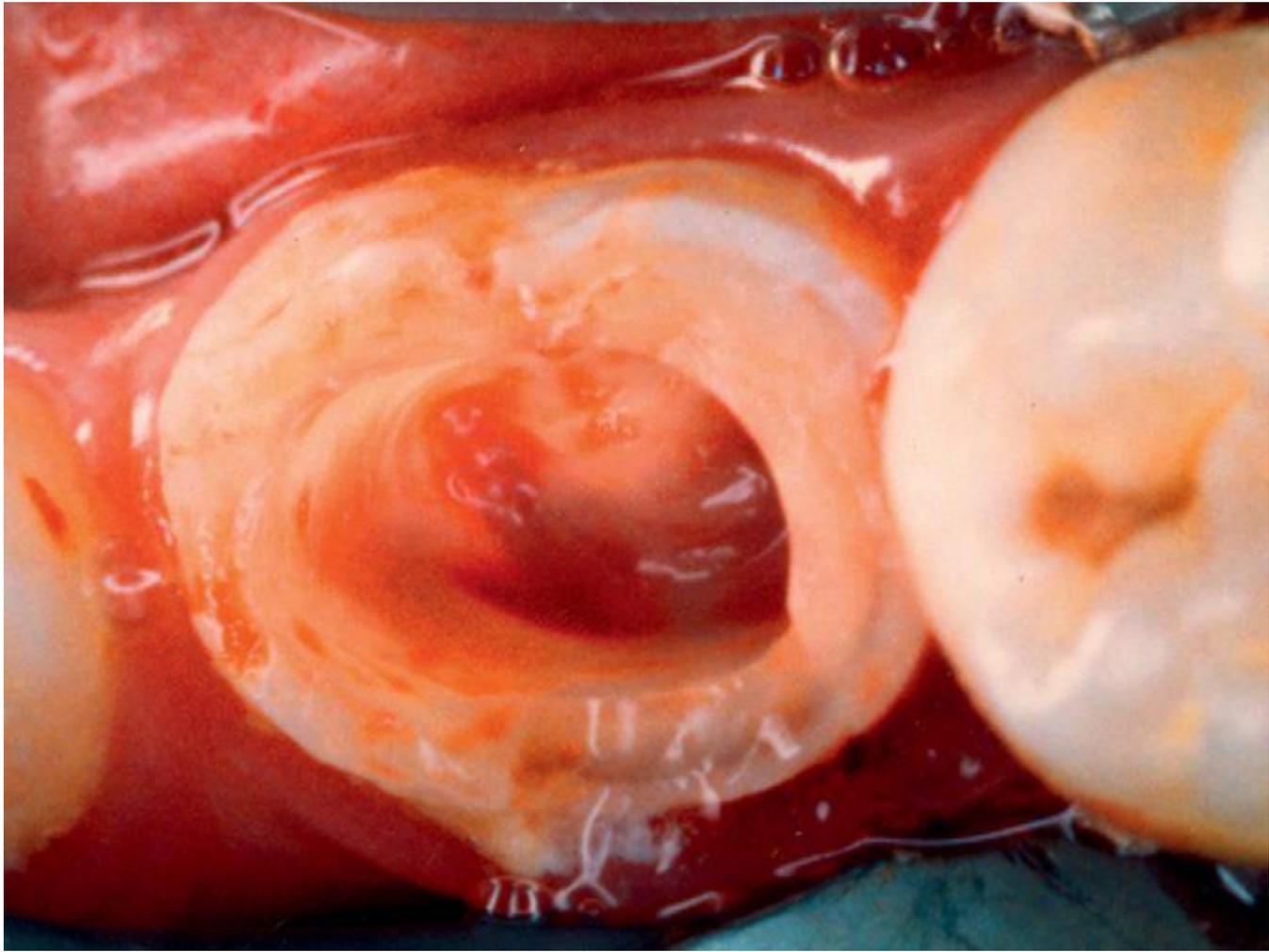
The abnormal tissue can be removed, and the healing can be allowed to take place at the entrance of the pulp canal in an area of essentially normal pulp. Even the pulpotomy procedure, however, is likely to result in a high percentage of failures unless the teeth are carefully selected.

In the pulpotomy procedure the tooth should first be anesthetized and isolated with the rubber dam. A surgically clean technique should be used throughout the procedure. All remaining dental caries should be removed, as well as the overhanging enamel, to provide good access to coronal pulp. Pain during caries removal and instrumentation may be an indication of faulty anesthetic technique.



The entire roof of the pulp chamber should be removed. No overhanging dentin from the roof of the pulp chamber or pulp horns should remain. No attempt is made to control the hemorrhage until the coronal pulp has been amputated. A funnel-shaped access to the entrance of the root canals should be produced. A sharp discoid spoon excavator, large enough to extend across the entrance of the individual root canals, may be used to amputate the coronal pulp at its entrance into the canals.

The pulp chamber should then be irrigated with a light flow of water from the water syringe and evacuated. Cotton pellets moistened with water should be placed in the pulp chamber and allowed to remain over the pulp stumps until a clot forms.



# Pulpotomy Technique for Permanent Teeth

The calcium hydroxide pulpotomy technique is recommended in the treatment of permanent teeth with carious pulp exposures when there is a pathologic change in the pulp at the exposure site. Recently the use of mineral trioxide aggregate and Biodentine show perfect result.

This procedure is particularly indicated for permanent teeth with immature root development but with healthy pulp tissue in the root canals. It is also indicated for a permanent tooth with a pulp exposure resulting from crown fracture when the trauma has also produced a root fracture of the same tooth. The procedure is completed during a single appointment. Only teeth free of symptoms of painful pulpitis are considered for treatment.



# Pulpotomy Technique for Primary Teeth

The same diagnostic criteria recommended for the selection of permanent teeth for the pulpotomy procedure should be used in the selection of primary teeth for the pulpotomy procedure. The treatment is also completed during a single appointment.



A surgically clean technique should be used. The coronal portion of the pulp should be amputated as described previously, the debris should be removed from the chamber, and the hemorrhage should be controlled.

If there is evidence of hyperemia after the removal of the coronal pulp, which indicates that inflammation is present in the tissue beyond the coronal portion of the pulp, the technique should be abandoned in favor of the partial pulpectomy or the removal of the tooth. If the hemorrhage is controlled readily and the pulp stumps appear normal, it may be assumed that the pulp tissue in the canals is normal, and it is possible to proceed with the pulpotomy

Although the formocresol pulpotomy technique has been recommended for many years as the principal method for treating primary teeth with carious exposures, a substantial shift away from use of this medicament has occurred because of concerns about its toxic effects.

