Let’s Talk About Infection Control & OSHA

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Disclosures:
Consultant, Hu-Friedy Manufacturing, Inc.
Consultant, SciCan, Inc.

WHY Continue To Be Concerned?
✓ 2007 ((NV): Hepatitis C transmission in med practice
associated with re-use of multi-dose anesthetic vials
✓ 2012 (Italy): 1st reported Legionella case from DUWL
✓ 2012: MERS-CoV outbreak in Middle East & spread
✓ 2013 (OK): OS office c multiple safety violations
  1st case dental pt-to-pt hepatitis C transmission
✓ 2013 CA: Antibiotic-resistant Enterobacteriaceae
✓ 2014: Ebola outbreak
✓ 2014 (CA): Measles outbreak in unvaccinated persons
✓ 2015 (NY): Legionnaires’ Disease in NYC & Flint
(187 total cases; 20 deaths)

Transmission of Bloodborne Pathogens in Dental Settings: CDC (2002-2014)

<table>
<thead>
<tr>
<th>Setting</th>
<th>Year</th>
<th>Pathogen</th>
<th>No. Infected</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMS Practice</td>
<td>2002</td>
<td>HBV</td>
<td>1</td>
<td>Pt-to-Pt</td>
</tr>
</tbody>
</table>
| Portable Dental  | 2009 | HBV      | 5            | Multiple procedural & infection control breaches
  Dental clinic in school gymnasium
| OMS Practice     | 2013 | HCV      | 1            | Pt-to-Pt                                    |
| Cleveland, OSAP  | (2015)|         |              | Multiple breaches in injection safety documented |

Infectious Disease Emergence Factors

Human demographics and behavior
International travel and commerce
Technology and industry
Human susceptibility to infection
War and famine
Lack of political will
Poverty and social inequality

Microbial adaptation and change
Antibiotic misuse
Microbiome changes

Ecological factors
Zoonotic diseases
Economic development & land use
Changing ecosystems
Climate & weather

Breakdown in public health measures
Vaccination decreases

Important Recent Infection Control Documents

Updated CDC Guidelines For Infection Control In Dentistry
(in progress)
2013 – 2015

Issues To Address
- Risk of Transmission:
  - Surgical smoke
  - Burs & endodontic files
  - MRSA, CJD, C. difficile
- Intervention:
  - Double gloves
  - Equipment:
    - Dental unit waterlines
    - Sterilization monitoring
Globally Harmonized System Phase-in Period

- Dec 1, 2013: Employers train employees - SDS sheets, labels
- June 1, 2015: Manufacturers & employers comply, but older packaging may be shipped
- June 1, 2016: Employers update labeling and HazCom program, training update
- Must comply with either 29 CFR 1910, GHS, or both during transition

Mtb Transmission in Dental Office (JADA 5/2014)

- RDH with pulmonary TB.
- Continued to work for several months in practice while infectious.
- Likely transmitted Mtb infection to another RDH in the practice.
- Practical implications: “All dental practices should implement administrative procedures for TB identification & control as described, even if none of their patients are known to have TB.”
- June 30, 2015: OSHA updates TB inspection procedures in HC settings
Does your office routinely evaluate the office infection-control program?

- Periodic assessments
- Review and document procedures (SOP)
- Review occupational exposures and prevention strategies
- Purpose:
  1. improve IC program effectiveness & dental practice protocols
  2. dental team understanding
  3. communicate IC practices to patients

Are Safe Injection Practices Used?

Single-dose vials:
- Preferable
- Discard leftover contents
- Never combine with medications for use on another patient

Multi-dose vial:
- Dedicate multi-dose vials to a single patient whenever possible
- Clean diaphragm c 70% alcohol
- Only insert sterile needle into vial
- Discard if sterility is compromised

The Chain of Transmission

How to Break the Chain

Critical Importance of Hand Hygiene

- 60-70% nosocomial infections related to improper hand washing & care
- MRSA, C. difficile, gram-negatives outbreaks
  patient-to-patient transmission from HCW hands
Multiple handwashing & asepsis guidelines since 1975
- Multiple handwashing guidelines since 1975
- New strategies & product types
- CDC 2002 guidelines – most recent & comprehensive
- CDC 2003 IC recommendations for dentistry
- Updated CDC dental IC guidelines 2015 – proposed date?

III. Hand Hygiene

A. General Considerations

1. Perform hand hygiene with either a non-microbial or antimicrobial soap and water when hands are visibly dirty or contaminated with blood or other potentially infectious material.
   If hands are not visibly soiled, an alcohol-based hand rub can also be used. Follow the manufacturer’s instructions.

2. For oral surgical procedures, perform surgical hand antisepsis before donning sterile surgeon’s gloves

**HAND HYGIENE**

Multiple Acceptable Choices
- Non-antimicrobial
- Antiseptic
- Alcohol-based

Are products available for hand hygiene manufactured for health care providers?

**Are HCP hands exhibiting skin irritation problems?**

Factors Associated with Dermatitis in Health Care Settings
- Frequent hand hygiene procedures
- Improper wash technique
- Insufficient hand hygiene procedures
- Incomplete rinsing of antiperspirants

Types of Microflora
- Resident flora – normal body flora
  - Located on skin & in deeper skin layers
  - Provide innate immune protection
  - If disrupted, re-establish at same site
- Transient flora – potentially pathogenic
  - Acquired by direct contact
  - Outer skin layers
  - More easily removed

Ability of Hand Hygiene Agents to Reduce Bacteria on Hands

<table>
<thead>
<tr>
<th>Time After Disinfection</th>
<th>Log % Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>99.9</td>
</tr>
<tr>
<td>60</td>
<td>99.0</td>
</tr>
<tr>
<td>180 minutes</td>
<td>99.9</td>
</tr>
</tbody>
</table>


Hand Hygiene Considerations
- Always wash and rinse when hands are visibly soiled or dirty
- Wash hands regularly and use warm water
- Do not wear jewelry, long nails, or artificial nails
- Maintain epithelial integrity with frequent hand hygiene procedures

Are products available for hand hygiene manufactured for health care providers?

**Improved:**
- Skin integrity after repeated use
- Compatibility with soaps, alcohol-based hand rubs, etc.

**Fewer:**
- Fewer scents
- Fewer allergenic components

**Also consider:**
- Consistency (i.e., “feel”)
- Acceptance by HCP
- Accessibility
- Dispenser systems
- Cost per use
Are appropriate hand lotions or gels available to prevent skin disorders?

- Normal, healthy skin
- Cracked, scaly skin

Are Standard Precautions followed for all patients?

- Integrate & expand universal precautions for BBP
- Apply to all HCP for all patients
- Precautions include, among others:
  - Hand hygiene
  - Vaccinations
  - Use of personal protective equipment (PPE)
  - Injury prevention
  - Cleaning and decontamination of instruments
  - Cleaning & disinfection of environmental surfaces
  - Waterline maintenance

Viral Hepatitis Overview

Hepatitis A
- ~150,000 new U.S. cases each year
- 10,000,000 new cases reported globally every year
- 100 annual U.S. deaths

Hepatitis B
- ~140,000 new U.S. cases each year
- 300,000,000 people in the world chronically infected
- 1,000 deaths a year in U.S. from HBV-related liver cancer

Hepatitis C
- ~35,000 new U.S. cases each year
- 3.2 million people in the United States chronically infected
- 9,000 deaths a year in U.S. from HCV-related liver disease

CDC (2015)

Current BBP Issues

- 364% increase

2. HIV outbreak in IV drug users in Southern Indiana (>170 cases):
- Almost all pts co-infected c HCV

HCV Prevalence (2013)

Prevalent genotypes worldwide: 1>2,3
Hepatology (2013)
Hepatitis C Virus (HCV) Epidemiology

- RNA virus (family Flaviviridae); discovered 1989
  - high genetic diversity ("quasi-species") in infected host
- HCV chronic infection occurs in 75% pts after acute infect.
  - major global cause of chronic liver disease
- Est. > 185 million infected persons
- Transmission: blood exposure most common
  - developed countries: IV drug abuse
  - developing countries: unsafe medical practices
  - sexual transmission infrequent
- Effective antiviral treatment breakthrough!
- No current vaccine candidates

Natural History of HCV Infection

In 20 years, 15-30% progress to cirrhosis
Progression accelerated by HIV, HBV, alcohol use, and fatty liver

Therapeutic Milestones for HCV

FDA Approval of HCV Treatments:
- 1991: Interferon (IFN)
- IFN & ribavirin
- Pegylated IFN
- Boceprevir & Telaprevir
- Sofosbuvir & Ledipasvir (HARVONI)
  - highly effective; 1 pill/day for 12 weeks
  - 96-99% pts cured (HCV not detected in blood after 3 months post–tx)

World Map of Prevalence of HIV Infection.
Diagnoses of HIV Infection among Adults and Adolescents, by Transmission Category, 2014—United States and 6 Dependent Areas

<table>
<thead>
<tr>
<th>Transmission Category</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male-to-male sexual contact</td>
<td>29,771</td>
<td>66.7</td>
</tr>
<tr>
<td>Injection drug use (IDU)</td>
<td>2,732</td>
<td>6.1</td>
</tr>
<tr>
<td>Male-to-male sexual contact and IDU</td>
<td>1,222</td>
<td>2.7</td>
</tr>
<tr>
<td>Heterosexual contact</td>
<td>10,781</td>
<td>24.2</td>
</tr>
<tr>
<td>Other</td>
<td>103</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>44,609</td>
<td>100</td>
</tr>
</tbody>
</table>


Potential Transmission Risks To HCWs

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Concentration (Conc) / ml</th>
<th>Transmission Rate (Post-Needlestick)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBV</td>
<td>1,000,000 - 100,000,000</td>
<td>6.0 - 30.0 %</td>
</tr>
<tr>
<td>HCV</td>
<td>10 - 1,000,000</td>
<td>2.7 - 60.0 %</td>
</tr>
<tr>
<td>HIV</td>
<td>10 - 1,000</td>
<td>0.3 % (Blood splash to eye, nose, mouth is 0.1%)</td>
</tr>
</tbody>
</table>
Occupational Exposures to Bloodborne Pathogens

- Percutaneous injury
- Mucous membrane exposure
- Non-intact (broken) skin exposure
- Bites

- CDC estimates ~385,000 sharps injuries annually among hospital-based healthcare personnel (>1,000 injuries/day)
- Increased risk for bloodborne virus transmission
- Costly to personnel and healthcare system

Healthcare Personnel with Documented and Possible Occupationally Acquired HIV Infection, by Occupation, 1988-2010

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Documented</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse</td>
<td>24</td>
<td>36</td>
</tr>
<tr>
<td>Laboratory worker, clinical</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Physician, nonsurgical</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Laboratory technician, nonclinical</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Housekeeper/maintenance worker</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Technician, surgical</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Embalmer/morgue technician</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Health aide/attendant</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Respiratory therapist</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Technicians, diabetics</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Dental worker, including dentist</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Emergency medical technician/paramedic</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>Physician, surgical</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Other technician/therapist</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Other healthcare occupation</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>143</td>
</tr>
</tbody>
</table>

* Also 0 occupational HIV cases in world

CDC Surveillance as of Dec. 2010  Updated May 23, 2011

Health Care Workers with Documented Occupationally - Acquired HIV/AIDS as of 12/2006 (Yr of Occupational Exposure / Injury)

Risk Factors:
- Deep injury
- Visible blood on device
- Needle placed in artery or vein
- Terminal illness in source patient

Characteristics of Percutaneous Injuries Among DHCP

- Declining frequency
- Improved awareness & precautions
- Most incidents: burs, other solid sharps, & NOT hollow-bore needles
- Most occur outside patient’s mouth
- Small amounts of blood
- Needles – 25, 26, 27, 30 gauge vs. larger medical needles

Does the practice have a post-exposure management plan?

- Clear written policies and procedures
- Education of dental health care personnel (DHCP)
- Rapid access to:
  - Clinical care
  - Referral mechanisms to qualified HCP
  - Post-exposure prophylaxis (PEP)
  - Testing of source patients/HCP
- Confidentiality!!!

Categories of Immunity:

- Natural Active: recovery from symptomatic or asymptomatic disease.
- Natural Passive: cross-placental transfer of Ab; colostrum.
- Artificial Active: vaccination with Ag.
- Artificial Passive: temporary protection from injection of exogenous Ab.

Vaccination: Science & Success

Protection Against Infection Accomplished by:

- Antimicrobials -- therapeutic or prophylactic
- Recovery from Disease
- Immunization -- prophylactic
Is Hepatitis B Vaccination offered & records kept?

Healthcare Personnel Vaccination Recommendations

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Recommendations in brief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B</td>
<td>Given 1 dose when immune &amp; HBV carriers known, HepB (Merck)</td>
</tr>
<tr>
<td>Influenza</td>
<td>Given 2 doses within 3 years (after 1st dose)</td>
</tr>
<tr>
<td>MMR</td>
<td>For healthcare personnel only (MC)</td>
</tr>
<tr>
<td>Tetanus, diphtheria, pertussis</td>
<td>Given at routine intervals (MC)</td>
</tr>
<tr>
<td>Multivalent</td>
<td>Given at routine intervals (MC)</td>
</tr>
</tbody>
</table>

Hepatitis B Vaccines: 2 Generations

- **Heptavax B (Merck)** -- 1982
  - Natural component vaccine from plasma of HBV carriers

- **Recombivax HB (Merck)** -- 1986/1987
  - *in vitro* recombinant DNA technology in yeast cultures

- **Engerix B (SmithKline)** -- 1986/1987
  - *in vitro* recombinant DNA technology in yeast cultures

HEPATITIS B VACCINATION SCHEDULE

HBsAg + Alum Adjuvant

Adolescents & Adults

IM injection
0, 1, 6 mos.

Anti - HBs
1. confers protective immunity
2. up to 90 - 95% respond

For People Who Do Not Respond to HBV Vaccination

Results of Additional Injections:

<table>
<thead>
<tr>
<th>Injection</th>
<th>% Responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>25%</td>
</tr>
<tr>
<td>5th</td>
<td>40%</td>
</tr>
<tr>
<td>6th</td>
<td>50%</td>
</tr>
</tbody>
</table>

IF recipient negative after 6 injections:
- ≠ genetic hepatitis B vaccine non-responder.
- ≠ active hepatitis B virus infection:
  - prodromal or icteric disease phase
- ≠ hepatitis B carrier (HBsAg +): vaccine ineffective

Interpretation of Hepatitis B Serologic Test Results

<table>
<thead>
<tr>
<th>HBsAg anti-HBc</th>
<th>negative</th>
<th>negative</th>
<th>Susceptible</th>
</tr>
</thead>
<tbody>
<tr>
<td>anti-HBs</td>
<td>negative</td>
<td>negative</td>
<td>Immune due to natural infection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HBsAg anti-HBc</th>
<th>negative</th>
<th>positive</th>
<th>Immune due to hepatitis B vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>anti-HBs</td>
<td>positive</td>
<td>negative</td>
<td>Acutely infected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HBsAg anti-HBc</th>
<th>negative</th>
<th>positive</th>
<th>Chronically infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgM anti-HBc</td>
<td>positive</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td>anti-HBs</td>
<td>positive</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td>HBsAg anti-HBc</td>
<td>negative</td>
<td>positive</td>
<td>Interpretation unclear; four possibilities:</td>
</tr>
<tr>
<td>anti-HBs</td>
<td>negative</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Are Booster Doses Needed?

- **NO -- not routinely recommended at this time**
- recent data: protective immunological memory at least 30 years; ongoing long-term studies
- while vaccine-induced anti-HBs titer might decline over time, immunological memory remains intact
- thus, people with declining anti-HBs titers still protected against infection & chronic disease

booster recommendations -- certain circumstances:
1. hemodialysis patients: annual assessment for need; booster dose given when anti-HBs titer <10mIU/ml
2. other immune compromised persons: need for boosters not determined; <10mIU/ml consider

CDC/APIC/JAM (2013)
Influenza Virus Transmission
- Viral replication: antigenic “drift” & “shift”
- Person-to-person: respiratory droplets
- Direct contact with person-contaminated object before washing hands.
- Incubation period 2 days (range 1-4 days)
- Adults infectious 1 day before symptoms thru 5 days after onset of illness (children up to 10 days).
- Abrupt symptoms: fever, myalgia, sore throat, malaise, nonproductive cough, headache
- HCW at high risk
- Confused with “bad cold?”
- cross-rx Ab’s between strains

Ongoing Influenza Virus Mutations

Antigenic Drift
- Small “point” mutation changes
- Creates new variants
- May be immune to previous strains
- New strain: no prior immunity
- Causes epidemic

Antigenic Shift
- Re-assortment of strains
- Completely new antigens
- Everyone susceptible
- Will spread uncontrollably
- Causes pandemic

Influenza Vaccines
All of the 2014-2015 influenza vaccine protected against:
- an A/California/7/2009 (H1N1)pdm09-like virus
- an A/Texas/50/2012 (H3N2)-like virus
- a B/Massachusetts/2/2012-like virus.
- Some of the 2014-2015 flu vaccine also protects against an additional B virus (B/Brasil/60/2008-like virus). CDC (9/2014)

2015-2016 influenza vaccine made to protect against:
- A/California/7/2009 (H1N1)pdm09-like virus
- A/Switzerland/9715293/2013 (H3N2)-like virus
- B/Phuket/3073/2013-like virus. (This is a B/Yamagata lineage virus)

Some of the 2015-2016 flu vaccine is a quadrivalent vaccine & also protects against B/Brasil/60/2008-like virus. CDC (8/2015)

Available Influenza Vaccines (2014-15)

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Manufacturer</th>
<th>Age Range</th>
<th># of Strains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afluria</td>
<td>Merck/CSL</td>
<td>9 years and older*</td>
<td>Trivalent</td>
</tr>
<tr>
<td>Flurix</td>
<td>GSK</td>
<td>3 years and older</td>
<td>Trivalent</td>
</tr>
<tr>
<td>Fluval</td>
<td>Novartis</td>
<td>18 – 49 years</td>
<td>Trivalent</td>
</tr>
<tr>
<td>Fluad</td>
<td>GSK</td>
<td>3 years and older</td>
<td>Trivalent</td>
</tr>
<tr>
<td>Fluad 3</td>
<td>Novartis</td>
<td>6 months and older</td>
<td>Quadrivalent</td>
</tr>
<tr>
<td>Flumist</td>
<td>Medimmune</td>
<td>2 – 49 years</td>
<td>Quadrivalent</td>
</tr>
<tr>
<td>Fluemix</td>
<td>Sanofi Pasteur</td>
<td>4 years and older</td>
<td>Trivalent</td>
</tr>
<tr>
<td>Fluzone</td>
<td>Sanofi Pasteur</td>
<td>65 years and older</td>
<td>Trivalent</td>
</tr>
<tr>
<td>Fluzone High-Dose</td>
<td>Sanofi Pasteur</td>
<td>18 – 64 years</td>
<td>Trivalent</td>
</tr>
</tbody>
</table>

IIV: Inactivated Influenza Vaccine  (Afluria, Flurix, Fluvirin, Fluad)
IIV3 = Trivalent IIV;  IIV4 = Quadrivalent IIV
LAIV (Quadrivalent): Live, Attenuated Influenza Vaccine (Flumist)
RIV3: Recombinant Influenza Vaccine, Trivalent (Flumist)
ccIIV3: Cell Culture Inactivated Influenza Vaccine, Trivalent (Flucelvax)

Influenza Vaccine
Preparations are strain specific—use of current year strain for vaccine (due to viral “antigenic drift”)
- High-dose vaccine for elderly
- Recent vaccine advance for people c egg allergy (Flublok)
- Goal: reduce influenza complications and mortality
- ~70-90% recipients develop protective Ab’s
- Prevents death in 80% vaccinated, compromised pts
- Contraindications:
  - Pregnancy (1st trimester)
  - Allergy to eggs (?) or thimerosol (only in multi-dose vials)
Note: Do not get flu from vaccine!!

Personal Protective Equipment
- A major component of Standard Precautions
- Protects skin & mucous membranes from exposure to infectious materials in spray or spatter
- Proven effectiveness against microbial pathogens
- Should be removed when leaving treatment areas
Are Appropriate Gloves Available?

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>- latex, vinyl, nitrile, chloroprene</td>
</tr>
<tr>
<td>Skin sensitivity</td>
<td>- allergies to latex or nitrile - hand perspiration</td>
</tr>
<tr>
<td>Size</td>
<td>- proper size, lightweight &amp; pliable - snug fit without hand constriction</td>
</tr>
<tr>
<td>Tactile sensation</td>
<td>- appropriate finger length - fits palm without compression</td>
</tr>
<tr>
<td>Function</td>
<td>- ambidextrous vs. right- &amp; left-fitted</td>
</tr>
<tr>
<td></td>
<td>- grip</td>
</tr>
<tr>
<td></td>
<td>- glove thickness</td>
</tr>
<tr>
<td></td>
<td>- slipperiness of material when wet</td>
</tr>
<tr>
<td>Molinari &amp; Nelson, TDA (2/2015)</td>
<td></td>
</tr>
</tbody>
</table>

Are Hands Hurting When Wearing Gloves?

- Repetitive hand movements
- Awkward wrist positions
- Mechanical stresses to digital nerves (i.e. sustained grasping on instrument handles)
- Forceful treatment procedures in confined, small space
- Extended vibratory instrument use (i.e. handpieces, ultrasonic scalers)

Are Gloves Infallible?

- Cardiovascular surgeon with inflammation on hands transmitted *Staphylococcus epidermidis* infection to 5 pts
- Hospl surgeries involved heart valve replacements
- Long procedures same pair gloves – “microscopic tears” allowed bacteria to pass into pts
  - valve surgery requires use of thick sutures and >100 knots tied -- can cause extra stress on the gloves
- Same *S. epidermidis* strains traced to surgeon’s hands (12/2012)

Protective Eyewear

- Meets/exceeds ANSI standards
- High impact resistance
- Side shields
- Sufficient size to cover and protect eyes
- Desirable: no fogging, scratch resistant, anti-static
- Face shields effective – must still use mask
- Disposable eyewear available

Representative Occupational Respiratory Infections

- “Classic” Respiratory Risks
  - Tuberculosis
  - Influenza
  - Bacterial Pneumonia
  - Pertussis
  - Common Cold

- New “Emerging” Diseases
  - MERS-CoV
  - A(H7N9) Influenza
  - Legionellosis
  - EV-D68

- Future Threats
  - SARS
  - A(H5N1) Bird Flu
Masks: What to Wear & When

Molinari & Nelson. TDA (2014)


N – 95 Respirators

- NIOSH – approved disposable respirator mask (PRM)
- Type of particulate respirator mask (PRM)
- For: HCW working in close contact c pts with A/H1N1 influenza or influenza-like illness
- More efficient than masks used for routine pt treatment
- Work best when fitted properly - employers to ensure
- Note: more efficient the PRM, the more difficult breathing through them ---- greater perceived discomfort

Are effective masks worn for laser/electro surgery to protect against plumes & surgical smoke

☐ Tissue destruction creates smoke - may contain harmful by-products
☐ Carcinogens, mutagens, other irritants found in laser plumes
☐ Infectious materials (HSV, HPV, bacteria) may contact nasal mucous membranes
☐ No evidence of HIV/HBV/HCV transmission
☐ Suitable eye & respiratory protection required
☐ Mask Level ?
☐ Further studies needed for occupational dental risks

Do clinic personnel change masks between patients?

- Fluid resistance (for specific tasks)
- 20 min. approximate use-life (“wicking”)
- Bacterial filtration efficiency (BFE%)
- Particulate filtration efficiency (PFE%)
- Differential Pressure (P-Delta—breathability)
- Flammability
- Latex - & fog – free
- Remember: masks wetted from both sides

Laser Plume Content

<table>
<thead>
<tr>
<th>Potential Health &amp; Safety Hazard</th>
<th>Controls</th>
</tr>
</thead>
</table>
| Dust                            | Lung damage | - Appropriate masks  
|                                 |          | - Plume scavenging systems (PSS) |
| Toxic chemicals*               | Fire     | - Respiratory protection suitable for plume composition  
|                                 | - Irritation | - Plume scavenging systems (PSS) |
|                                 | - Carcinogenic, mutagenic & teratogenic potential | |
| Biological Agents               | Infection | - Respiratory protection suitable for plume composition  
|                                 |          | - Protective clothing & gloves  
|                                 |          | - Plume scavenging systems (PSS) |
| Smoke (general)                 | Respiratory damage | - Scavenging of smoke near the source  
|                                 | - Eye damage | - Suitable eye & respiratory protection |
|                                 | - Irritation | |
|                                 | - Obstruction of workers’ field of vision | |

AVAILABLE STERILIZATION METHODS

- Steam under pressure
- Prolonged dry heat
- Rapid heat transfer
- Unsaturated chemical vapor
- Ethylene oxide
- Chemical (cold) sterilization

Heat – stable items

Heat – labile items
**Liquid Chemical Sterilization**

**Advantages**
- Can sterilize items that would be damaged by heat
- Relatively inexpensive compared to heat sterilization

**Disadvantages**
- Less reliable than heat methods
- Very time-consuming & limited use-life
- Expensive
- Cannot be spore tested
- Fumes may require ventilation
- Potential for allergic reactions
- PPE required during use
- Cannot package items
- Sterilized items must be rinsed off with STERILE water
- Inst corrosion or rusting
- Possible glut. alternatives

---

**Gravity Steam Sterilizers**

- 10 to 25 minutes exposure time at 132° – 135°C (270°F to 275°F)
- 15 to 30 minutes exposure time at 121° – 123°C (250°F to 254°F)
- Drying times vary according to load configuration, materials, contents

---

**Pre- & Post-vacuum Steam Sterilizers**

- 3 to 4 min at 132 – 135°C (270 – 275°F)
- Evacuate chamber to enhance steam penetration
- More effective sterilization of handpieces & wrapped items
- Post-vacuum cycle
  - Evacuate chamber to enhance drying
  - Decreased corrosion of high-carbon steel

---

**Monitoring Indicators & Integrators**

- Class I (Process Indicator)
- Class II (Bacterial Indicator)
- Class III (Temperature Indicator)
- Class IV (Multi-Parameter Indicator)
- Class V (Integrating Indicator)

---

**Are chemical indicators and BIs used & correctly interpreted?**

- Yes! heat sterilization accomplished
- No! failed cycle
Is sterilization equipment properly monitored and records maintained?

- CDC recommends weekly biological monitoring
  - In case of a positive spore test:
    - Remove the sterilizer from service
    - Do not use the sterilizer until inspected and working properly

CDC recommends weekly biological monitoring
- In case of a positive spore test
  - Remove the sterilizer from service
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Sterilization Process Problems

<table>
<thead>
<tr>
<th>Error</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper instrument cleaning and potentially compromise the sterilization process</td>
<td>Biological and other debris can shield adherent microbes and potentially compromise the sterilization process</td>
</tr>
<tr>
<td>Improper packaging</td>
<td>Examples: wrong type material for method, too many items in package, excessive amounts of wrap material</td>
</tr>
<tr>
<td>Overloaded sterilizer</td>
<td>Can prevent thorough contact of sterilizing agent with all items in unit</td>
</tr>
<tr>
<td>Inadequate Maintenance</td>
<td>Critical area; example issues include worn gaskets and seals</td>
</tr>
<tr>
<td>Improper sterilization equipment</td>
<td>Use of non-FDA approved equipment</td>
</tr>
</tbody>
</table>

Person in Charge !!

Single-Use Disposable Devices

- Introduced in 1960’s -- convenient & easy to use
- Designed for use on 1 patient & then discarded
- Not intended to be cleaned & sterilized for reuse on another patient
- Not heat tolerant & cannot be reliably cleaned
- More recyclables and biodegradables available
- FDA now requiring manufacturers to document reprocessing reusable items – no reuse for single use devices!

Spaulding Classification

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>Penetrate soft tissue, contact bone, enter into or contact the bloodstream or other normally sterile tissue.</td>
</tr>
<tr>
<td>Semicritical</td>
<td>Contaminate membranes or maintain risk, but will not penetrate soft tissue, contact bone, enter into or contact the bloodstream or other normally sterile tissue.</td>
</tr>
<tr>
<td>Noncritical</td>
<td>Contact with intact skin.</td>
</tr>
</tbody>
</table>

Viable bacteria cultured from the lumens of 4/40 (10%) metal tips used 100x’s

- Heat - sterilized between uses.
- Particulate material also visually observed after sterile TSB aseptically forced thru 5/40 (12.5%) AWS tip lumens

Conclusion: unable to clean lumens – provides support for routine use of disposable AWS tips.

Harte & Molinari

Reusables versus Disposable Air/Water Syringe Tips

Table 11-1 Categories of Patient-Care Items

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Examples in Dentistry</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>Penetrate soft tissue, contact bone, enter into or contact the bloodstream or other normally sterile tissue.</td>
<td>Surgical instruments, periodontal scalers, scalpels, surgical instruments.</td>
<td>High priority risk of transmissible infections—clean and heat sterilize.</td>
</tr>
<tr>
<td>Semicritical</td>
<td>Contaminate membranes or maintain risk, but will not penetrate soft tissue, contact bone, enter into or contact the bloodstream or other normally sterile tissue.</td>
<td>Dental mouth mirror, periapical X-ray film, reusable dental impression trays, dental handpieces.</td>
<td>Lower priority risk of transmissible infections—clean and heat sterilize. If a semicritical item is heat-sensitive, it should, at a minimum, be processed with high-level disinfectant.</td>
</tr>
<tr>
<td>Noncritical</td>
<td>Contact with intact skin.</td>
<td>Radiographic head/face, blood pressure cuff, toothache, child exanthema.</td>
<td>Prioritize risk of transmission of infection—clean and disinfect or use disposable barrier protection.</td>
</tr>
</tbody>
</table>

Critical Items -- penetrate tissue or bone
Semicritical Items -- touch mucous membranes
Noncritical Items -- touch intact skin
Cleaning Instruments: Options

“Cleaning is the first step in every decontamination process” (CDC)

- Ultrasonics
- Mechanical (Hand Scrubbing)
- Inst Washer / Disinfectors

Holding Solutions or Foam Sprays (optional step)

- Goal: avoid drying of debris prior to cleaning & sterilization
  - loosen debris
  - helps to decrease contaminant MO’s
  - minimize instrument handling
  - soap & water -- ultrasonic cleaning soln
  - foam sprays c enzymes available
  - NEVER, EVER use glutaraldehydes!

If hand scrubbing is performed, is long handled brush utilized and utility gloves worn?

✓ Not as efficient as ultrasonic cleaners
✓ Dangerous – increased potential for sharps exposure when scrubbing instruments
✓ Wear utility gloves & other PPE
✓ Use of cassettes – manual cleaning not necessary

Ultrasonic Cleaners

- Wear PPE – Utility gloves, mask, glasses, gown
- Sound waves cause bubbles to implode, loosening debris
- Use only correct solution, change daily
- Never overload
- Rinse instruments after cycle
- Dry before placing in pouches / wraps
- Keep lid on during use
- Periodic foil test for unit efficacy

When ultrasonic is utilized, are enzymatic solutions used, & is testing performed?

Automated Instrument Cleaning

- effective
- efficiency
- ↓ exposure to blood & body fluids
- ↓ exposure to sharps

Instrument washers NOT dish washers!
Advantages of Cassettes
- Safe transport
- Safe instrument cleaning
- Ease of instrument set-up
- Cannot overload sterilizer
- Ease of storage
- And….

Evolution of Instrument Cassettes

Is the sterilizer loaded such that sterilant may reach all surfaces of the package?
- Paper Side Up?
- Paper Side Down?

Sterilized Wrapped Instruments
Keeping Instruments Wrapped Until Patient Treatment
The Pay-off: Patients Note Sterile Packages (Perception & Reality)

Are wrapped instrument packages inspected to insure they are intact?
Event- vs. Date-related sterilization:
- Date & maintain as sterile until use
- Stored in clean, dry location in manner to prevent contamination during storage
- Inspect packages for integrity & dryness before opening
- If compromised, clean, package, re-sterilize
If instruments are sterilized unwrapped, are they handled aseptically and used immediately?

- **Immediate use (i.e. flash) sterilization**
- Use chemical indicator in each cycle
- Allow to dry & cool in sterilizer before handling
- Handle aseptically during removal
- Use instruments ASAP
- Do not sterilize implantable devices unwrapped.

Are handpieces cleaned, lubricated, and sterilized between patients?

1. Flush air/water lines 20-30 sec. (bur in place)
2. Clean and dry handpiece
3. Lubricate
4. Expel excess lubricants (prevents “gumming”)
5. Clean fiber optics
6. Package and heat sterilize

Environmental Surface Asepsis: Role of Hospital Surfaces in HAI

- Surface contamination plays important role in MO transmission
- Well-established for MRSA & VRE
- New evidence for noroviruses, *C. difficile*, & *Acinetobacter*
- Extent of pt-to-pt transmission proportional to level of environmental contamination


Microbial Persistence on Dry Inanimate Surfaces

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Duration of Persistence</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em>, incl. MRSA</td>
<td>7 days – 7 mos.</td>
</tr>
<tr>
<td><em>Mycobacterium tuberculosis</em></td>
<td>2 days – 4 mos.</td>
</tr>
<tr>
<td><em>Bordetella pertussis</em></td>
<td>3 – 5 days</td>
</tr>
<tr>
<td><em>Enterococcus sp.</em> (incl. VRE)</td>
<td>5 days – 4 mos.</td>
</tr>
<tr>
<td><em>Clostridium difficile</em> spores</td>
<td>up to 2 yrs.</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>1.5 hrs. – 16 months</td>
</tr>
<tr>
<td><em>Influenza viruses</em></td>
<td>1 – 2 days</td>
</tr>
<tr>
<td><em>Rhinoviruses</em></td>
<td>2 hrs – 7 days</td>
</tr>
<tr>
<td><em>Herpes simplex viruses</em> (HSV)</td>
<td>4 hrs. – 8 wks.</td>
</tr>
<tr>
<td><em>Hepatitis B Virus</em> (HBV)</td>
<td>&gt; 1 wk. (in blood)</td>
</tr>
<tr>
<td><em>Hepatitis C Virus</em> (HCV)</td>
<td>16 hrs. – 6 wks. (in blood)</td>
</tr>
<tr>
<td><em>Hepatitis A Virus</em> (HAV)</td>
<td>2 hrs. – 2 mos.</td>
</tr>
<tr>
<td>Human Immunodeficiency Virus (HIV)</td>
<td>few min. – 7 days**</td>
</tr>
</tbody>
</table>

Environmental Stability of HBV & HCV

- HBV can survive in dried blood on environmental surfaces for at least 1 week.
- HCV infective on dry surfaces for up to 6 weeks.
- HBV & HCV transmission via contact with environmental surfaces demonstrated in investigations of outbreaks among patients & staff of hemodialysis units.

Categories of Patient Items

- Critical
- Semi-Critical
- Noncritical

Categories of Environmental Surfaces

- Clinic Contact Surfaces: (light handles, switches, tray) may be touched frequently with gloved hand during pt care, or may become contaminated with blood / OPIM
- Housekeeping Surfaces: (floors, walls, sinks) do not come into contact with devices used in dental procedures; cleaned on regular basis

Are Clinical Contact Surfaces Covered or Cleaned & Disinfected Between Patients?

- Cleaning
- Sanitization
- Disinfection
- Sterilization

Surface Covers:

Advantages
1. Prevents contamination
2. Protects difficult-to-clean surfaces
3. Less time consuming
4. Reduces chemical use
5. More eco-friendly choices

Disadvantages
1. Need varied sizes / types
2. Non-biogradable plastics
3. Esthetically undesirable?
4. Additional costs over chemical sprays?

Are surface barriers changed between patients?

Properties of an IDEAL Surface Disinfectant

- broad antimicrobial spectrum
- rapid, lethal action on all vegetative forms
- not affected by physical factors (i.e. active in presence of organic matter)
- non-toxic; non-allergenic; easy to use
- surface compatibility: should not compromise integrity of equipment & metallic surfaces
- residual effect on treated surfaces (reactivation of agent when moistened)
- odorless
- eco-friendly (does not add “damaging” chemicals to environment)

Environmental Surface Asepsis

- cleaning
- disinfection
- clinical contact surfaces
- housekeeping surfaces
- high-level disinfectant
- intermediate-level disinfectant
- low-level disinfectant
- tuberculocidal
- Do Not Make Your Own Wipes From Disinfectants Approved As Sprays Only!
Potential Surface Disinfectant Problems
1. Surface stains after switching surface disinfectants
   - most common going from sprays to wipes
   - accumulated disinfectant chemical rxs
   - clean surfaces before new disinfectant use

2. Unpleasant odor when using surface disinfectant
   - sulphur in gloves reacting c chemical
   - not present in most gloves; sulphur can be removed

Recent Re-emergence of Legionella & Water Quality Concerns
Ohio Outbreak Traced to Cooling Tower
Legionnaires’ Disease in VA Hospital: Source was Shower Heads
Legionnaires’ Disease: Deaths Rise to 10 in NYC
87 cases, 10 fatal, of Legionella bacteria found in Flint area; connection to water crisis unclear

Dental Unit Waterline Concerns

OSHA & Waterlines
- No current OSHA rules on occupational exposure to water in dental office ---- HOWEVER

- Compliance officers to include dental exposures in investigation of Legionella outbreaks

General Duty Clause

Does the dental unit water meet EPA regulatory standards for drinking water?

Use water that meets regulatory standards for drinking water (< 500 CFU/ml of heterotrophic water bacteria) for routine dental treatment output water.

Dental Unit Waterline (DUWL) Asepsis
- Sanitized, Potable, Drinking Water (PH Standards): 500 CFU/ml of heterotrophic bacteria
- Most untreated dental unit water samples: 1,000 to 10,000 CFU
  (some DUWL > 1,000,000 CFU documented)
- CDC Recommendation (2003):
  Use water that meets regulatory standards for drinking water (fewer than 500 CFU/ml of heterotrophic water bacteria) for routine dental treatment output water.
DUWL Biofilm Formation

Representative Isolated DUWL Microbes

- Waterborne infections & disease in hospital / public health settings
- Many involve medical devices (nebulizers, endoscopes)
- Most DUWL MO’s from public water supply, & do not pose high risk for healthy persons (i.e. opportunistic pathogens)
- Increasing # of immune compromised dental pts – common waterborne MO’s involved as increased infection / illness risks

Recent DUWL Developments

- No current definable public health problem
- Waterborne infection is a major public health concern
- Unacceptable to use highly colonized water for any kind of dental treatment

1st Reported Case of Legionella From DUWL

- Lancet (February 18, 2012)
- 82 yr. old woman died from Legionnaires disease
- During Legionella incubation period, only left house for 2 dental visits
- No underlying disease or other obvious Legionella risks
- L. pneumophila serogroup 1 isolated from bronchial aspirate & DUWL
- Dental office tests: 4x10^3 CFU/mL from DUWL; 6.2x10^4 CFU/mL from high speed handpiece turbine
- “Benidorm” L. pneumophila subgroup isolated from aspirate & DUWL:
  - Same rare sequence type (ST 593) found in both one of most virulent L. pneumophila subgroups
- No other Legionnaires’ Disease or Pontiac Fever cases found among dental staff or practice pts identified by epidemiological investigation

Thank You
Any Questions?

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