Modern Procedures For Diagnostic Transillumination

Introduction

Diagnosis and clinical information in dentistry has been limited in the past by the paucity of instruments available to the dentist for this purpose. Historically, the dentist would rely on the patient's indication of the painful tooth or would manually probe for large decayed or abscessed areas. With the advent of x-ray equipment, diagnostic technique expanded rapidly to allow detection of proximal caries, endodontic problems, cysts and many other previously invisible clinical entities. There are, however, many limitations to the information provided by radiographs. As a two dimensional image, the radiograph cannot show the position of anything on a buccolingual plane such as an endodontic orifice nor is it possible to see pathology such as a fracture of the clinical crown which extends from mesial to distal. The x-ray beam is also easily blocked by metal restorations, overlapped teeth or orthodontic appliances.

Recently, x-ray safety has been the focus of great controversy. It is well known that x-rays should be avoided on patients who are pregnant as well as patients with certain other systemic ailments or who have been receiving radiation therapy. The safety of x-rays even in patients without these particular problems is now in question and patients are often requesting that x-rays not be taken. Doctors have also realized that even when the patient is covered by a lead apron, two of the most radiation-sensitive areas, the corneas and the thyroid gland, are unprotected and irradiated with highly questionable side effects. Clinical evidence as well as consumer advocates and patients have placed limitations on the frequency and number of radiographs which the dentist may take, greatly reducing its usefulness as a diagnostic tool.

Transillumination, the technique of viewing decay, fractures, endodontic orifices and other clinical entities by passing an intense light through them can substantially add to the dentist armamentarium. Transillumination is based on the fact that healthy tooth structure has an index of light transmission greater than that of decay or calculus. A fracture line or endodontic orifice also has a reduced ability to transmit light. Therefore, if an intense light is placed in direct proximity to a tooth and other overall light is reduced, these clinical entities will appear as distinct dark areas in the otherwise bright structure.

The acceptance of transillumination as a diagnostic technique has been greatly enhanced by the availability of modern devices made expressly for this purpose. These "transilluminators" use white L.E.D. lamps to generate the necessary intense white light which is then transmitted to the working area without heat by a fiber optic rod, allowing the light to be placed directly on the tissue without fear of patient discomfort or injury. An important feature is that this fiber optic rod can be easily removed and autoclaved to avoid cross contamination between patients. The small size and portability of these new devices allows the convenient use of transillumination by the doctor and auxiliary personnel.

General Clinical Procedure

The technique of transillumination depends upon placing an intense small spot of light directly on the structure under examination and reducing the other sources of light in the area to a minimum. It is not necessary to darken the room completely, but the dental operating light as well as bright overhead lighting should be turned out. The transilluminator tip is placed on either the facial or lingual surface of the tooth and the area viewed from the occlusal surface or the surface opposite the transilluminator. Direct vision or a dental mirror may be used for viewing, depending upon the area under examination. The exact placement of the transilluminator differs for decay, endodontics, fractures, etc. and will be discussed under each clinical entity.

Decay

Probably the oldest and most widely known use of transillumination is the diagnosis of proximal decay. Although not as discriminating as x-ray, especially for the diagnosis of incipient caries, transillumination does have other advantages in this application. Since the transilluminator may be easily positioned by the doctor and moved to avoid interfering structures, decay may be more easily diagnosed on overlapped teeth. Transillumination is also capable of diagnosing proximal decay under orthodontic bands and appliances without necessitating their removal ... a tremendous time and work saver.

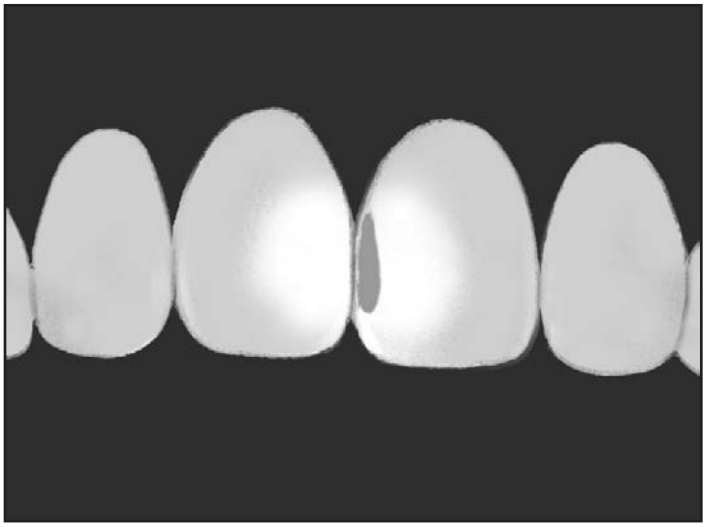
Presented to the patient as a completely safe alternative for caries detection, "diagnostic transillumination" may be used to reduce the number of necessary x- rays and the attendant radiation hazard. Patients generally appreciate this updating of the doctor's techniques and his concern for their safety.

Technic For Decay

As previously stated, the diagnosis of decay by transillumination is based upon the fact that the passage of light through tissue is proportional to its index of light transmission. Caries does not transmit as much light as healthy enamel or dentin and so appears as a dark area in the otherwise bright tooth.

To detect anterior caries the transilluminator is placed first on the labio-cervical region of the tooth and moved from the mesial to the distal while observing from the lingual with a dental mirror. The transilluminator is then placed on the lingual-cervical region of the tooth both mesially and distally while viewing from the labial surface. Anterior caries will show up as a well defined dark shadow in the class III region of the tooth (see fig. 1).

Figure 1



To detect posterior caries the transilluminator is placed first on the buccal at the cervical third of the tooth and moved from the mesial to the distal while observing from the occlusal for the triangular shaped shadow which indicates the presence of proximal decay. The procedure is then repeated with the transilluminator placed on the lingual surface of the tooth (see fig. 2).

Caries under orthodontic bands or brackets may be detected by placing the transilluminator gingival to the appliance (onto the gingival soft tissue if necessary) and observing proximal decay as a shadow on the occlusal surface as previously described.

In all areas, it is important that each tooth be evaluated for mesial and distal decay with the transilluminator placed on both the buccal and lingual surfaces. All surfaces should be thoroughly examined for proper caries detection.

Endodontics

Endodontic treatment presents some unique problems in dentistry. The necessity of locating tiny orifices which may be partly or mostly obliterated and which emerge in various locations and in differing numbers on the bottom of a deep access opening is further aggravated by the difficulty in lighting the work area. Transillumination for endodontic procedures is accomplished by light shined on the gingival tissue being conducted into the root and up to the floor of the pulp chamber. Since the canal and orifice is essentially a hole in the root, its light transmission will differ from tooth structure and will generally appear as a dark spot in the otherwise bright structure (see fig. 3).

Figure 2

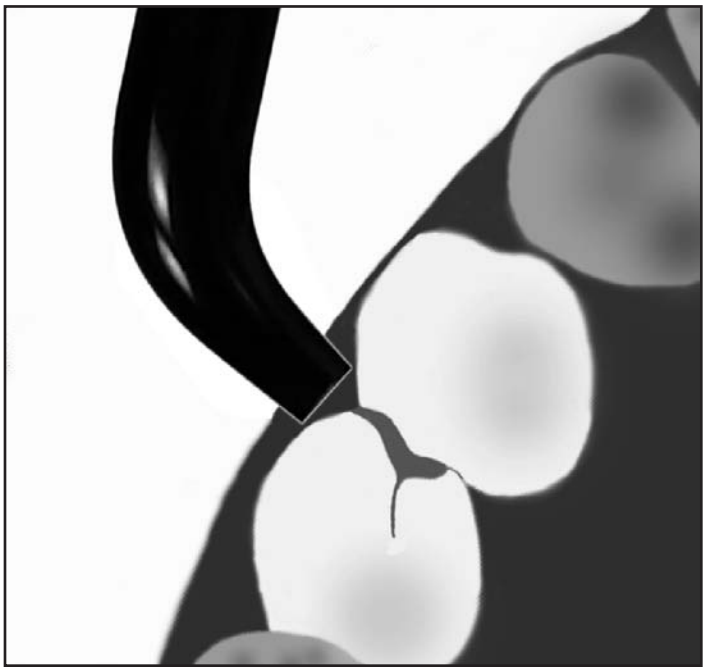


Figure 3

Even if a canal is obliterated by calcified material or reparative dentin, the altered light transmission is such that a dark spot will still be visible upon transillumination. This greatly reduces the possibility of misplacement of the bur when trying to gain access into an obliterated canal and the chance of perforation resulting in the loss of the tooth.

Figure 4 shows the appearance of an endodontic access in a central incisor whose pulp receded when observed using normal dental lighting. Figure 5 shows the appearance of the same tooth when transillumination is used. You can see by the drawing the appearance of the obliterated canal using transillumination greatly reduces the risks involved in the endodontic treatment.

One of the major causes of trouble in endodontics and the failure of many endodontically-treated teeth is the presence of undetected and untreated "extra" canals. These aberrant canals can occur on anterior as well as posterior teeth and are frequently the cause for continued pain and inflammation after thorough treatment of the "normal" canals is accomplished. Routine transillumination of all endodontic accesses tremendously enhances the ability to detect these canals before they become a problem (see fig. 6).

Figure 4

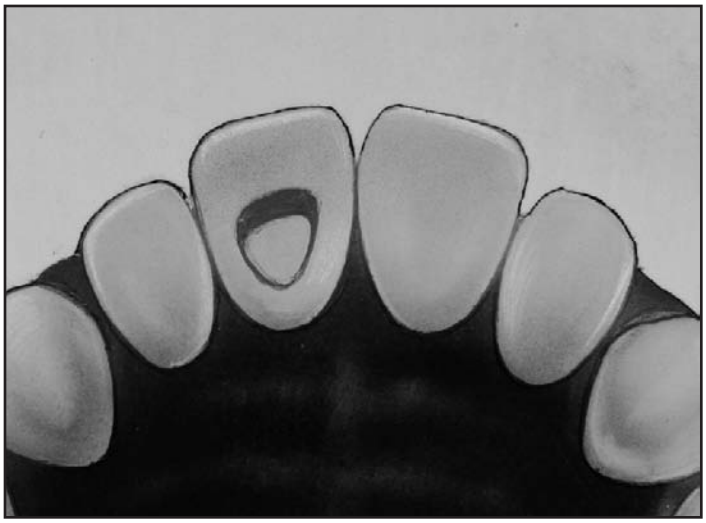


Figure 5

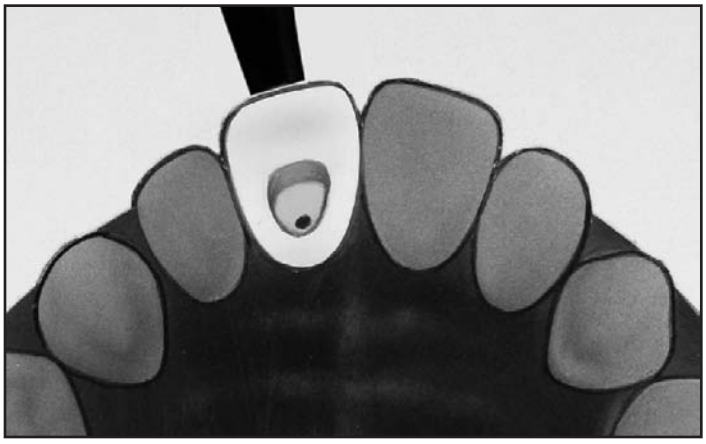


Figure 6

Transillumination is also useful for other facets of endodontics such as providing excellent visibility for preparing a post or drilling out an existing post and the ability to transilluminate into a fairly large canal to insure that the walls are properly instrumented.

Technic For Endodontics

First prepare the customary access opening and pulpotomy with normal overhead dental lighting. The transilluminator is then placed on the cervical portion of the tooth either buccally or lingually. This usually necessitates placement gingival to the rubber dam and clamp but this is not an absolute requirement. Turn out the dental operating light and view the endodontic orifices with direct or indirect vision as follows:

For anterior teeth the transilluminator is placed on the labio-cervical region and the tooth viewed from the lingual with direct or indirect vision (see fig. 5).

For posterior teeth the transilluminator is placed on the cervical portion of the tooth nearest the root under investigation. For example, if the mesio-buccal canal is being located, the transilluminator should be placed as close as possible to the mesio-buccal root (see fig. 3). The floor of the access opening is then viewed for the appearance of the endodontic orifice using direct or indirect vision.

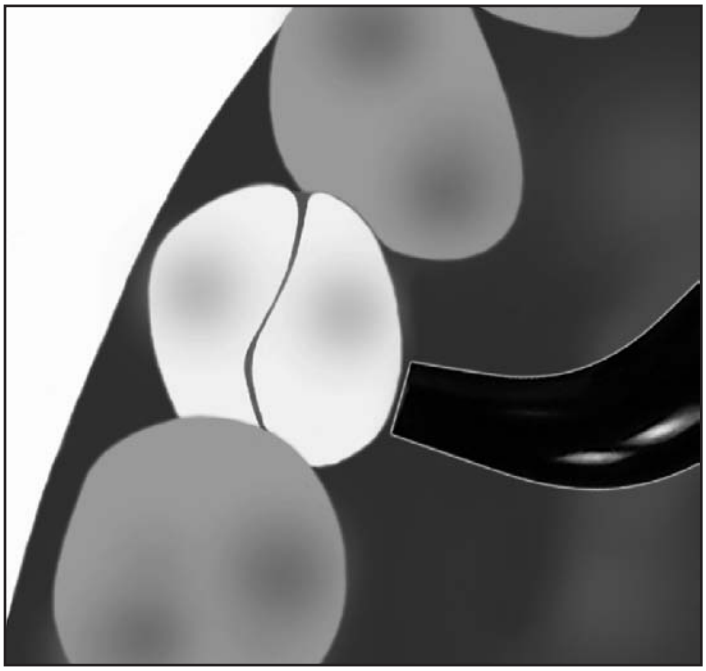
Clinical Crown Fractures

The clinical entity which presents one of the most vexing diagnostic problems in dentistry is a hairline fracture of the clinical crown. The patient generally presents with vague symptoms of pain on biting and percussion which are difficult to reproduce in the operatory. X-ray radiographs of the area show no periapical or periodontal pathology and nothing to indicate the presence of the fracture. Very often a multi-surface restoration is present which further complicates the diagnostic problems. Transillumination is the most effective tool at the dentist's disposal for the diagnosis of such fractures. Light transmitted through the tooth is not conducted as well by the fractured tooth structure causing the appearance of a dark line in the otherwise bright area.

Technic For Clinical Crown Fractures

Reduce overhead lighting as much as possible and place the transilluminator on the buccal gingival area of the suspect tooth. Move the transilluminator slowly from mesial to distal while observing from the occlusal for the dark line which indicates a fractured crown (see fig. 7).

Figure 7



Examine the marginal ridges and proximal surfaces for a continuation of the fracture line. Repeat the procedure on the lingual surface of the tooth. If a restoration is present, the fracture line is usually visible at the marginal ridges and unrestored proximal tooth surfaces.

Other Uses Of Transillumination

PROSTHODONTICS - Routinely checking porcelain and porcelain fused to gold restorations for fracture lines prior to placement in the mouth helps avoid difficult and embarrassing clinical problems. Porcelain jackets should be transilluminated from the inside out and porcelain fused to metal restorations transilluminated tangentially along the porcelain. The appearance of a distinct line in the material indicates a potential trouble spot and should be evaluated for corrective procedures.

SURGERY - In surgical procedures, the transilluminator provides an excellent source of auxiliary lighting as well as facilitating the location of bone chips and fractured roots. The transilluminator may be placed directly in the extraction sight to provide intense light directly on the work area. The light may be transilluminated through the cortical bone from the buccal or lingual allowing root tips to be found by the difference in light transmission.

In periodontal surgery the transilluminator provides an excellent source of light for evaluating boney pockets and the condition of root surfaces.

It is essential in surgical as well as other clinical uses that the tip of the transilluminator be autoclaved to avoid the possibility of cross contamination.

RESTORATIVE DENTISTRY - Transillumination is useful in the placement of pins for restorative procedures by delineating the pulp chamber after the tooth is prepared allowing for the safe selection of pin locations.

The transilluminator may be used in all restorative procedures as an auxiliary light source for detailed work in hard to light areas.

PREVENTION - Use of the transilluminator by the doctor or hygienist for the detection of supra and subgingival calculus as well as for illuminating clinical problems for patient education (see fig. 8).

For the procedures described here as well as many others developed by its users, the transilluminator is an effective addition to the dentist's armamentarium. As with other instruments, practice in its use, as well as the application of good clinical judgment is necessary for the greatest benefit.

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Transilluminator Product Description

The ***TransCure*** **TRANSILLUMINATOR** provides important diagnostic features and advanced simplicity. It is completely self-contained and may be conveniently transported between operatories. The power source consists of rechargeable batteries and can be used anywhere without the necessity of an available wall outlet.

The power source, when fully charged, will last between 2 and 6 months before recharging depending upon the model selected. The ***TransCure*** **TRANSILLUMINATOR** is available in two design packages to provide the dentist with the most functionality for a particular operatory.

TransCure-C Cordless

- Autoclavable fiber optic probe.
- High intensity pure white light at 7000K.
- Long life L.E.D. light source (5000hrs.).
- Completely self-contained battery operation.
- Rechargeable battery module with recharger.

TransCure-P Portable

- Autoclavable fiber optic probes.
- High intensity white transilluminator probe at 7000K.
- High intensity blue curing probe for sealants at 470nm.
- Completely self-contained battery operation.
- Automatic ambient light no-hands activation.
- High density NiCd batteries provide 6 month charge.

TransCure-C Cordless

TransCure-P Portable

KINETIC INSTRUMENTS inc.

17 Berkshire Boulevard Bethel, Connecticut 06801

800-233-2346