Infection Control in Optometric Practice

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1) Why we need to implement infection control in Optometry
   a) Changes in health care
      i) Disease entities
      ii) AIDS, Hepatitis B & C, Herpes simplex
      iii) Adenovirus
      iv) Amoeba
         (1) In 2003, the agency (EPA) decided not to measure or regulate Acanthamoebas in public water supplies. Although the amoebas were listed as a candidate for regulation, the EPA decided against regulating or monitoring them. In its decision, the EPA said that amoeba infections were a personal-hygiene matter and that contact-lens users shouldn't use tap water to clean their lenses or shower while wearing contact lenses
         (2) Govinda Visvesvara, a scientist at the federal Centers for Disease Control and Prevention, criticized the EPA's decision not to monitor amoebas in the water supply. "I don't know why the EPA didn't want to put that in," said Mr. Visvesvara, who studies the amoeba and helped investigate the recent outbreak.
   b) Changes in national standards
      i) Dentistry; $23,713 = average per office cost to meet national standards:
   c) Changes in legal climate- "a litigious society", OSHA regulations
   d) Changes in Optometry- held to the same standards as ophthalmology
      i) Therapeutic states = 50 but we have are still undiscovered by OSHA, others
      ii) In-office procedures
      iii) Widespread use of instruments, spuds, Alger brush, forceps,
2) Microbiology 101 revisited; know your enemies-
   a) Microorganisms- free living, capable of respiration & reproduction
   b) Procaryote- bacteria, blue-green algae
      i) No cell nucleus
      ii) No cell organelles
      iii) Single DNA strand for genetic information
   c) Eucaryotes- fungi, algae, protozoa, amoeba
      i) True cell nucleus
      ii) True cell organelles
      iii) True chromosomes
   d) Bacteria - most common form of contaminant
      i) Shape- important for classification
         (1) Cocci- round, less affected by drying
            (a) diplo- pairs
            (b) strepto- chains
            (c) staphylo- clusters
         (2) Bacillus- rods; longer, increased surface area
         (3) Spiral-allows improved motility
         (4) Helix- elongated spirals
      ii) Reproduction- binary fission (division)

(1) In one day, a single bacteria can replicate into 1 billion offspring

iii) Structure-
(1) Size- variable
(2) Flagella- motility (not universal)
(3) Capsule- (glycocalyx) slime coat for protection
(4) Cell Wall- lacking in animal cells, rigid, provides shape,
(a) Accounts for staining characteristics, ie, Wright, Gram, Giemsa
(b) Protein- primary component
(c) Lipid- secondary component
(5) Cytoplasm- chromatin material, lipids for energy, ribosomes for protein synthesis

iv) Toxins & Enzymes- promote spread of pathogen within the organism & retard growth of other, competing organisms
(1) Exotoxins- discourages growth of other organisms to grow in same area
(2) Collagenase- breaks down collagen (supports cells)
(3) Hyaluronidase- breaks down hyaluronic acid (bonds cells)

v) Endospore formation- limited to a few species
(1) Bacteria transform from vegetative form to spore form
(2) Occurs under highly hostile environment, hostile conditions
(3) Spores smaller, more resistant to heat, chemicals
(4) Can germinate to vegetative form when conditions improve
(5) Examples:
(a) Clostridial species- cause tetanus, gangrene, botulism
(b) Bacillus species- anthrax, corneal ulcers

e) Viruses- Are they living? Incapable of respiration and independent reproduction
i) Intracellular obligate parasites
ii) Genetic elements (not cells) that contain DNA or RNA.
iii) Structure- varies greatly between species, but basically composed of:
(1) A core of genetic material (RNA or DNA)
(2) A covering (capsid) or protein coat overlying the core

iv) Replication
(1) Viruses are incapable of independent reproduction
(2) Virions (viruses outside the host cell) carry information from host cell
(3) The virion attaches to another cell, injects DNA or RNA into the cell cytoplasm and replication of new virus particles is initiated.
(4) Virus particles from the infected cell are released to continue the process
(5) Host cells are damaged and eventually destroyed by the process
(6) Viral viability outside the cell varies greatly
(a) Some viruses are fragile and die quickly outside the cell (HIV)
(b) Some viruses can exist from hours to weeks outside the cell (EKC)

v) Viruses important to eye care
(1) Herpes simplex (I & II)
(2) Adenoviruses
(3) Varicella zoster
(4) Hepatitis B & C
(5) Papova viruses (molluscum)
(6) Enterovirus 70 (hemorrhagic conjunctivitis)

vi) Special considerations
(1) HIV found in tears
(2) Risk of acquiring AIDS via tears is very low

(3) Universal precautions required with all AIDS patients: gloving, masking, scrubs

f) Chlamydia
   i) Small, bacteria-like organisms
   ii) Intracellular, obligate parasites (like viruses)
   iii) Independent actions & function i.e. reproduction, movement (like bacteria)
   iv) Respond well to antibiotics
   v) Disease entities-
      (1) Adult inclusion conjunctivitis (follicular conjunctivitis)
      (2) Trachoma- most common sexually transmitted disease, can cause blindness
   vi) Treatment must systemic (topical of limited value)
      (1) Tetracycline, Minocin or Doxycycline PO,
      (2) Azithromycin 1000 mg single dose
      (3) Treat all sexual partners

3) Infection Control - a systematic means of preventing <u>clinic-based</u> infection
   a) General principles- "Do no harm"
      i) Protect the patient, doctor, and staff from contaminated instruments, contact lenses, solutions, and surfaces.
      ii) Prevent the inadvertent spread of disease by instituting a system to avoid cross-contamination.
      iii) Terminology
         (1) Sterilization- all forms of life including spores, cysts and viruses are destroyed.
         (2) Disinfection- all vegetative forms of life and viruses are destroyed.
         (3) Antiseptic- chemical germicide for use on skin; not for inanimate objects.
         (4) Cidal- indicates destroys a specific life form i.e.virucidal, sporicidal
   b) Spaulding classification- based on type of tissue into which object will enter.
      i) Critical- enters sterile tissue, vascular tissue (corneal spuds, burrs, spatulas)
      ii) Semicritical- touches mucous membranes (forceps, lacrimal dilators, canulas, tonometer probes)
      iii) Noncritical- touches skin (forceps, stethoscopes, occluders)
4) Basic infection control procedures
   a) Hand washing- "the single most important procedure for preventing nosocomial infections"
      i) Vigorous rubbing of all surfaces of lathered hands “Happy Birthday Song”
      ii) Rinse under a continuous stream of water
      iii) Avoid bar soaps (*Pseudomonas* is routinely cultured from bar soaps)
      iv) Use a liquid soap, preferably bacteriostatic (Sporicidin)
      v) Use paper towels; not cloth towels
   b) Gloving- not necessary for "healthy" patients
      i) Non-sterile gloves acceptable for most applications
      ii) Sterile gloves when doing invasive procedures
      iii) Keep gloves in all patient contact areas
      iv) Get proper size- tight gloves are uncomfortable and tend to tear easily
      v) Always wash hands after de-gloving
   c) Surface disinfection
      i) <u>Always</u> after patients with suspected pathology are evaluated
      ii) <u>Always</u> at the end of the day
      iii) Disinfectant media include
         (1) Isopropyl alcohol 60%
         (2) Hypochlorite (bleach) diluted to 1/1000 concentration

(3) Disinfectant sprays available (odor less offensive?)

d) Tonometer disinfection
   i) After every patient
   ii) Isopropyl alcohol acceptable but degrades tonometer probe
   iii) Hydrogen peroxide ideal but must soak for 10 mins & rinse w/ saline
   iv) Homemade soaking unit can be fabricated from enzyme vial
   v) Commercially available units relatively inexpensive
   vi) Vigorous rubbing with tissue & povidone iodide
   vii) CL solutions as a means of tonometer disinfection?????
   viii) PASCAL tonometer
e) Instrument cleaning, sterilization, and disinfection
   i) Cleaning- bacteria survive better, longer in protein or blood, not bare surfaces
      (1) Removal of protein, blood a vital step in infection control
   ii) Presoak in 3% H_2O_2 for minimum of 10 minutes
   iii) Ultrasound helps loosen contaminants
   iv) Hand scrub with heavy, waterproof gloves (not surgical gloves) to avoid puncture wounds.
   v) Rinse with sterile saline

5) Disinfection vs. Sterilization- management considerations
   a) Long term effects of chemical disinfectants & sterilants on stainless steel
      i) Corrosion
      ii) Dulling of sharp edges
   b) Storage of instruments- sealed, "clear window" pouches best
      i) Shelf life- re-sterilize at least 1x year
   c) Factors that influence "kill rate"
      i) Temperature- higher is better
      ii) Pressure- higher is better
      iii) Concentration of antimicrobial chemicals- higher is better
      iv) Moisture content- higher is more efficient
      v) Time- longer is better
6) Chemical systems- disinfection or sterilization depends on above
   a) Relatively inexpensive
   b) Ideal for plastics, rubber, other heat-sensitive devices
   c) Toxic- must be rinsed off instruments prior to use
   d) Alcohols
      i) Kill by coagulating and denaturing proteins
      ii) Higher MW (isopropyl, propyl) more efficacious than lower MW (ethyl, methyl)
      iii) Not useful as sterilants- do not destroy spores
      iv) Useful in surface disinfectant- concentration > 60% kills viruses
   e) Chlorine (hypochlorites)
      i) Inhibit enzymes, denature proteins, inactivate nucleic acids
      ii) Do not destroy spores at **any** concentration
      iii) Bleach useful as disinfectant at 200 ppm - 10 min exposure time
      iv) Excellent for disinfection of tonometer probes (1/100 solution)
         (1) [add 5 ml bleach to 495 ml distilled H_2O]
      v) Good for surface disinfectant but odor is somewhat unpleasant
   f) Hydrogen peroxide
      i) Destroys membrane lipids & DNA
      ii) Sterilant only in high concentrations

iii) Good for surface disinfection
iv) Good for pre-soak of instruments prior to cleaning, sterilization
v) Excellent for tonometer tip disinfection- 3% solution/ 10 min soak (holder for tips commercially available, home made)
vi) Destroys corneal epithelium in seconds

g) Glutaraldehyde
i) Activated by addition of alkalinating agent
ii) Alters RNA, DNA, protein synthesis
iii) Unpleasant odor @ 3.2 % and 2% concentration
iv) May be disinfectant or sterilant
v) 2% @ 37 °C
(1) *Sterilant* after 6 hrs
(2) *Disinfectant* after 2 hrs
vi) 0.5% combined with phenol may be used a sterilant or disinfectant

h) Phenols- the original disinfectant
i) Disrupt cell wall and precipitate proteins
ii) One of the first disinfectants used
iii) Some viruses, many spores unaffected by phenols
iv) Commonly used in conjunction with glutaraldehyde

i) Procedure to disinfect or sterilize instruments w/ glutaraldehyde/phenol systems
i) Add activator to solution (if required)
ii) Dilute with distilled water (if indicated)
iii) Fill disinfecting tray to fill line
iv) Place pre-soaked, cleaned instruments in tray
v) Soak for desired time (disinfection vs. sterilization)
vi) Rinse with sterile saline
vii) Store in sealed container

7) Heat sterilization- Coagulates enzymes and proteins
a) Autoclaving- saturated steam under pressure
i) Pressure increases efficiency
ii) 270°F for 4 minutes at 150 psi- total cycle 35 mins.
iii) Instruments wrapped prior to sterilization
iv) Instruments dated and stored in "see-through" envelopes
v) Initial expense is moderate to high
vi) Used in hospitals & clinics, high volume practices
vii) Recently, small units available "Cavoclave" for reduced cost
viii) NB. Boiling instruments in water **does not sterilize**- *spores survive this method of disinfection*

b) Dry heat
i) Kills by oxidizing intracellular constituents
ii) Less efficient than autoclaving = increased time, heat
iii) Conventional units 320°F for 60-120 minutes
iv) "Flash" units under 10 minutes
v) Newer units gaining popularity in Dentistry
vi) Requires special packaging- melts window in conventional packaging
vii) Cost is low, packages now have clear windows

c) Heat/Chemical (Chemiclave)
i) Unsaturated chemical vapor under low pressure, high heat
ii) 270°F at 20-40 psi for 20-40 minutes

iii) Chemical vapor (Vaposterile) includes water, ethyl alcohol, and formaldehyde
iv) Moderate cost- obtain used from dental suppliers
v) Instruments can be packaged in same materials as autoclave
vi) Disadvantages include odor and incompatibility w/ plastics

8) Diagnostic contact lens disinfection
   a) Disposables have virtually eliminated this issue.
   b) Non-disposables require disinfection - are classified according to water content.
      i) Cleaning diagnostic lenses can reduce total bacteria population by 99%.
      ii) Greatly enhances the disinfection process
      iii) All stock CL should be cleaned with a bactericidal cleaner such as Miraflow.
         (1) Leach et al found that chemically disinfected diagnostic lenses pre-cleaned w/ Miraflow were negative for microbial growth.
   c) Disinfection: low water content lenses
      i) Heat vs. chemical; use heat when possible.
      ii) Contamination rates: heat = 5% vs chemical = 67.6%
      iii) Does not damage low water content lenses
      iv) Callender et al showed that heat-treated lenses become contaminated w/time.
         (1) Heat disinfected lenses should be re-treated every month.
   d) Disinfection: high water content lenses
      i) Heat vs. chemical; heat reduces life,
      ii) Meticulous cleaning with bactericidal cleaner critical
      iii) Use a chemical system with maximum "kill rate" (hydrogen peroxide), Optifree express contains bactericidal and amoebacidal agents
      iv) Re-disinfect chemically treated lenses monthly.
9) Implementation of infection control in your office
   a) Designate an infection control person- usually a technician
      i) This person must be meticulous, responsible, and a self starter.
      ii) Decide on the system(s) you want to use for infection control-materials and methods you feel will best suit your practice; consider
      iii) Sterilization vs. Disinfection
   b) Heat vs. Chemical
      i) Purchase required materials- consult your supplier of optometric instruments
      ii) Educate staff personal on various basic and advanced procedures
      iii) Educate yourself first- read up on this subject
      iv) Educate your infection control person
      v) Set up a written plan of action for each area, instruments, CLs, personal infection control
      vi) Conduct staff meetings and training sessions- explain what you are trying to accomplish, why, and how you plan to do so.
      vii) Initiate and maintain a system to insure compliance, ongoing staff education
         (1) Periodic inspections, "pop quizzes"
      viii) "Practice what you preach", your example is vital to success of any program
10) Conclusion
   a) Optometry will pass new legislation that will allow more aggressive procedures.
   b) We are now held to the same standards as our medical colleagues.
   c) We must protect our patients and staffs from inadvertent infection.
   d) Some day, we may be "discovered" by government regulatory agencies
   e) The best time to start an infection control program in your office is now