

# Identifying restorations in need of replacement using the DIFOTI Transillumination imaging system

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Porcelain inlays, onlays, and laminates are conservative treatments that are often considered simply a cosmetic solution to improving a patient's smile. Additionally, it has been proven that



Fig. 1 Seat the patient.



Fig. 2 Slide the mouthpiece from one tooth to the next.



Fig. 3 Display and discuss images with the patient.

the placement of these bonded restorations strengthens teeth that have been weakened by directly placed amalgam restorations.

Locating fractures that weaken these teeth or determining the extent of decay under old amalgam filling, has always presented a challenge. The two-view provided by an x-ray image is many times inadequate for fully detecting decay and fractures in teeth or not particularly helpful in communicating what we see and recommend to the patient.

While transillumination of teeth has proved a successful method of finding such conditions, the problem has been how to capture the image and show it to the patient. Hand mirrors have been used, but this cumbersome technique was neither reliable nor useful, because the patient could never see what was done. With the advent of computer technology, we are now able to digitally capture transilluminated images on all tooth surfaces and view

Following are step-by-

Step instructions on how to discover previously unseen fractures and decay around old restorations using the DIFOTI (Digital Imaging Fiber Optic Trans Illumination) diagnostic imaging system and how to

use these images for patient education purposes to explain the need for removal and replacement of these restorations.

## Getting started

1. Turn the operatory computer and the DIFOTI system on.
2. Select the patient name or ID from the database or add a new patient.
3. Advance to the "Take Picture" mode of the software.

## Capturing images

1. Seat the patient in much the same manner as for a typical radiographic examination

(Fig. 1).

2. Select [he appropriate disposable mouthpiece for the surface to image:

- The proximal-surface disposable mouthpiece is placed over the tooth in question, allowing light to be shined from one surface, through the tooth, and captured on the opposite side using a CCD camera in the DIFOTI handpiece.
- The occlusal-surface mouthpiece illuminates the tooth at angles through both the facial and lingual surfaces and images the light emerging from the top of the tooth.

Slide the mouthpiece from one tooth to the next (Fig. 2 ). Note: The image appears in real time on the computer screen.

4. Scan through the mouth and capture to-be-saved images of clinically suspicious teeth using the foot pedal or voice recognition software.

Note: All captured images are saved in a patient's datafile, according to tooth number, surface (occlusal, facial, lingual), and date of imaging session (for com

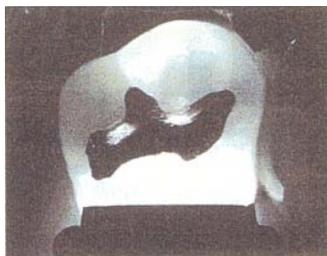


Fig. 4 An occlusal amalgam filling on tooth No. 15.



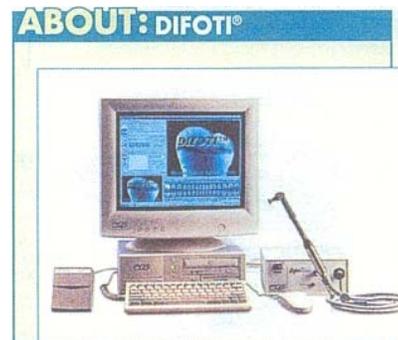
Fig. 5 Radiograph shows no evidence of decay on tooth No. 30.



Fig. 6 DIFOTI shows decay on No.



Fig. 7 No decay apparent on No. 14.



Fiberoptic transillumination digital imaging unit for the early detection of dental caries.

## Applications

- Detects caries on occlusal, interproximal, and smooth surfaces
- Detects recurrent decay around restorations
  - Monitors the excavation process
- Assesses efficacy of restorative materials, detects fractures

## Features

- Detects caries before visible radiographically
- Image acquisition from either labial, lingual, or occlusal surfaces

Disposable mouthpieces in 4 sizes (small adult, large adult, pedodontic proximal, and occlusal)

Data conversion into digital format via dedicated image analysis software for storage on CD, hard drive, or external device

Real-time image acquisition that can be printed or e-mailed to patients and/or to third-party payors

Proprietary handpiece with fixed focus optics

CCD (charged couple device) camera

- Customized image capture card
- Windows-based diagnostic and management software
- Automatic light exposure and footpedal
- Portability or full integration into office network
- Interfaces to practice management software

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Select 76.

parison of images over time).

### Patient education

After the imaging is complete, display and discuss images with the patient in the "Review" mode (Fig 3).

Following are three cases that demonstrate DIFOTI's detection and patient education applications:

**Case 1: Intact amalgam with no decay** The image is of an occlusal amalgam filling on tooth No. 15 (Fig 4). The cavosurface margins appear as sharp intact continuous lines against translucent healthy tooth structure with no shadows around the borders. The tooth is healthy and no treatment is necessary.

#### Case 2: Decay under amalgam not visible with x-ray

Fig. 5 shows an x-ray of tooth No. 30 that looked as if there was no decay upon visual and radiographic examination. The corresponding DIFOTI image (Fig. 6) shows diffuse darker cloudy areas extending from the margins of the restorations against the more translucent and brighter background of surrounding healthy tooth structure. A similar comparison of tooth No. 14 is shown in Figs. 7 and 8. Both cases show recurrent decay under an amalgam that occurs due to the continuous expansion and shrinkage of amalgam over time that allows bacteria to settle between the tilling and tooth structure.

The extent of the decay/fracture and where it is located can be easily explained to the patient to justify treatment plans. With the widespread use of fluoride it is often difficult to diagnose recurrent decay, because the fluoridated water and toothpastes remineralize the outermost portion of our enamel around our fillings, making it difficult to feel or see decay underneath.

Use of transillumination permits timely removal of existing amalgam and recurrent decay that would not have been found otherwise; the patient probably may have needed more extensive treatment by the time the problem was detected radiographically. The patient clearly saw

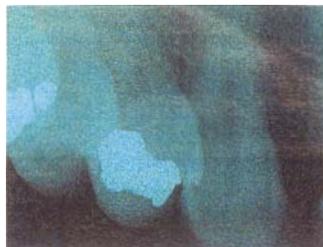
#### Case 3: Laminate margin breakdown

The x-ray image (Fig. 9) of porcelain laminates on tooth No. 7 shows no problem with the laminates. The DIFOTI image (Fig. 10) clearly shows a breakdown in the margins of the laminate with decay present.

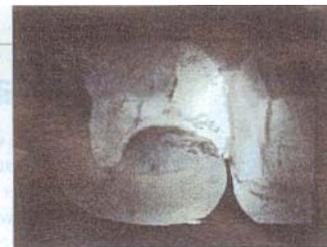
The DIFOTI image illustrates exactly where the laminate begins and ends and where the decay and breakdown occurs. In this case, the veneers were removed and replaced with new porcelain veneers. The margins can be checked using the system at each recall to make sure they are intact. The images can also be shown to patients at each recall.



**Fig. 8 DIFOTI** reveals diffuse and cloudy areas on No. 14.



**Fig. 9 X-ray** of porcelain laminates on tooth No. 7 **shows** no problem.



**Fig. 10 DIFOTI** image **shows** break down in margins of laminate on No. 7.