Eye Safety in Dentistry

Because safety matters

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• N.B.: In the interest of transparency, the presenter hereby submits that he is a co-inventor of a patented product for eye protection.
Major Types and Sources of Dental Practice Eye Occupational Hazards

- Drilling at very high speeds (200,000 – 400,000 rpm) generates debris traveling at speeds of up to 50 mph.

- Debris includes:
  - Blood Borne Pathogens
  - Tooth Material
  - Calculus
  - Pumice
  - Broken Dental Burs
  - Pieces of Amalgam and Other Restorative Materials
Typical (Eye) and (Mouth and Nose) Protective Wear
Possible Entry Routes of Debris Towards Dental Practitioner’s Eyes

• Three Possible Routes Dental Debris May Take In Order To Reach The Dental Practitioner’s Eyes

  • Frontal Entry Route
    • By debris traveling perpendicular to the practitioner’s face. OSHA-Required protective eyewear provide the necessary protection against such debris. *(OSHA Standard 1910.133(a)(1))*

  • Sideways
    • By debris traveling tangential (right to left and left to right) to the practitioner’s face. OSHA-Required side shields provide effective protection against such debris. *(OSHA Standard 1910.133(a)(2))*

  • Bottom Gaps Entry Routes
    • Gaps formed between the bottom profile of the eyewear and the top edge of the worn mask.
    • General OSHA-Requirement Statement. *(appropriate eye or face protection). No dedicated standard.*
History and Background

- My personal story as a practitioner
- Information and feedback from colleagues
- Stories from students
- Observations
A Closer Look At the Bottom Gaps
I am a student at School of Dental Medicine. This past fall I was finishing cementation of a temporary crown for a patient. The patient was HIV positive. When I treated this patient I took all of the necessary precautions which include wearing a gown, gloves, face mask, and brand loupes with frames for eye protection. While cleaning the margins with a piece of floss some of the patient’s saliva splashed into my eye. The patient’s gingiva was bleeding and it was possible that some of his blood had splashed into my eye too. When this occurred my facemask and loupes were fully tightened. I was confused how this happened, so I examined how my loupes sat on my face and noticed a slight opening between my face and the frames just lateral to the ridge of my nose. I noticed there was a space not protected by my loupes or facemask which left my eye exposed at certain angles. Even though I followed all of the mandatory safety guidelines, my eyes were still susceptible to flying debris and an infectious disease. Immediately after the incident I went to the emergency room to wash my eye and was prescribed prophylaxis medication.

The incident was taxing on my school work, family life, and health. The time in the emergency room caused me to miss an exam. The faculty was incredibly supportive, allowed me to make up my exam, and was willing to help in every way. Also, the harsh reality of the risks of the dental field became very apparent to my wife, but she was able to cope and be supportive through the very stressful situation. The medications I took had dramatic side effects that made doing simple things feel more difficult. Fortunately, I was able to recover without any major problems. However, I believe the situation could have been avoided with proper eye protection. The current standard for eye wear is unacceptable and requires improvement for the safety of all dentists.
OSHA Regulates Safety in The Work Place
(Administrative Law)

- What Does OSHA Require for Eye Protection?
OSHA 1910.133 - Eye and face protection.

1910.133 Eye and face protection.

(a) General requirements.

(1) The employer shall ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

(2) The employer shall ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) meeting the pertinent requirements of this section are acceptable.

(3) The employer shall ensure that each affected employee who wears prescription lenses while engaged in operations that involve eye hazards wears eye protection that incorporates the prescription in its design, or wears eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

(4) Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer.

(5) The employer shall ensure that each affected employee uses equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation. The following is a listing of appropriate shade numbers for various operations.
Evidence Based Experimental Investigation (Spray Studies)

Subject Options:

- No Humans
- No Animals
- A Medium Size Los Alamos Head (Average Facial Biometrics)
Spray Study Test Apparatus
Spray Study Test Apparatus
Location, Angles, Distances, . . . Selected To Simulate Dental Practice Spatial Relations
Spray Study Methodology

- Spray medium
- Spray angles
- Spray distance
- Repeatability
1) Spray Study Experiments With Standard Mask and Safety Glasses
Standard Mask and Safety Glasses After Spray Study
Standard Safety Glasses Removed After Spray Study
After Spray Study, With Mask and Safety Glasses Removed
2) Spray Study Experiments with Full Face Shield & Mask Combination
Full Face Shield & Mask Combination After Spray Study
Full Face Shield & Mask Combination Removed After Spray Study (Effective Protection)
Liability Issues:

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Liability Analysis:

OSHA 1910.133 Eye and Face Protection.

a) (1) The **employer** shall ensure . . . appropriate eye or face protection . . .
(2) The **employer** shall ensure . . .
(3) The **employer** shall ensure . . .

The **Burden of Compliance** is placed on the **employer**.

**Compliance burden**, also called regulatory **burden**, is the administrative cost of a regulation in terms of dollars, time and complexity.

The **Duty of Care** is placed on the **employer**

**Duty of care** is a **legal** obligation which is imposed on an individual requiring adherence to a standard of reasonable **care** while performing any acts that could foreseeably harm others. It is the first element that must be established to proceed with an action in **negligence**.

Failure to provide **appropriate eye or face protection** would be regarded as **Breach of Duty of Care** by the **employer**

Thus, in a case of eye injury **caused** by inappropriate eye or face protection, the **employer** would likely be held liable.

**N.B.**: It’s the combination of protective equipment that should meet the OSHA regulation.
Combination of Mask and Protective Eyewear not in compliance with OSHA 1910.133.

Reason: The Combination would not prevent Reasonably foreseeable debris from reaching the practitioner’s eyes through the bottom gaps.
Legal Analysis of Employer’s Liability

OSHA Standard 1910.133(a) (1) states:

“The employer shall ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.” Emphasis added.

It places the burden of providing “appropriate” eye protection and hence the liability for failure to provide the “appropriate” eye protection on the employer. And, considering the fact that it is inherent and unavoidable in the process of wearing a non-full face shield dental mask and deforming its nose clip to fit over the wearer’s nose that bottom gaps are generated, it follows that OSHA Standard 1910.133(a) (1) is inevitably not met in dental medicine practice and that the currently used combination of protective eyewear and dental mask does not provide the “appropriate” eye protection required by OSHA. Also, the unavoidable generation of the bottom gaps renders the combination of regular protective eyewear and non-full face shield dental mask an unreasonably dangerous combination since it is reasonably expected that dental debris may reach the eyes of the dental practitioner through such bottom gaps. As such, a dental practice employer that fails to provide some “appropriate” means for closing the bottom gaps may be held negligent since, in the absence of a means for closing the bottom gaps, the dental practitioner is not effectively protected.
Conclusions:

These findings demonstrate clearly that there is a major inadequacy and breach of the present dental mask and eyewear combination for protecting the eyes of a dental care provider and that closing the bottom gaps is essential and should be mandated by OSHA when defining adequate personal protective equipment standards.

The evidence suggests updating OSHA Standard 1910.133(a)(1) to mandate effective eye protection for dental care practitioners by requiring the use of an effective means for closing the bottom gaps between the lower rims of the lenses of the protective eyewear and the upper edge of the mask worn by the practitioner.
Recommendations:

Based on the above experimental work and legal analysis, it is recommend that OSHA Standard 1910.133(a)(1) be amended to include specific language that addresses the safety of dental practitioners as follows;

“The employer shall ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation. For employees, engaging in performing dental procedures, the employer shall ensure that each affected employee uses eye protection that provides protection from flying particles that may enter through the gaps between the lower rims of the lenses of the protective eyewear and the upper edge of the mask worn by the employee. Full-face shields, full goggles, bottom gap-closing-skirts attached to the lower rims of the lenses of the protective eyewear and other commercially-available means for closing said gaps meeting the pertinent requirements of this section are acceptable.”
New Eye Safety Standard Needed

- Presentations have been made to U.S. Senate and Congress members along with OSHA
- American Dental Association Standards Committee
- Commission on Dental Accreditation
Suggested reading
Thank You