

Clinical Guidelines for Dental Handpiece Use with Fluorescence



Statement - This guideline was prepared by Lares Research based on the professional opinions of Dr. Aine Lennon. This document is intended to include only existing scientific knowledge of dental handpiece use with fluorescence. Lares Research Fluoresce HD products are intended to help visualize caries, healthy tooth and filling material and may not be cleared as safe and effective for other clinical uses described below.

Introduction

Using near-UV (405 nm wavelength) handpiece light output during restorative dental treatment allows the clinician to directly visualize both composite restorative materials and bacterially infected dental hard tissue through fluorescence.

Modern composite materials are designed to look as much like natural dental tissue as possible. This property makes the detection and differentiation of previously placed composite restorations from natural tooth substance very difficult. Using a handpiece with 405 nm output, the area being treated is excited by the near-UV light. The resulting fluorescence emitted by the tooth and the composite is different, allowing the dentist to easily differentiate between the two for most composites.

A dental handpiece with 405 nm light output can also aid in the clinical visualization of bacterially infected dental hard tissue. Traditional tools (probing the hardness of the tissue or staining) indicate only indirectly whether hard tissue is infected. Using a handpiece with near UV light output together with the appropriate loupe insert filter, the remaining bacterially infected dentin can be directly visualized during the restoration procedure.

Both capabilities increase the efficiency and precision of restoration and caries removal in practice, saving time and tooth structure.

Factors Affecting Fluorescence in the Dental Practice

When using dental handpieces to create fluorescence in the dental practice the near-UV light output should be as intense as possible. The handpiece/turbine should use solid rod optics with high transmission efficiency.

External sources of light can diminish the visible fluorescence contrast. White light from the operatory light, a head lamp, room lighting, or even daylight can interfere with your ability to see the fluorescence contrast. Therefore, these white light sources should be shut off or minimized while using fluorescence.

Red fluorescence in carious dentin is caused by red-fluorescing porphyrin compounds in live bacteria. These are known to bleach out over time when exposed to light. The cavity should not be continuously illuminated with near-UV light for long periods as this may reduce red fluorescence and distort the visible contrast.

When using fluorescence for cavity preparation, the tooth surface should first be thoroughly cleaned of mature plaque on the enamel surface and in the fissures. The bacteria in the plaque may also fluoresce red and should not be mistaken for carious enamel.

Caries indicating dyes and stains marketed for residual caries diagnosis generally also fluoresce strongly. These staining solutions should not be used in combination with fluorescence.

Equipment

1. Fiber optic air turbine with 405 nm near-UV light output coupler or electric motor with 405 nm near-UV light output and fiber optic contra angle.
2. Loupe insert filter for visual contrast (not safety)

Caries and Composite Excavation Step-By-Step

1. *Access Cavity Preparation

In order to provide access to carious dentin, an access cavity should be prepared. This allows the full extent of the carious dentin to be assessed. Highspeed handpieces with water-cooled rotary diamond burs are recommended for this stage of cavity preparation. Carious enamel should be removed whether bacterially infected or demineralized**. Bacterially infected enamel appears red with fluorescence while sound enamel appears green. Enamel, which is merely demineralized, will not fluoresce as brightly as sound enamel or dentin.

2. *Composite Removal

If a composite restoration is to be removed, using a handpiece with fluorescence makes it much easier to differentiate composite from tooth substance. Using fluorescence, sound dental hard tissue fluoresces green. Dental composites generally have a different appearance (often white) in fluorescence light compared to natural dentin or enamel. Because of this differentiation, the time needed for careful composite removal is reduced and the chance of inadvertent removal of dentin or enamel is minimized.

*Clinical directions and suggested restoration actions are the opinions of Aine M. Lennon PhD, Doctor of Medical Dentistry.

**In exceptional cases demineralized enamel can be left at the margin if the lesion is arrested and excellent oral hygiene can be expected.

3. *Detection and Removal of Residual Caries

Following access cavity preparation the extent of caries in dentin should be assessed. Carious areas in dentin are easily identified as they appear red in fluorescence mode as opposed to sound dentin, which is green (Figure 2). Red-fluorescing areas have a high degree of bacterial infection and should be removed. Residual caries can be removed at slow speed with round burs. Red-fluorescing areas are removed layer by layer until green fluorescing dentin is exposed. Traditionally dentin hardness needs to be checked using a probe at intervals during excavation. This is not necessary when using fluorescence, but it is still advisable to check dentin hardness at the margins of the cavity (see below).

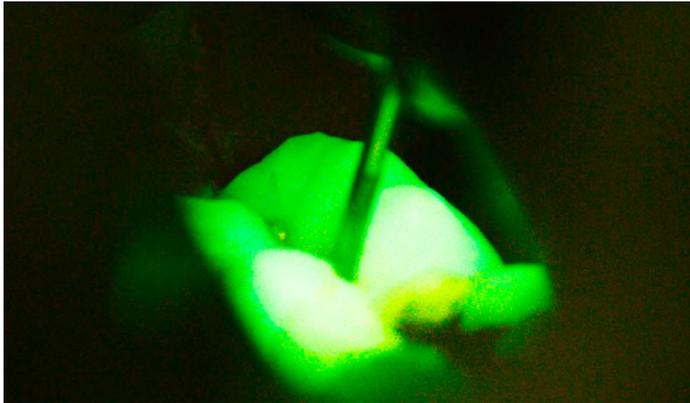
4. *End point of Caries Excavation

Generally, red-fluorescing bacterially infected dentin should be completely removed. However, when excavating close to the pulp it is advisable to be more conservative leaving infected dentin rather than risk a pulp exposure. Dentin near the pulp may also appear red or brown. It is advisable to check the floor of the preparation with a probe rather than risk a pulp exposure.

4.1 *General Recommendations for Dentin Excavation

In areas where there is no danger of causing a pulp exposure, complete removal of red-fluorescing dentin is recommended. This aim is firstly to eliminate bacterially infected tissue and secondly to have the margins of the cavity in sound tissue which is important for the marginal seal of adhesive restorations or for anchorage of mechanically retentive restorations.

Figure 1



Composite is clearly visualized vs. healthy tooth

4.2 *Excavation of Dentin near the Pulp Chamber

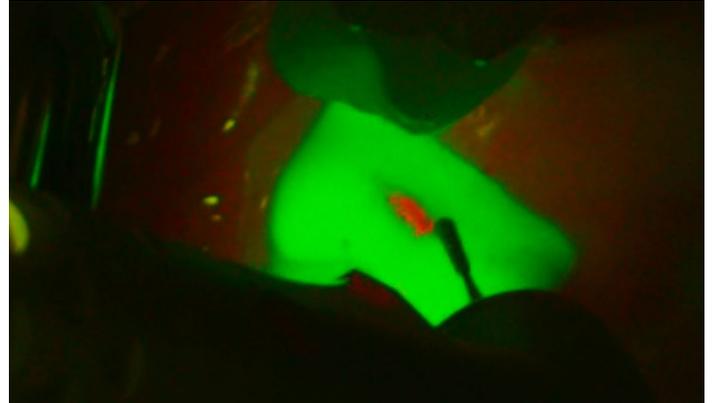
When excavating close to the pulp in a vital tooth, the aim should be to remove as much red fluorescing dentin (infected) as possible without inadvertently opening the pulp chamber. Allowing bacterially infected dentin close to the pulp to remain (i.e. selective caries removal) is recommended in cases where complete excavation of caries might cause a pulp exposure, loss of vitality and leading to a root canal treatment. Dentin areas close to the pulp should be covered with calcium hydroxide or hydraulic silicate cement before placement of the restoration.

4.3 *Green-fluorescing Soft Dentin

In some cases, dentin at the advancing front of a carious lesion may be softened but not red fluorescing (affected dentin). This happens when acids produced by bacteria in the dentin penetrate further along the dentinal tubules than bacteria. This dentin fluoresces green using fluorescence, indicating that it is not bacterially infected. This non-infected softened dentin needs to be removed if it is at the margin of the cavity to allow placement of the restoration in sound tissue. If it is adjacent to the pulp, it should be allowed to remain as described above.

Fluorescence provides the dental practitioner with a tool which can aid in the detection of residual caries and identify the presence of bacteria in dentin in vivo with accuracy similar to laboratory methods. This allows precise and efficient differentiation between infected and non-infected dentin, allowing maximum preservation of tissue.

Figure 2



Caries appear red with fluorescence

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72875 REV 10-25

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