Future Smiles
Community and School-Based Dental Hygiene Program
Policies and Procedures

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I. FUTURE SMILES POLICIES

Program Objective: Community and School-Based Dental Hygiene Program

Original Effective Date: September 28, 2009
First Amendment: November 1, 2014

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The administration of the community and school-based preventive oral health program will be completed under the direction of the Future Smiles Executive Director and Program Administrator.

The following comprises the protocol for this community and school-based preventive dental hygiene oral health program. All new employees or volunteers are required to read and acknowledge that they will abide by these protocols for the duration of their employment or volunteerism. It is also recommended that this manual be reviewed once a year for any revisions.

II. PROGRAM GOALS AND OPERATIONS

Mission

To improve the oral health of low-income, at-risk populations by providing preventive dental hygiene health care services through evidence-based clinical Best Practices to include: oral hygiene education, screenings, x-rays, prophylaxis, sealants and fluoride varnish. Service population refers to infants, toddlers, young children, youths, adolescents and adults. Services are to be provided at community health facilities, health fairs, Head Start, WIC centers, schools (classroom, etc.), School-Based Health Centers (SBHC) and/or Education and Prevention of Oral Disease (EPOD).

Program recipients with additional dental needs will be referred to community dental providers that have agreed to partner with Future Smiles. The program promotes working within the dental community to establish a dental home for at-risk populations. Our primary goal is to improve the oral health and overall health of our service population. Future Smiles believes that through optimal health outcomes we will help safeguard at-risk children's long term capacity to learn and success within the school environment.

Goals

- Provide information on oral health education and the benefits of dental prophylaxis, dental sealants, x-rays and fluoride varnish.
- Oral health screening, x-rays (limited locations) provide dental prophylaxis, determine recall status, evaluate teeth suitable for placement of dental sealants and apply fluoride varnish.
- Identify oral health needs and provide a referral source for follow-up dental care.
- Work directly with the medical staff and physicians; refer when necessary to best care for all of the participants' health needs.
- Promote a safe and healthy clinical treatment environment adhering to current OSHA standards and green technology.
- Follow the most recent evidence-based clinical Best Practices and CDC guidelines.

Rules and Regulations

All program employees and volunteers must adhere to Nevada Statutes, Rules and Regulations governing the practice of dentistry and dental hygiene as outlined in NRS 631 and NAC 631 and 459 inclusive.

Occupational Safety and Health

All employees must follow the CDC guidelines for infection control in the dental office.

Hours and Days of Operation

Future Smiles operates at community health facilities, health fairs, Head Start, WIC centers,

schools (classroom, etc.), School-Based Health Centers (SBHC) and/or Education and Prevention of Oral Disease (EPOD) Monday through Saturday dependent on personnel availability. In general the program will operate from 8:00 am to 4:00 pm, however, as a school-based clinic that is physically separate from the school, hours and days of operation are contingent to the staff availability and community needs.

Attendance and Punctuality

All employees are expected to adhere to their contracted days and hours of operation and are expected to be on time to the clinical sites. In the event of an emergency that detains the employee from working, the program administrator or supervisor must be contacted immediately. Employees must fulfill and not exceed their contracted hours of employment.

Payroll and Compensation

Employees are paid by the hour. Payroll is administered through a payroll service. Timesheets must be turned into program administrator who will forward them to the payroll service for payment.

Holiday Schedule

Employees will not be required to work on Federal holidays and are allowed to take personal days and vacation time off with notification to the program administrator.

Technology Requirements

All staff must be familiar with basic computer applications; word processing and data base programs. Staff will be expected to utilize the CDC SEALS data entry software, input program data, maintain program records, recall children and assist with program reporting.

Program Policy

The staff of Future Smiles will serve low-income, at-risk populations who are uninsured, underinsured, lack access, or are Medicaid/CHIP recipients at public health sites to include community health facilities, health fairs, Head Start, WIC centers, schools (classroom, etc.), School-Based Health Centers (SBHC) and/or Education and Prevention of Oral Disease (EPOD). Eligible low-income, at-risk populations will be from the local community served by Future Smiles. Children will either be accompanied by a parent or guardian who will authorize consent to provide treatment (consent forms), or will have returned a signed parental/legal custodian/guardian medical history/consent forms authorizing treatment.

All preventive dental hygiene services will follow evidence-based clinical Best Practices.

Signed medical history/consent forms represent consent to treat between parents/legal custodian/guardians and Future Smiles staff.

The administration of the prevention oral health program is the responsibility of the Future Smiles Administrator.

Only a Registered Nevada State-Licensed Dental Hygienist (RDH), who has been successfully approved for Public Health Dental Hygiene Endorsement (PHDHE) through the Nevada State Board of Dental Examiners (NSBDE), may provide services to Nevada residents through Future Smiles. All PHDHE Future Smiles staff will be covered under Professional Liability provided by Future Smiles. The program will provide OSHA and CPR instruction for staff in accordance with licensure.

The Future Smiles Administrator may assign additional support staff members, which have been approved for PHDHE, as deemed necessary to achieve program goals under appropriate budgetary restraints.

Target Population

The staff of Future Smiles will serve low-income, at-risk populations who are uninsured, underinsured, lack access, or are Medicaid/CHIP recipients with a focus on schools with 50% or higher Free & Reduced Lunch (FRL) enrollment.

III. CLINCAL DUTIES AND OPERATIONS

Program Clinical Duties

- Inventory and order program supplies as needed including printing of forms as needed.
- Order and maintain program incentives.
- Compile program data.
- Jointly complete a quarterly assessment report for the Nevada State Health Division.
- Monitor grant budget and program expenses.
- Represent Future Smiles at community meetings when requested.
- Keep and maintain an inventory list of treatment supplies.
- Arrange for equipment maintenance with manufacturers.
- Communicate with school officials to set up dispersal of forms and treatment days.
- Be a liaison with school officials.
- Maintain equipment and pursue repairs when needed.
- Organize and set up treatment materials.
- Provide oral health education.
- Organize daily paperwork.
- Utilize electronic health records-Dentrix.
- Take digital x-rays at limited locations.
- Assess oral health status and provide oral prophylaxis.
- Assess and maintain patient management with topical anesthetics as needed.
- Assess recall needs for each child seen and schedule recall.
- Assess molars and pre-molars suitable for placement of a sealant.
- Assess teeth suitable for placement of fluoride varnish.
- Apply sealants and fluoride varnish.
- Provide post-op instructions.
- Sterilize program instruments and prepare for the next day.

- Stock treatment room accordingly.
- Supervise and evaluate student dental hygienists and student dentists. (Student dentists will have a dentist teaching staff at UNLV SDM present).
- Maintain compliance with CDC guidelines for infection control in the dental office.
- Adhere to standard practices and use of ethical discretion in the workplace.

Set-Up/Take Down Protocol

Equipment Set-Up:

- Turn on all equipment including compressor, vacuum, Statim, ultra sonic unit and dental chair.
- Remove water bottle, fill with either distilled water, Sterisilstraw™ or use standard water and disinfectant tablets.
- Wipe delivery unit, patient chair and light, clinician chair, evacuation hose, air/water syringe handle, and curing light with Cavi-cide wipe.
- Set up patient chairs and use appropriate barriers on chair, overhead light and other handles.
- Set clinician chairs to desired height.

Delivery Tray Set-Up

Each delivery tray should have the following:

- Air/Water syringe tip
- Saliva ejector
- 4 cotton rolls
- 2 Dri-Angles
- 3 Syringe sleeves (1 with corner cut off for curing light)
- 1 curing light sleeve
- Unit dose of fluoride varnish with brush
- Unit doses of sealant material and etch
- Prophy polish
- Instrument pack with mirror, explorer and hygiene instruments
- Patient bib

Items on tray will depend upon what type of sealant and etch are being used.

Delivery Unit Set-Up

- Place saliva ejector and air/water syringe tip on appropriate connectors. Place barriers on air/water syringe handle, saliva ejector, and curing light. Place curing light sleeve on curing light then put orange shield on.
- Open unit doses of etch and sealant material and put tips on.
- Open instrument pack and collect Personal Protection Equipment (PPE) for operator.
- Organize paperwork by classroom.
- Retrieve child from classroom.
- Have child pick out toothbrush, floss, and incentive cup from boxes set up at entry door.
- Introduce yourself and anyone helping and place bib on patient.

- Explain procedure and eating limitations after sealant/fluoride varnish.

Equipment Breakdown

- Following last patient of the day: Dispose of all barriers and waste. Place dirty instruments and tips from sealant and etch in the dirty instrument container. Wipe down delivery units with Cavi-cide wipes.
- Turn delivery unit OFF. Remove and empty water bottle. Replace water bottle on unit, turn unit ON. Dry lines by running water out into the evacuation hose. Lift evacuation hose to completely drain. Turn delivery unit OFF.
- Turn off compressor, vacuum, light and dental chair and all other equipment in operatory.
- Turn off room light.

IV. PROPHYLAXIS PROTOCOL

Extra Oral and Intra Oral Inspection

1) Introduce yourself and ask if patient has any questions or concerns.
2) Review medical history.
3) Identify special needs.
4) Ask the patient is in oral pain.
5) Identify area or areas of discomfort.
6) Put on Protective Personal Equipment (PPE).
7) Place bib on child and safety glasses.
8) Extra oral inspections note any abnormalities.
9) Intra-oral inspection to include oral cancer screening.
10) Determine if patient presents with any medical health needs. If medical health is in question refer to medical health care partner within clinic, Pediatrician, and/or school nurse. Notification is sent home to alert parents/legal custodian/guardians.
11) Chart on Data Collection Form all existing, decayed, restored and sealed teeth.
12) Chart preventive services to be delivered to include x-rays (limited locations), prophylaxis, sealants, recommend reseal and varnish application.
13) Chart follow-up to community-based dental clinic and other referrals as indicated.
14) Identify dental treatment urgency 0- no obvious problem, 1- early dental care and 2- urgent care.
15) Patients with 1 and 2 urgency need immediate referral to dental care provider. All program recipients will be advised to pursue routine dental care at community-based dental clinic.
16) Assess gingival health and bleeding index.
17) Develop preventive dental care plan.
18) Assess plaque levels.
19) Evaluate diet and oral habits.
20) Discuss smoking and other unhealthy behaviors that can be detrimental to oral and systemic health.
21) Review proper home care to include brushing and flossing.

22) Discuss findings with patient in a positive manner while developing trust and behavior modification.

Prophylaxis

1) Sterilized dental hygiene instruments will be used to remove plaque, calculus, and materia alba and food debris.
2) If tongue is coated remove coating.
3) Review proper home care to include brushing and flossing while providing services.
4) Coronal polish with prophy paste.
5) Full mouth flossing.
6) Rinses away all polish residues.
7) Proceed with sealant and fluoride varnish application.

Post-Operative Instructions for Prophylaxis

1) Encourage regular recare dental visits.
2) If dental need is identified explain referral process and community partners. Review importance of paperwork that is to be given to parents/legal custodian/guardians.
3) Case management and care navigation is important and follow-up and documentation is needed in records. On forms be sure that home information is accurate for follow-up to determine that patient did receive necessary medical/dental care.
4) Review importance of daily brushing and flossing.
5) Advise additional, case specific oral health care instruction, which can include, diet recommendations, oral rinses, additional oral health aids, behavior modification and etc. Each patient is unique and individual needs are determined on a "case by case" basis using evidence-based clinical Best Practices.

V. SEALANT PROTOCOL

Sealant placement

1) Place orange safety glasses (to protect their eyes from the curing light ray) on child if they are not already wearing orange safety glasses.
2) If prophylaxis was not performed dry brush molars (in one direction only – otherwise it can get foamy) with patient toothbrush and rinse thoroughly.
3) Assess molars suitable for placement of a sealant using protocol and record findings on Treatment/Referral form.
4) Isolate teeth, dry off excess saliva, and etch for 30 seconds. (Time is dependent on etch in use).
5) Rinse teeth thoroughly and dry off with air.
6) Apply sealant – check that all pits and grooves are covered. Including buccal and lingual grooves.
7) Cure for 20 seconds. Check for adequate coverage; add additional sealant material if indicated. Cure again for 20 seconds.
8) Remove isolation and check for excess flash.

Post-Op Instructions for Sealants

1) Don't eat anything sticky (caramel, taffy, gum) for 1 day. Best to avoid sticky items always).
2) Don't eat anything hard (jawbreakers, hard nuts) for one day.
3) Don't chew on ice.

VI. FLUORIDE VARNISH PROTOCOL

Fluoride Varnish Application

1) After placing sealants – have patient swallow and dry teeth off with air.
2) Paint varnish on all teeth avoiding any large, open areas of decay.
3) Give patient post-op instructions.
4) Remove Personal Protective Equipment, patient's bib and patient's orange safety glasses. Reinforce post-op instructions and complete the Treatment/Referral form.
5) Separate treatment/referral form. Staple white copy to post-op instructions and give to child with instructions to take home to parents/legal custodian/guardians. Staple canary copy to health history and set aside to be counted at end of day.
6) Explain the need for regular maintenance care and that Best Practice Standards recommend that it is best for the at-risk population to receive a fluoride varnish application 4 times per year.

Post-Op Instructions for Fluoride Varnish

1) Eat a soft, non-abrasive diet for the rest of the day.
2) No hot drinks.
3) Do not brush or floss for at least 6 hours – if placed in the afternoon then advise not to brush until the next morning.
4) Depending on fluoride varnish type teeth may appear dull and yellow – this will brush off at next brushing.

VII. X-RAY AND TREATMENT PROTOCOL

X-ray and Treatment Procedures

1) Obtain completed health history with consent from parent or guardian.
    a. Parent or guardian signature is required.
2) Review medications/medical conditions with patient and parent or guardian.
3) At Clark EPOD take radiographs
    a. Confirm parent/guardian approval.
    b. Inquire if patient is pregnant.
    c. If patient is pregnant or potentially pregnant do not take x-rays.
        i. X-ray recommendations:
            1. Explain x-ray process and answer any questions.
            2. Wash hands and prepare operator for procedure.
            3. Set-up computer for Dexis imaging **make sure that you have the correct patient record open in Dentrix*.

4. Prepare Nomad with barriers.
5. Prepare Dexis senor with barriers and holder.
6. Prepare patient with lead shield and thyroid collar.
7. Prepare operator with lead shield and thyroid collar.
8. Operator to use dosimeter and required.
9. 2-5 years of age maxillary and mandibular occlusal films- 2 bitewing x-rays if possible.
10. 5-12 years of age maxillary and mandibular occlusal films and 2 bitewing x-rays.
11. 12-14 years of age maxillary and mandibular 2-3 anterior films and 2 bitewing x-rays.
12. 14 years and older 4 bitewing x-rays and full mouth series.
    a. If unable to take full mouth series do take the 4 bitewings and 2-3 anterior films and schedule to take full mouth at recare appointment.

4) Expose radiographs using standard protocol.
5) Review radiographs and establish a <u>dental hygiene treatment plan</u>
    a. Full mouth debride with follow-up fine scale 2 weeks later.
    b. Deep subgingival calculus can require segmenting appointments to provide scaling and root planning. Break treatment up into quadrants with a focus on patient comfort and home care. With gingivitis and inflammation advise warm salt water rinses at home and desensitizers, like MI paste.
    c. Prophylaxis
    d. Dental sealants to be placed on deciduous teeth with deep occlusal groves, all healthy molars, premolars and anterior teeth with deep lingual groves.
        i. When time does not allow for full application of dental sealants do reschedule the patient for follow-up treatment of the sealants.
        ii. With the mobile program leave a note for the next dental hygienist to complete the sealants on the next program delivery day.
    e. Fluoride varnish is to be applied no more than every 3 months. Double check records if other services were offered and fluoride varnish was applied. You may polish with MI Paste when fluoride varnish was provided at the previous appointment and the patient is returning for subsequent treatment.
    f. Case management requires that all patients served receive a treatment letter with community resource list.
    g. Patients identified with urgent dental needs (dental pain) must have Care Navigation:
        i. Urgent dental needs would be identified as:
            1. Draining abscess.
            2. 1 quadrant with deep tooth decay that causes pain.
            3. The patient notes that he/she experiences regular dental pain.
            4. Rampant caries where there are multiple areas of tooth decay in all 4 quadrants of the oral cavity.

ii. Dental Referral Network includes:
    1. Once a patient is identified in urgent dental need the dental hygienist who assessed the patient needs to call the parent or guardian to provide health status of the patient and aid with Dental Referral Network:
        a. UNLV SDM Saturday Clinics (free to participants).
        b. Dental Care International
        c. Huntridge Teen Clinic (13 years and older)
        d. Sedation Dental Care-Dr. Steven Delisle
        e. Nevada Health Centers
        f. Project Smile
        g. Local Dentist(s)
        h. It is important to keep notes regarding the Care Navigation and the programs efforts to assist families with access to dental services.

6) Complete tooth charting in Dentrix—tooth charting of existing restorations, conditions and tooth decay.
7) Full mouth perio charting in Dentrix—all patients above the age of 14 are to have full mouth 6-point probing with 12 point oral cancer exam, abnormalities documented.
8) When parent or guardian is present review clinical findings with both the parent or guardian and the patient.
9) Provide oral hygiene education with home care instructions—brushing, flossing, disclosing as needed, tongue cleaning, oral piercing education, tobacco intervention.
10) Proceed with comprehensive dental hygiene treatment.
11) Reappoint patient to complete treatment when more time is needed.
12) Process paperwork for referral with case management notes.
13) Complete documentation in records with Dentrix.
14) Sign and Initial all documentation in Dentrix.

RISK ASSESSMENT OF THE INDIVIDUAL
Caries experience
Dental care utilization pattern
Use of preventive services
Medical history predispositions

↓

RISK ASSESSMENT OF INDIVIDUAL TEETH
Pit and fissures morphology
Eruption status
Caries pattern

↓

DO NOT SEAL IF:
The tooth cannot be isolated

EVALUATE PIT AND FISSURE SURFACES

Caries Free	Incipient Caries Cavitation < 1 mm	Advanced Caries Cavitation > 1 mm
↓	↓	↓
Seal	Seal	Referral for restoration
↓	↓	↓
Place fluoride varnish on all tooth surfaces	Place fluoride varnish on all tooth surfaces	Place fluoride varnish on all tooth surfaces avoiding large open caries where there may be pulp involvement

VIII. RESOURCES

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LEGAL AUTHORITY:

• Nevada State Board of Dental Examiners in accordance with the Practice of Dental Hygiene NRS 631 and NAC 631 inclusive.

Simple Strategies For Surface Disinfection

CLINICIANS NEED TO BE WELL INFORMED ABOUT THE PROPERTIES OF THE PRODUCTS THEY USE FOR CLEANING AND DISINFECTING SURFACES.

By Laura Gail Hendricks, RDH, MEd

As globalization, or the interconnectedness and interdependence of populations and countries around the world, increases, so does the risk of disease transmission.[1] International travel, just one facet of globalization, has experienced significant growth. For example, in 1980, approximately 227 million individuals traveled internationally via airplanes. In comparison, more than 1 billion people crossed international borders via airplane travel in 2012.[1] As more people and goods cross international borders, so do diseases such as hepatitis B virus (HBV), tuberculosis, severe acute respiratory syndrome, Middle East respiratory syndrome, and Avian influenza.[2] As such, maintaining infection control protocols in all facets of health care is imperative to the safety of both patients and clinicians.

Adherence to proper infection control protocols can minimize or prevent disease transmission among patients and the dental team. By strictly following evidence-based methods of infection control as outlined by the United States Centers for Disease Control and Prevention (CDC), dental offices will remain safe clinical environments.[3]

According to the CDC,[3] there are four principles of infection control:

1. Take action to stay healthy
2. Avoid contact with blood and other infectious body substances
3. Ensure patient care items are safe for use
4. Limit the spread of blood and other infectious body substances

A clear understanding of the CDC's *Guidelines for Infection Control in Dental Health-Care Settings—2003* is necessary to implement and achieve an effective infection prevention protocol.[3] These recommendations are designed to help oral health professionals properly prepare the dental operatory for patient treatment. Heat sterilization is typically used on equipment and instruments that can withstand high heat.[4] For those devices that are not heat-tolerant or cannot be removed for heat sterilization, chemical sterilization is used to supplement infection control efforts.[4] Those surfaces with potential for exposure to blood or other potentially infectious materials must be disinfected with an intermediate-level disinfectant.[3]

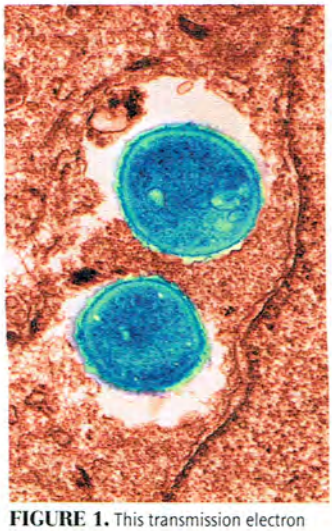

FIGURE 1. This transmission electron micrograph shows *Staphylococcus aureus* (blue). Disinfectants that can kill this Gram-positive bacterium, in addition to *Salmonella choleraesuis* and *Pseudomonas aeruginosa*, can claim to be a hospital-level disinfectant.

FIGURE 2. This colored scanning electron micrograph illustrates *Pseudomonas aeruginosa* (turquoise). In order for a disinfectant to claim itself as hospital-level, it must be able to kill these Gram-negative, rod-shaped bacteria, as well as *Salmonella choleraesuis* and *Staphylococcus aureus*.

FIGURE 3. *Mycobacterium tuberculosis* bacteria are shown in this transmission electron micrograph. Intermediate-level disinfectants must be able to kill the rod-shaped bacillus, in addition to *Salmonella choleraesuis*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.

ENVIRONMENTAL SURFACES

The CDC and Organization for Safety, Asepsis and Prevention (OSAP) categorize environmental surfaces as either clinical contact surfaces or housekeeping surfaces. Clinical contact surfaces are those directly touched by instruments, devices, hands, or gloves with direct contact with blood or other potentially infectious materials. These include but are not limited to light handles, switches, delivery trays, and chairside computers.

Housekeeping surfaces are not directly touched during the delivery of care and include walls, floors, sinks, and countertops. Unless they become visibly contaminated, housekeeping surfaces require only regular cleaning with soap and water to remove soil and dust.[5]

While environmental surfaces are not often associated with transmission of disease in the dental setting, some of the most harmful health care-associated pathogens can survive on these surfaces for days, weeks, or months. For example, HBV can remain infectious when contained in dried blood on environmental surfaces for at least 1 week and possibly longer.[6,7] Reducing the potential for disease transmission via these surfaces is an important component of infection control protocol. Although it is impossible to achieve 100% sterilization on surfaces in the dental operatory, high levels of disinfection can be achieved through proper technique, use of barriers, and surface disinfectants.

Sterilization uses heat or chemicals to kill all microorganisms including spores. Disinfection, on the other hand, chemically destroys most microorganisms on items or objects but does not eliminate all bacterial spores. Using a combination of barriers and surface disinfection in the infection control routine can significantly reduce the risk of disease transmission.[8]

Surfaces that cannot be easily cleaned due to their inability to withstand moisture or chemical exposure or their size or shape should be covered with fluid-resistant barriers during delivery of care. These items may include switches, irregular surfaces, digital radiography sensors, and keyboards.[3,4] These barriers must be replaced between patients with clinicians being careful to minimize the possibility of cross-contamination. If contamination inadvertently occurs, the surface must be cleaned and disinfected before another barrier is placed.

CLEAN AND DISINFECT

Cleaning should be conducted first to remove debris and visible contamination. It is a critical step to effective infection control because debris that is left behind can interfere with the efficacy of disinfection.[9] Cleaning should be followed by disinfection, which eliminates, inactivates, or destroys most pathogens to reduce the risk of transmission.[3,5]

OSAP recommends that "areas should be cleaned and then saturated with enough disinfectant for the surfaces to remain moist for the required contact time without evaporation."[9] Two methods are acceptable to accomplish this goal. One is the spray (to clean)-wipe-spray (to disinfect) method. The second method uses pre-moistened wipes and suggests wipe (to clean)-discard-wipe (to disinfect). A clean wipe should be used for each surface. Use a sufficient number of

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wipes to ensure the surface remains damp for the appropriate clinical contact time.[8,9]

CHOOSING A SURFACE DISINFECTANT PRODUCT

Surface disinfectants are categorized in three levels: low level, intermediate level, and high level (Table 1).[3] High-level disinfectants are not typically used in dental offices, so they will not be discussed here. Product labels do not state the level of efficacy but rather make a label claim. Both low- and intermediate-level disinfectants claim "hospital disinfectant." This means they are effective against three test organisms: *Salmonella choleraesuis, Staphylococcus aureus* (Figure 1, page 44) and *Pseudomonas aeruginosa* (Figure 2, page 44). Some low-level disinfectants may kill human immunodeficiency virus (HIV) and HBV, if stated on the label. They can be used as cleaners on surfaces that are not visibly contaminated with blood or other potentially infectious materials. These are most useful for cleaning housekeeping surfaces and clinical contact surfaces not otherwise contaminated.

Intermediate-level disinfectants include the above claims but also are tuberculocidal. Potency against *Mycobacterium tuberculosis* (Figure 3, page 44) has been recognized as a substantial benchmark. The tuberculocidal claim, however, is used only as measurement of germicidal potency. Tuberculosis is not transmitted via environmental surfaces but rather through airborne routes. Because mycobacteria have some of the highest levels of resistance among vegetative bacteria, viruses, and fungi, any germicide with a tuberculocidal claim on the label is considered capable of inactivating a broad spectrum of pathogens, including less-resistant organisms such as bloodborne pathogens (eg, HBV, hepatitis C virus, and HIV). It is this broad-spectrum capability rather than the product's specific potency against mycobacteria that is the basis of tuberculocidal chemicals for surface disinfection.[10]

Intermediate-level disinfectants can be used for both housekeeping surfaces and clinical contact surfaces that are soiled with blood or other potentially infectious materials. Most will have label claims stating bactericidal, fungicidal, virucidal, and tuberculocidal abilities. If the label claim says tuberculocidal, it is an intermediate-level disinfectant.[5] Because it often is difficult to see blood or other potentially infectious material, an intermediate-level disinfectant is the agent of choice for most clinical contact surfaces.

The CDC and OSAP both recommend using personal protective equipment when cleaning and disinfecting, which includes heavy-duty utility gloves, face mask, protective eyewear, and protective gown. Chemicals can be absorbed or inhaled if personal protective equipment is not properly utilized.[3]

Before using a cleaner or disinfectant, the manufacturer instructions should be well understood. Contact times vary among products. Clinicians should search for products with reasonable contact times (less than 10 minutes). The label should be checked to determine if the product is ready to use or needs to be mixed.[8]

Understanding the chemical compounds or type of disinfectant used also is important. There are four standard types:

1. Chlorine-based products contain chlorine dioxide and sodium hypochlorite and have a broad kill spectrum but limited shelf life. Sodium hypochlorite is no longer recommended, as it is not EPA registered.
2. Phenolic solutions are water or alcohol based and are identified with prefixes and suffixes such as "phenol" or "phenyl." They provide antifungal and antiviral properties.

TABLE 1. United States Centers for Disease Control and Prevention's Methods for Sterilizing and Disinfecting Patient-Care Items and Environmental Surfaces[3]

Process	Result	Method	Examples	Patient-Care Item	Environmental Surface
Sterilization	Destroys all microorganisms, including bacterial spores	High temperature	Steam, dry heat, unsaturated chemical vapor	Heat-tolerant critical and semicritical	Not applicable
		Low temperature	Ethylene oxide gas, plasma sterilization	Heat-sensitive critical and semicritical	Not applicable
		Liquid immersion	Chemical sterilants: glutaraldehyde, glutaraldehydes with phenol, hydrogen peroxide, hydrogen peroxide with peracetic acid, peracetic acid	Heat-sensitive critical and semicritical	Not applicable
High-Level Disinfection	Destroys all microorganisms, but not necessarily high numbers of bacterial spores	Heat-automated	Washer-disinfector	Heat-sensitive critical	Not applicable
		Liquid immersion	Chemical sterilants/high-level disinfectants: glutaraldehyde, glutaraldehyde with phenol, hydrogen peroxide, hydrogen peroxide with peracetic acid, ortho-phthalaldehyde	Heat-sensitive critical	Not applicable
Intermediate-Level Disinfection	Destroys vegetative bacteria and the majority of fungi and viruses; inactivates *Mycobacterium bovis*; not necessarily capable of killing bacterial spores	Liquid contact	United States Environmental Protection Agency (EPA)-registered hospital-level disinfectant with label claim of tuberculocidal activity: chlorine-containing products, quaternary ammonium compounds with alcohol, phenolics, iodophors, EPA-registered chlorine-based products; Occupational Safety and Health Administration (OSHA) also requires label claims of human immunodeficiency virus (HIV) and hepatitis B virus (HBV) potency for clinical contact surfaces (eg, quaternary ammonium compounds, some phenolics, some iodophors)	Not applicable	Clinical contact surfaces, if blood spills on housekeeping surfaces
Low-Level Disinfection	Destroys the majority of vegetative bacteria, certain fungi, and viruses; does not inactivate *Mycobacterium bovis*	Liquid contact	EPA-registered hospital disinfectant with no label claim regarding tuberculocidal activity; OSHA also requires label claims of HIV and HBV potency for clinical contact surfaces (eg, quaternary ammonium compounds, some phenolics, some iodophors)	Not applicable	Clinical contact surfaces, housekeeping surfaces

odophors are less irritating to the skin and identified with "iodi" or "iodo." Quaternary compounds are not corrosive and have a lower kill spectrum. All hospital-level disinfectants must contain an EPA registration mber. The EPA requires manufacturers to test formulations by ng accepted methods for microbial activity, stability, and toxicity humans and animals.[9]

ONCLUSION

h dental office has unique needs and there is no perfect disin-tant. Clinicians need to understand the *CDC Guidelines* and w they relate to daily practice. These are currently under revi-n and updates may be released in the future. By reading prod-labels and choosing appropriate products for the office's eds, clinicians can be confident in their adherence to infection ntrol protocols. Remember that stronger is not necessarily bet-as stronger may mean more toxic to the user and the envi-nment. The ideal surface disinfectant is broad spectrum; fast ing; active in the presence of organic matter; nontoxic; nonal-genic; nondamaging to surfaces such as metal, cloth, rubber plastics; leaves no residual effect on treated surfaces; easy to ; and economical. While all products have some limitations, icians who are well versed in the active ingredients and engths and weaknesses of the products they use will be pre-red to enforce infection control protocol.[11] Overall, the safety of staff, patients, and the environment must be considered when choosing a disinfectant. Clinicians who take the time to become knowledgeable about the properties of their chosen products are helping to ensure the efficiency of infection control efforts while minimizing the potential for disease transmission.

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Five critical minutes

EFFICIENT INSTRUMENT PROCESSING IS NOT A VICTIM OF TIME CONSTRAINTS

BY **KAREN SIEBERT,** RDH, MA

FIVE CRITICAL MINUTES: EFFICIENT INSTRUMENT PROCESSING

Instrument processing is often hurried in light of the meager amount of time allotted for treatment room turnover. If rushed, compromises might be made in personal safety, instrument care, and sterilization. These three "time savers" can lead to a personal risk of infection, a shorter lifespan for instruments, and a risk of cross-contamination.

Let's look at personal safety. I'll admit I used to clean my wedding ring in the ultrasonic. Granted, it was inside a Baggie of tartar and stain remover and within a beaker that sat in the ultrasonic, but I am sure the lid was off while it ran in cloudy solution.

A recent post on a Facebook dental hygiene forum told a story about a hygienist who "dips her bare hands in the ultrasonic to retrieve instruments." While many posters were revolted, it was interesting to see there were some who admit doing this even now. I love the multigenerational responses on the forum. The hygienists who began careers in the preglove era told stories about offending patients when hygienists began to wear gloves. Patients assumed we thought they were "sick."

Can you imagine if we went to treat a patient without gloves today? Inadequate instrument processing can be just as risky.

SELF-PROTECTION DURING PROCESSING

Time is a very precious commodity when it comes to turning over treatment rooms. The step of processing instruments between patients tempts us to cut corners. OSHA is very clear about personal protective equipment protocol for instrument processing. Considering the potential for cross-contamination, wear a protective gown over clinic attire. Heavy-duty utility gloves are a must for protection from sharps, bloodborne pathogens, and chemical disinfectants. The 2015 OSAP Instrument Processing course adds the suggestion to wear noncontaminated treatment gloves under utility gloves to minimize cross-contamination between multiple utility glove wearers. OSHA states:

"Utility gloves may be decontaminated for reuse if the integrity of the glove is not compromised. However, they must be discarded if they are cracked, peeling, torn, punctured, or exhibit other signs of deterioration or when their ability to function as a barrier is compromised."

Protective glasses and masks are required in the instrument processing area to protect the clinician from microbe-containing aerosols. Wear masks that have a high bacterial filtration efficiency (BFE) rate to prevent aerosol from entering the mask.

A study done in England researched the percentage of clinicians who wore proper PPE during instrument processing:

- Most clinicians wore gloves
- 51 % did not wear eye protection
- 57% did not wear a mask
- Only 7% wore a protective, waterproof gown.

Training consisted of another staff member showing the new trainee how to process on the job, and most offices did not have a written protocol to use for training purposes (Bagg, Smith, Hurrell, McHugh, Irvine 2007).

The ultrasonic cleaner has potential to be a weak link in the instrument processing chain of asepsis. As the ultrasonic heats up, a warm, wet environment is the perfect playground for heterotrophic bacteria to multiply. Heterotrophic bacteria require an organic carbon source for growth, deriving energy and carbon from organic compounds. As we add instruments loaded with bioburden, heterotrophic bacteria receive an ideal food source.

By the end of the day, the ultrasonic solution can contain 40 million CFUs (colony-forming units) of heterotrophic bacteria. Those bacteria are aerosolized as the unit runs, releasing into the air we breathe, or landing on our clothing/skin as we are about to go treat another patient. Do we really want to wear a cocktail of microbes to greet our next patient? PPE specific to instrument processing helps avoid the possibility.

INSTRUMENT CARE

Now that the proper PPE and solution have been chosen, the instruments themselves need consideration. Instrument care affects instrument lifespan. Each instrument manufacturer has specific directions available for the proper processing technique, based on the metallurgic makeup of the instrument. Yet, we tend to treat our instruments with a one-size-fits-all approach.

Several regulatory bodies and infec-

tion control organizations have contributed to dentistry's protocol for infection control and sterilization. In the dental office, instruments are defined as critical, semicritical, and noncritical to distinguish levels of possible infection transmission (ADA, 2009). Periodontal scalers and surgical blades are critical instruments. The Food and Drug Administration, however, goes a step further, defining them as medical devices that enter sterile tissue and/or alter the body in some way. Semicritical instruments, such as a dental mirror, come in contact with mucosal tissues. A blood pressure cuff is considered a noncritical item in contact with intact skin only.

OSHA, Centers for Disease Control and Prevention (CDC), and the Organization for Safety, Asepsis and Prevention (OSAP) have defined disinfection and sterilization. Disinfection is the step required to remove bioburden from instruments. Sterilization is accomplished through the process of steam under pressure, dry heat, or chemical vapor (ADA, 2009). OSHA, CDC, and OSAP recommend that critical and semicritical instruments go through both disinfection and sterilization. Without disinfection, bioburden can remain on the instruments and may not be inactivated during the sterilization cycle (Molinari, Harte, 2010).

There are a few ways to accomplish disinfection, the most common being the ultrasonic cleaner. The ultrasonic uses cavitation to degrade bioburden prior to sterilization. In the event that instruments must be hand scrubbed, OSAP recommends a long-handled brush and full personal protective equipment, including heavy-duty gloves. The instruments should be immersed in water or an instrument cleaning solution while scrubbed to reduce the chance of spray (OSAP).

Before disinfection begins, the instruments have to be securely transported from the operatory to the processing area. Minimizing the handling of sharp, contaminated instruments is an important consideration for this step. Utilizing an instrument cassette and solid transport container minimizes the risk of sharps and contaminants. A transport container with solid walls and lid allows cassette transport from the treatment room to the central processing area without risk of cross-contamination or instrument sticks. If instruments cannot be processed immediately, they can be transferred to a soaking tray containing an ultrasonic solution.

The CDC recommends critical and semicritical instrument soaking and cavitation as soon as possible after use to prevent bioburden from drying and becoming tenacious. A soaking tray is an ideal option for initial bioburden breakdown after instrument use. A soaking tray should contain an ultrasonic instrument cleaner — not surface disinfectant that can corrode instruments or make the bioburden harder to remove.

A study conducted in the United Kingdom compared soaking instruments in an enzymatic solution prior to ultrasonic cavitation vs. no presoak, and found the combination produced the most complete bioburden removal (Walker, Burke, Palenik, 2006).

Bioburden contains proteins, carbohydrates, fats, and plant matter. Think of it as a deluxe burger with all of the fixings. Digesting that burger bioburden is key to thorough sterilization. Like food digestion, bioburden needs a variety of enzymes for complete removal. Four enzymes that are crucial to breaking up bioburden are amylase, cellulase, protease, and lipase.

Amylase breakdown removes carbohydrates, carbon compounds, and resistant starch residues (the bun in our analogy). Cellulase breaks down cellulose, plant structures, and fibers (the burger's lettuce and tomato). Protease breaks up the "beef patty" by removing proteins and protein stains. Lipase assists in removing fatty materials and oily stains (the mayonnaise).

These enzymes work together synergistically to remove all components of our deluxe burger. When one or more enzyme is missing from the ultrasonic solution, the targeted component of bioburden is much harder to remove, possibly resulting in that little chunk of "sterilized" bioburden on a freshly opened pack of instruments.

ULTRASONIC SOLUTIONS

Enzymes have not always been included in ultrasonic solutions. Prior to enzyme addition, some solutions used detergents combined with an alkaline pH to attempt bioburden removal. An alkaline pH breaks up minerals found in hard water. Still available, detergents with an alkaline pH are no longer the preferred combination for bioburden removal.

Chlorine compounds can be found in some ultrasonic solutions. While an advantage of chlorine compounds might be their broad-spectrum antimicrobial activity as a diluted ultrasonic solution, the disadvantages outweigh advantages. In high concentrations (more than 500 ppm), organic material can inactivate chlorine and corrode instruments (CDC, 2008). It is also sensitive to pH changes, causing the chlorine compound to disassociate and convert to an ineffective solution. Phenols, glutaraldehydes, and quaternary ammonium compounds are considered surface disinfectants and not suitable for immersing critical and semicritical instruments with corrosive potential.

Instrument cleaners can contain additives that raise or lower the pH of the solution. An acidic pH can corrode instruments and damage the metal ultrasonic unit. Basic or neutral pH solutions are both acceptable for instruments and the unit.

Chlorine and chlorine compounds — sodium hypochlorite — for example, can also be corrosive to metals. Always follow the manufacturers' instructions to lengthen the life of instruments. Pitting and corrosion will render the instrument unusable and be a costly mistake in the long run.

An ultrasonic solution contains ingredients in addition to these enzymes, and may not utilize enzymes at all. When choosing a solution, the product MSDS is a great place to start. Ask questions such as:

- Does this ultrasonic cleaner effectively destroy bioburden?
- Is it anticorrosive?
- Is it gentle to the environment and staff?

These questions assess the office's individual needs and lead to appropriate product choice (see related sidebar).

As a final checkpoint for optimal ultrasonic effectiveness, a function test should be performed on the unit itself. Use a two-inch by three-inch piece of foil and immerse it into the solution. Run the unit for 20 seconds and then remove the foil. When the foil is held up to the light, small pinholes should be seen. If they are not there, the unit is not functioning properly (OSAP, 2015).

Sustainability factors into product choice for ultrasonic solutions. Sustainability is not only about the environment, although that is a very important component. Sustainable products consider the health of those exposed to them, as well as biodegradability and anything that leads to long-term safety for those exposed while in use or after disposal. Phosphates are one example of an ingredient to avoid in any solutions we use in dentistry as they have been shown to have a negative impact on the environment. A solution should list that it is phosphate free to ensure minimal environmental impact.

STERILIZATION

Now that the stage is set with a pH-balanced, antimicrobial, enzymatic solution, instruments can be placed in the ultrasonic unit. Follow the unit manufacturer's time requirements for optimum bioburden removal; 15 minutes is the average consensus. Wearing utility gloves, remove the instruments from the stopped unit and rinse. Cassettes prevent instrument sticks during this step, yet they can block water from the instruments inside for a thorough rinse. If confident the instruments are securely latched, open the cassette and run under water for 30 seconds. Air-dry instruments completely prior to wrapping for sterilization to prevent potential corrosion.

Keeping the balance between time constraints and proper handling of instruments is not easy. The consequences of shortcuts in any area of the process are important considerations in planning room turnover. Staff illness, instrument cross-contamination, or even shortening the lifespan of an instrument due to corrosion all impact the bottom line of the practice and quality of patient care. Take time to evaluate the office instrument processing routine, asking those important questions that standardize staff protocol and ensure OSHA-compliant infection control standards. The results can lead to a happier, healthier day of patient care to the standard of care! **RDH**

FIVE CRITICAL MINUTES CHECKLIST

1. PPE: Gown, mask, glasses, utility gloves
2. Read ultrasonic solution label
   a. Enzymatics
      i. Amylase
      ii. Protease
      iii. Cellulose
      iv. Lipase
   b. Antimicrobial
   c. Anti-corrosives
   d. pH neutral
   e. No corrosive additive agents
   f. Biodegradable
3. Transport container for each room
4. Soaking tray available
5. Ultrasonic unit function test (periodic)
6. 15 minute cycle
7. Rinse 30 seconds
8. Air-dry
9. Package for sterilization
10. Sterilize
11. Store away from processing area

KAREN SIEBERT, RDH, MA, earned a degree in dental hygiene from the University of Iowa and a master's in education with an emphasis on teaching with technology. She teaches oral pathology and theory and practice of dental hygiene to second-year dental hygiene students. She is a clinical instructor at all levels. Volunteer positions include local component trustee and state membership chair for the Illinois Dental Hygiene Association, and committee member of Northern Illinois Oral Cancer Walk for Awareness.

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STERISIL S365 STRAW PROTOCOL

A. What is it?

Silver Citrate impregnated resin beads incased in a tubular cartridge (or straw) delivery system composed of 17.5% silver and 82.5% Weak Acid Cation Exchange Risen and water. Non-toxic, non-irritating granular product exhibiting an HMIS rating of 1-health, 1-flammability, 0-reactivity. It is recommended that PPE-E be utilized in the handling of the product. Sterisil Straws are an in-line water delivery service. Company website: http://sterisil.com/products/sterisil-straw.

B. How does it work?

All water delivered through the unit flows via the straw. After an initial "shock" treatment, a continuous flow of Sterisil's Antimicrobial Silver Ion based component is supplied to the tubing over an extended period of time assisting in the resistance of bacterial growth in both tubing and bottle. The Sterisil Straw is formulated to be continuously present in the dental unit water system and recommends the use of distilled or deionized water.
FDA cleared and EPA registered to produce CFU per mL HPC purity 50 times below guidelines established by the ADA and CDC (line effluent ~ < 10 CFU/ml).

C. How is the product installed and maintained?

Future Smiles uses DNTLworks brand of mobile dental equipment. The manufacturer's waterline tubing is not removable and was altered to allow integration of the Sterisil Straw water delivery system. The initial installation of the Microbiological cartridges is engineered to automatically produce a "shock" treatment after initial connection and treatment of dental water.

Installation steps are as follows:

1) Remove water bottle from unit.
2) Measure existing tubing:
    a. Measure from the bottom of tube (against the tubing) allow ¼ inch at top (cut at bottom ring (see photo).
3) Slide Sterisil Straw onto tubing-listen for audible click:
    a. Tug on tubing to assure attachment.
4) Put distilled water in bottle.
5) Reattach bottle to unit.
6) Turn Unit on.
7) Run all lines attached to dental units until blue coloration appears assuring existence in the lines.
8) Allow lines to remain unused for a minimum of 12 hours.
9) Prior to use of dental unit, flush dental lines until blue color disappears (4 ounces).
10) Replace every 365 days.
11) Used straws can be disposed of in regular garbage receptacle.

D. Notes from the manufacturer:

Sterisil, Inc. 835 S. Hwy 105 Ste. D, Palmer Lake, CO 80133
1 year of continuous use with distilled water; Part # S365
Only product to include automatic shock treatment upon initial use for optimum control of bacteria.

- Works with any size water bottle-BioFree® Bottle recommended.
- Eliminates need to empty bottles-Purge and air dry lines at night.
- Easy annual replacement takes only 1 minute of your time-no tools required.
- FDA Cleared.
- EPA Reg. No 83315-

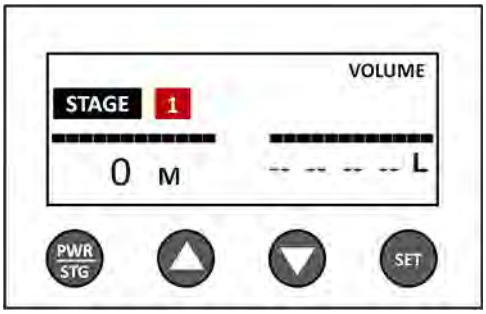

FOR USE WITH DISTILLED WATER
STERISIL
IMPORTANT!
Shock
NOW in USE.
Flush Water Lines
Before Patient
Treatment.

Instructions for:
Re-Setting the Monitor on the Sterisil® System

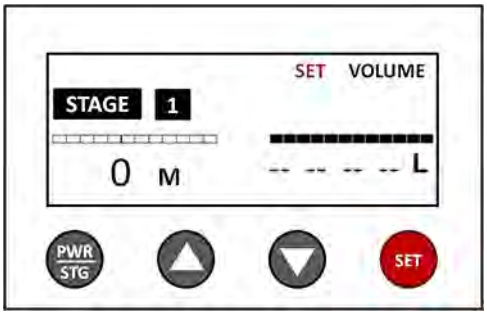
Every time you change your Stage 5 cartridge you must reset your monitor for maximum use of your cartridge.

1. Turn on the monitor by pressing the PWR/STG button.

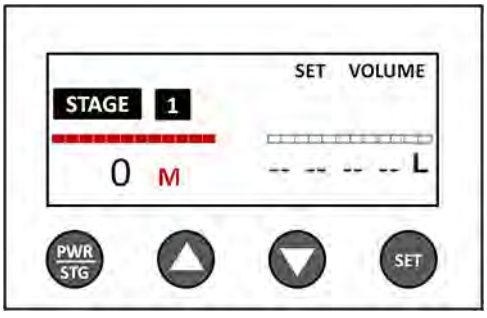
2. Ensure the monitor is highlighting **Stage 1**. If it is not, press the PWR/STG button to cycle through the stages until Stage 1 is selected.



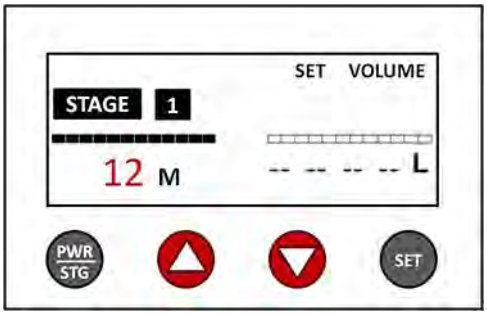
3. Once **Stage 1** is highlighted, press the SET button. The word set should appear near the upper right corner of the screen. Note that the set mode will turn off if no buttons are pressed for 15 seconds. The SET button will then have to be pressed again.



4. Ensure the black line is above month timer (left side). This line can be switched from side to side by pressing the PWR/STG button when the monitor is in set mode.

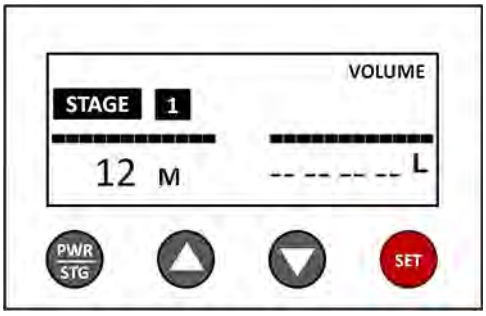


5. Use the arrow buttons to set the value to 12 months.

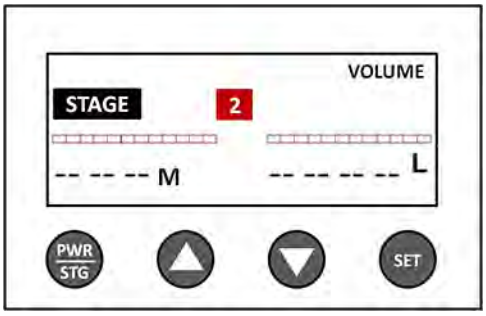


*MUST change Stage 1, 2, 3, UV light and batteries in the main monitor ANNUALLY!

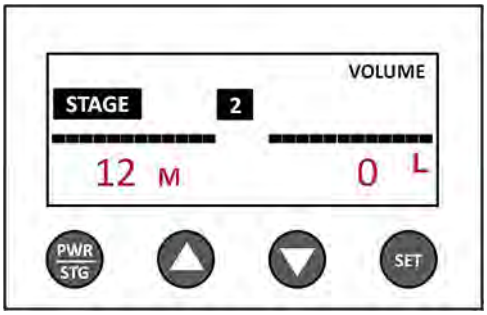
6. Hold down the SET button until you hear 2 beeps. This will save the 12-month setting, and will turn off the set mode.



7. Press the PWR/STG button to get to Stage 2. **Deactivate the months and Liters timers**. If the screen looks like the one on the top, skip to Step 16. If there are numbers for months and liters (for example, like the screen on the bottom), **go to Step 8**.

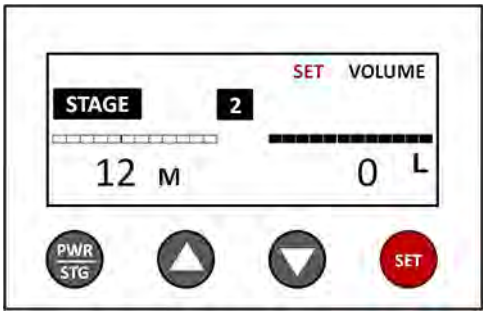


(Go to Step 16)

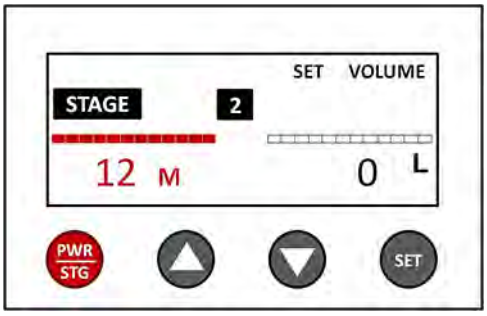


(Go to Step 8)

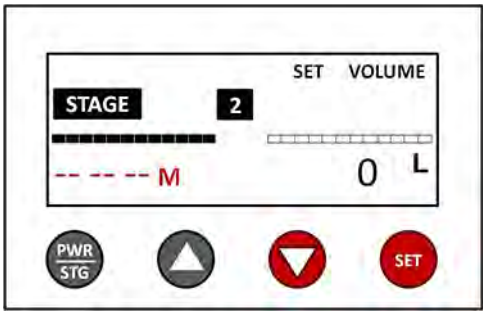
8. Press the SET button to enter set mode.



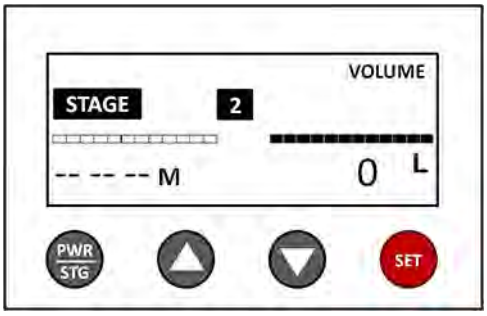
9. Make sure the black bar is over the month value by pressing PWR/STG.



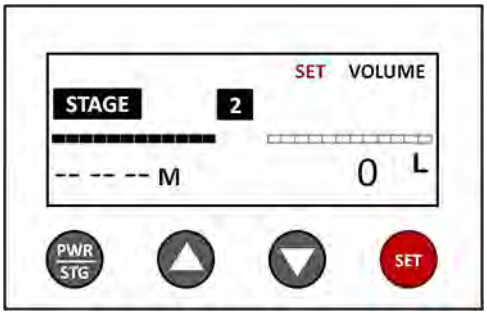
10. Hold the SET and Down Arrow buttons at the same time until you hear a beep. This will deactivate the month timer, showing dashes in the months display.



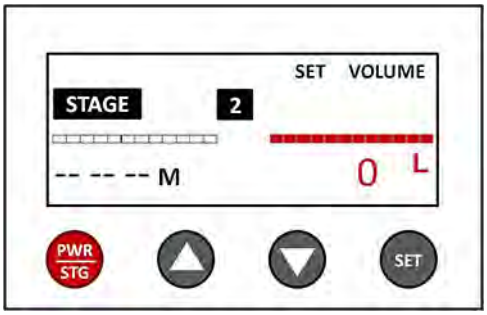
11. Hold down the SET button until you hear 2 beeps. This will save the deactivated month setting.



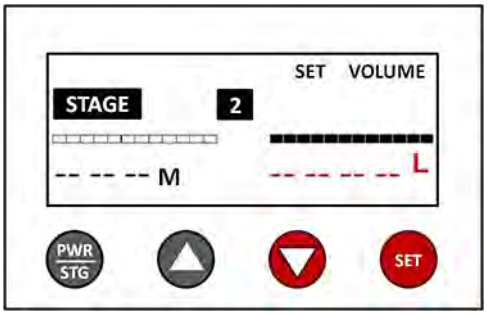
12. If there is a Liter value present in this Stage, press the SET button to go back into set mode.



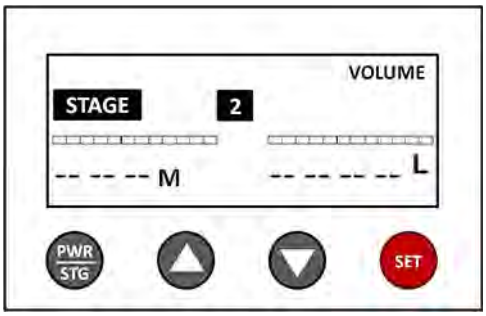
13. Press PWR/STG to get the black bar over the Liters display.



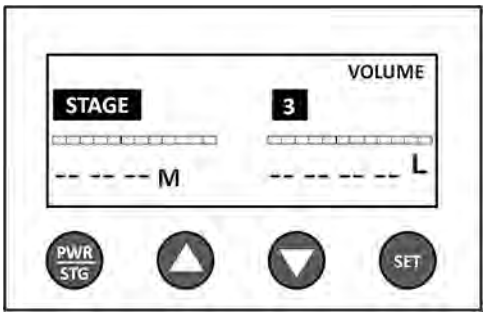
14. Hold the SET and Down Arrow buttons at the same time until you hear a beep. This will deactivate the Liter timer, showing dashes in the Liter display.



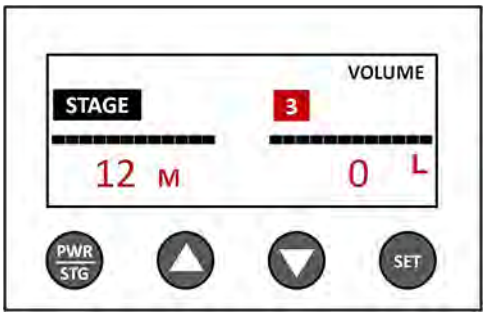
15. Hold down the SET button until you hear 2 beeps. This will save the deactivated Liter setting and get out of set mode.



16. Press PWR/STG to get to **Stage 3**. As with Stage 2, the months and Liters timers need to be deactivated. If the screen looks like the one on the top, continue to **Step 17**. If there are numbers for months and liters (screen on the bottom), repeat Steps 8-15. The steps are identical, except that it is for Stage 3 instead of Stage 2.

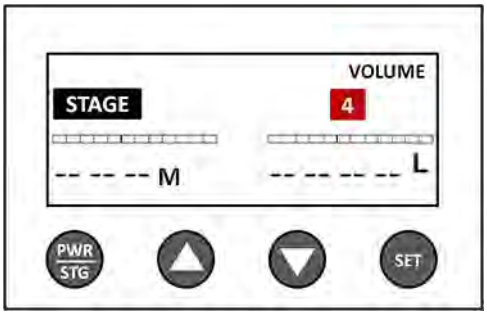


(Go to Step 17)

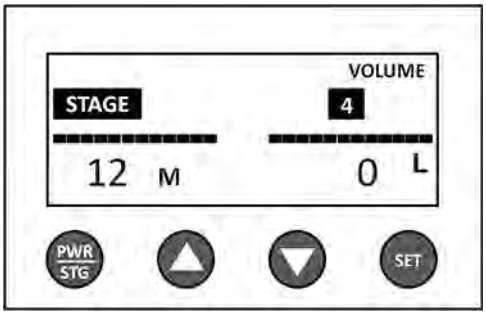


(Go to Step 8)

17. Press PWR/STG to get to **Stage 4**. As with Stages 2 & 3, the months and Liters timers need to be deactivated. If the screen looks like the one on the top, continue to Step 18. If there are numbers for months and liters (screen on the bottom), repeat Steps 8-15. The steps are identical, except that it is for Stage 4 instead of Stage 2.

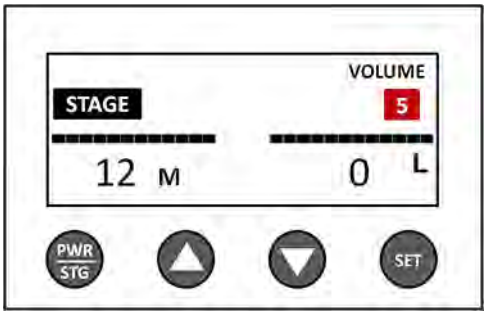


(Go to Step 18)

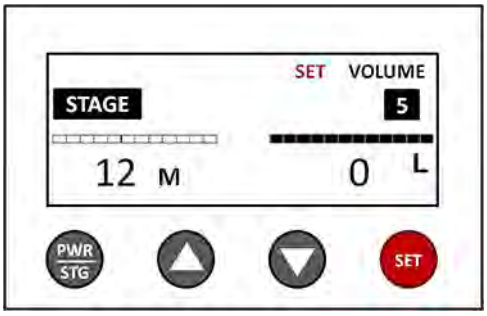


(Go to Step 8)

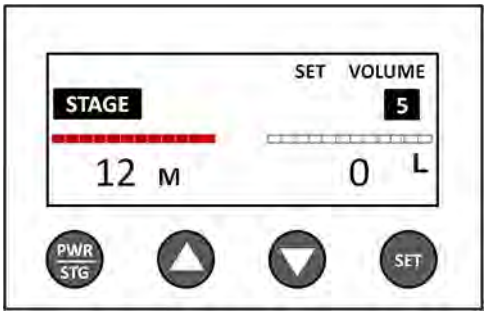
18. Press PWR/STG to get to **Stage 5**.



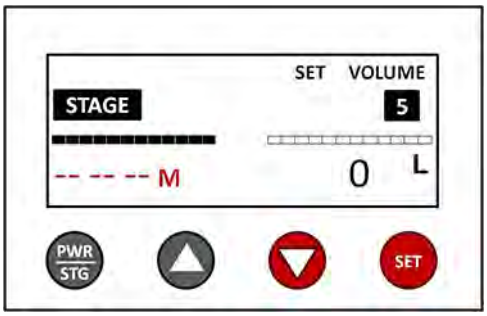
19. Press the SET button to enter set mode.



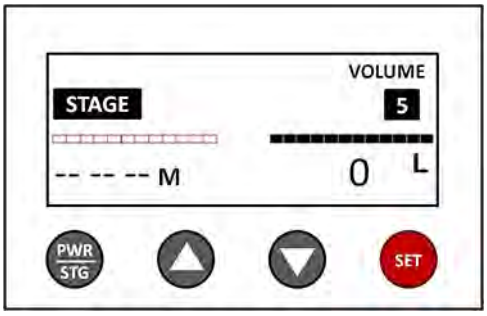
20. Make sure the black bar is over the month value by pressing PWR/STG.



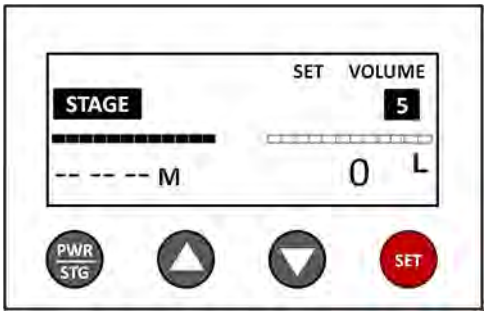
21. Hold the SET and Down Arrow buttons at the same time until you hear a beep. This will deactivate the month timer, showing dashes in the months display.



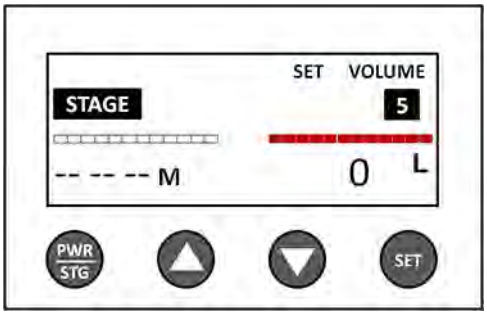
22. Hold down the SET button until you hear 2 beeps. This will save the deactivated month setting.



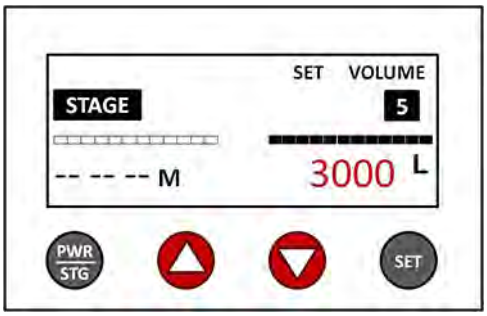
23. Press the SET button to go back into set mode.



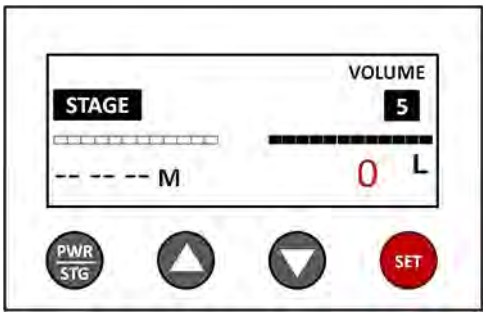
24. Press PWR/STG to get the black bar over the Liters display.



25. Use the Up Arrow key to adjust the Liters to the value labeled on your Stage 5 Cartridge (1,000, 3,000, 7,000, or 10,000 L). The arrows can be held down to speed up the process.



26. Hold SET until you hear two beeps. This will save the Liter setting, and will exit set mode. The display will show 0 L. **THIS IS NORMAL**. The Liter clock starts from zero, and will count upwards to the set value (3000 L in this example).



27. You are now done. Hold the PWR/STG button to turn off the monitor and save battery life.

CONGRATULATIONS!
You have successfully programmed your monitor!

Please feel free to contact Sterisil, Inc. at 719-622-7200 with any questions or visit us online at Sterisil.com.

12

The role of HPC in managing the treatment and distribution of drinking-water

W. Robertson and T. Brooks

12.1 INTRODUCTION

Safety, quality and quantity are of foremost concern when managing drinking-water supplies. Any number of approaches can be taken to ensure effective management during drinking-water treatment and distribution. The focus of this chapter will be on one specific water quality measurement that can be used in a management strategy: the test for heterotrophic plate count (HPC) bacteria.

The use of HPC bacteria, also known as colony counts and previously known as standard plate count bacteria, as an indicator for drinking-water quality dates back to as early as the 1800s. Even at that time, it was known that enteric bacteria were the

 Heterotrophic Plate Counts and Drinking-water Safety. Edited by J. Bartram, J. Cotruvo, M. Exner, C. Fricker, A. Glasmacher. Published by IWA Publishing, London, UK. ISBN: 1 84339 025 6.

cause of many significant illnesses, but HPC bacteria were used as surrogate indicators because of a lack of specific detection methods for the enteric organisms. With recent advancements in specific methodologies, such as defined-substrate media for *Escherichia coli*, the applicability of HPC in the treatment and delivery of drinking-water needs to be clarified. The information presented in this chapter summarizes the current uses of HPC and is intended to elucidate the logical role of these measurements in treatment plants and distribution systems as part of drinking-water management strategies.

12.2 HPC BACTERIA IN WATER TREATMENT PLANTS

HPC has a long history as a water quality indicator. Over the decades, interpretation of HPC results has shifted from indicating drinking-water safety to a role in determining drinking-water quality. At present, measuring HPC bacteria in water during treatment and immediately upon leaving the treatment plant can be used by plant operators as one of several routine tests to monitor plant operation. Other tests include those for coliform bacteria, turbidity and chlorine residuals. The latter two tests are preferred because they provide real-time information on water quality and treatment processes, whereas HPC measurements can take as long as seven days before they become available. For day-to-day management of plant operations, the waiting time for HPC results renders it impractical.

HPC measurements can play an important role in validation and verification of treatment plant procedures. Validation is used to ensure that any novel or existing treatment process or disinfection practice is operating effectively. For example, HPC can be used as a research tool when designing and testing new or redesigned water treatment systems. Alternatively, verification measures the overall performance of the system and provides information about the quality of the drinking-water. Neither validation nor verification is suitable for continuous control of drinking-water quality; hence, the lag time involved in testing is acceptable. Water utilities can generally achieve heterotrophic bacteria concentrations of 10 cfu/ml or less in finished water (Fox and Reasoner 1999). Low and consistent levels of HPC bacteria in the finished drinking-water add assurance that the treatment process is working properly. Other indicator bacteria, such as *E. coli*, thermotolerant coliforms or total coliforms, should not be found when HPC levels are low, since they are more susceptible than heterotrophic bacteria to disinfection.

An increase in HPC bacteria in finished water above recommended concentrations can indicate a problem with treatment within the plant itself or a change in the quality of the source water being treated. When this occurs, the quality of the finished drinking-water is questionable, and appropriate actions should be taken to ensure that the problem is identified and corrected.

12.3 HPC BACTERIA IN WATER DISTRIBUTION SYSTEMS

As expected, when high HPC levels are found in the water leaving the treatment plant, the HPC levels in the distribution system are usually also high. When the water leaving the treatment plant contains acceptable levels of HPC bacteria but levels in the distribution system water are above the recommended limit, this usually indicates bacterial regrowth occurring in the distribution system. Bacterial regrowth refers to the proliferation of viable organisms present in the water after drinking-water treatment, including the recovery and growth of organisms that were previously injured during the water treatment process. As stated earlier, heterotrophic bacteria acquire nutrients from their surroundings to survive and grow. Biodegradable organic matter (BOM) and assimilable organic carbon (AOC) that are not removed during the treatment process can provide nutrients for bacterial regrowth. Elevated concentrations of BOM can also place a higher demand on the disinfectant being used. In the case of chlorine, chlorine dioxide and chloramine, increased demand can lower the effective concentration of residual disinfectant. At lower disinfectant concentrations, the heterotrophic flora is less adversely affected by the disinfectant residual and better able to proliferate within the distribution system. When ozonation is used as the disinfection process, as is widely popular in Europe, the overall organic carbon levels are reduced but the AOC concentrations are increased, promoting bacterial regrowth in distribution systems (Escobar *et al.* 2001).

The distribution system referred to throughout this section consists of two distinct components: the complex network of pipes transporting water from the treatment plant to buildings and the internal plumbing systems of the structures themselves. Interpretation of HPC measurements differs in these two components. In the external distribution system, HPC testing can identify problem zones where bacterial regrowth is occurring. General regrowth is not of direct significance to public health but can contribute to the deterioration of physical water qualities such as taste and odour. High HPC measurements can occur during a contamination event where a health risk is possible, but HPC measurements are not the preferred indicator of this event. In this situation, faecal indicators, such as *E. coli*, are better markers of recent contamination, as they are unable to grow in the system. High HPC measurements within building plumbing systems may also be caused by bacterial regrowth or by contamination events. In this component, the necessary response will be dependent on the use of the building. All buildings should have water safety plans (WSPs) put into practice, but the actions recommended in these plans will vary, depending on the building. In health care facilities, for example, in-

building WSPs should detail the actions necessary when bacterial regrowth is detected. Although general bacterial regrowth is not a public health concern, in vulnerable populations, such as immunocompromised individuals, some heterotrophic bacteria can cause illness. In general, regrowth bacteria are respiratory pathogens and not pathogens associated with gastrointestinal illnesses. For example, *Legionella pneumophila*, the major cause of Legionnaires' disease, has the ability to regrow in building plumbing systems and infect susceptible populations. Although high HPC measurements have not been found to correlate with illness incidence and no outbreaks have been directly linked to elevated concentrations of HPC bacteria in tap water, they do indicate favourable conditions for bacterial growth and should be remedied.

The density of HPC bacteria reached in the distribution system can be influenced by numerous parameters, including the bacterial quality of the finished water entering the system, temperature, residence time, presence or absence of disinfectant residual, construction materials, surface-to-volume ratio, flow conditions and, as stated above, the availability of nutrients for growth (Prévost *et al.* 1997; Payment 1999). Biofilm formation within water distribution networks provides protection for bacteria by shielding them from chlorine and other disinfectants. In addition to the nutrients available in the water, the biofilm can also contain a readily available supply of nutrients to help maintain viability and promote regrowth (Gavriel *et al.* 1998). Drinking-water, in the absence of a free chlorine residual and in the presence of high turbidity and elevated temperatures, has been found to contain as much as 10 000 cfu/ml of HPC bacteria (Payment 1999).

12.4 HPC BACTERIA IN WATER TREATMENT DEVICES

Health Canada, the US Environmental Protection Agency (EPA), the US Consumer Product Safety Commission and the Italian government have all, at one time or another, proposed banning activated carbon filters used in home drinking-water treatment devices because of the growth of HPC bacteria on the carbon media and subsequent rises in HPC counts in the filtered water (Regunathan and Beauman 1994). After further study, however, all four decided against banning the filters. At Health Canada, the decision was made following consultations with stakeholders and was based on the absence of evidence of any illness linked to such devices. This decision was taken with the proviso that the manufacturers and distributors of activated carbon filters agree to take steps to help prevent the use of these devices on microbially unsafe waters or waters of unknown quality. In addition to growth on the carbon filter, it was shown that the filter media of some new commercial filters were already contaminated with

bacteria and moulds even before being installed in homes (Daschner *et al.* 1996).

Similar to water distribution systems, increased levels of HPC are not generally a health concern in drinking-water treatment devices. Some experimental evidence has shown that the presence of heterotrophic bacteria in point-of-use (POU) and point-of-entry (POE) devices may be beneficial, since ordinary bacterial growth may reduce the number of disease-causing organisms through dilution, competition or predation inside the treatment device — i.e., in carbon filters, resin beds, bladder tanks, etc. (Rollinger and Dott 1987). A US patent was granted for the development of granular activated carbon (GAC) filters containing additives intended to encourage the proliferation of beneficial bacteria inside the filter for health purposes (Lewis and Michaels 1993). This included the intentional inoculation of filters with beneficial bacteria such as those found in yoghurt, as well as providing support for ordinary HPC organisms that are native to the aquatic environment, specifically for the purpose of inhibiting the growth of pathogens inside the filter. These beneficial effects have not been observed in distribution systems where HPC increases are undesirable because of water quality issues related to regrowth and lowered disinfectant residuals. A properly maintained and operated treatment device should not have water quality problems associated with regrowth bacteria. Some heterotrophic bacteria are secondary pathogens, meaning that they can be problematic for immunocompromised individuals. These organisms may grow in the treatment devices. In most cases, these secondary pathogens are associated with inhalation and wound infections and are not a concern for water treatment devices used solely for consumption.

12.5 HPC BACTERIA IN BOTTLED WATER

In bottled waters, the HPC bacteria can grow to high concentrations within a few days of bottling. In a quantitative study of bacterial populations in mineral water, HPC bacteria (following incubation at 22 °C) increased from the initial 10^1–10^2 cfu/ml found in the source water to 10^5–10^6 cfu/ml in the bottled water after three days of storage. The bacterial growth was not stopped even when the water was stored at 6 °C (Gonzalez *et al.* 1987). There do not appear to have been any outbreaks of infectious illness associated with high concentrations of HPC bacteria in bottled waters.

12.6 STANDARDS AND GUIDELINES

The current standards or guidelines for HPC bacteria in tap water vary slightly between different nations. In general, HPC monitoring is used as a tool to gain information on the water treatment process and the general bacteriological quality of the water leaving the water treatment plant and within the distribution system. Examples of specific guidelines from several countries and agencies are listed below. The current requirements for bottled water are also included for each country.

12.6.1 World Health Organization (WHO) guidelines

The WHO *Guidelines for Drinking-water Quality* (WHO 1996) list HPC bacteria as an indicator of the general bacterial content of the water at incubation temperatures of 22 °C and 37 °C. [Editors' note: A revised third edition of the WHO *Guidelines for Drinking-water Quality* will be finalized in 2003.] Within the WHO drinking-water guidelines, HPC results at 22 °C are described as being of little sanitary value, but are a good indication of the efficiency of water treatment, specifically the processes of coagulation, filtration and disinfection, where the objective is to keep counts as low as possible. Also, these results may be used to assess the cleanliness and integrity of the distribution system and the suitability of the water for use in the manufacture of food and drink, where high counts may lead to spoilage. An increase in HPC bacteria recovered at 37 °C compared with those normally found may be an early sign of pollution, especially if it is not accompanied by a similar rise in HPC numbers at 22 °C. Sudden or progressive increases in HPC results in piped water may indicate enrichment of the water with AOC in a catchment or may be due to ingress in distributed water. In treated drinking-water that is not biologically stable, regrowth associated with increases in water temperature is frequent and can lead to taste and odour problems. It is suggested that an increase at 37 °C should prompt an investigation of the treated supply or of the catchment if the water is untreated. The draft revised WHO guidelines include recommendations for large buildings, including health care facilities, with respect to regrowth organisms that are a potential health concern, such as *Legionella*. The guidelines recommend implementation of preventative WSPs. These plans should specify adequate control measures previously shown to be effective in ensuring water quality and safety.

Although no specific numerical guidelines are recommended for HPC bacteria in drinking-water, it is suggested that they be maintained at the lowest level possible for aesthetic reasons and as a demonstration of treatment sufficiency.

The Codex Alimentarius Commission (1994) develops some bottled water standards, specifically those for natural mineral waters. These standards are developed based on the WHO *Guidelines for Drinking-water Quality*. The Codex Alimentarius Commission is also developing a draft codex for packaged water other than mineral waters. Currently, only the WHO *Guidelines for Drinking-water Quality* are applied to the latter products, and therefore the same HPC requirements are used as stated above.

12.6.2 European guidelines

In Europe, the current drinking-water guidelines in many countries (pertaining to water intended for human consumption) are based on recently revised directives from the European Union (1998). The current recommended microbiological standards include HPC limits for private supplies, i.e., no significant increase over normal levels when incubated at 22 °C and 37 °C, and for bottled water within 12 h of bottling, i.e., 100 cfu/ml when incubated at 22 °C for 72 h and 20 cfu/ml when incubated at 37 °C for 48 h (Barrell *et al.* 2000). Although the previous EU Council Directive specified non-mandatory numerical limits for HPC bacteria, the current EU directives do not specify numerical limits for HPC bacteria in public supplies but rather recommend no abnormal change when incubated at 22 °C.

12.6.3 United Kingdom regulations

The United Kingdom Water Supply (Water Quality) Regulations (Anonymous 2000) require colony count testing on water taken from public supplies, private supplies and bottled water as part of their required microbiological monitoring, based on the directives set by the European Union. Testing locations include treatment works, service reservoirs and water supply zones. For public water supplies, i.e., those that are provided by water purveyors via mains distribution systems, and private supplies, no maximum allowable value for HPC is set, but the regulations do state that there should be “no abnormal change” — i.e., measurements should show no sudden and unexpected increases as well as no significant rising trend over time.

The regulations for HPC in bottled waters in the United Kingdom are the same as those stated in the European Union directive above (Anonymous 1999).

12.6.4 German regulations

Similar to other countries, the German Drinking Water Regulation requires HPC monitoring of public water supply systems. This regulation is enforceable prior to individual consumer water meters but does not apply to water within the consumer's system. Water quality at the consumer's taps is included in other public health regulations.

The German Drinking Water Regulation states that drinking-water can contain no more than 100 cfu/ml of HPC bacteria (Hambsch 1999). Included in the law is the standard method required for HPC analysis. It specifies incubation temperatures of 20 °C and 36 °C for a period of 48 h on defined substrate media. The standardized method was integrated into the law to allow for comparison of HPC results.

12.6.5 Canadian guidelines

Drinking-water quality guidelines in Canada are established by the Federal-Provincial-Territorial Committee on Drinking Water. These guidelines (Health Canada 1996) are not enforceable by law but are developed for use by each province and territory for setting provincial standards. Because drinking-water regulations fall under provincial and territorial jurisdiction, the enforceable standards may vary between provinces and territories.

The current *Guidelines for Canadian Drinking Water Quality* do not specify a maximum allowable concentration for HPC bacteria but recommend that HPC levels in municipal drinking-waters should be less than 500 cfu/ml. If the acceptable HPC value is exceeded, an inspection of the system should be undertaken to determine the cause of the increase in heterotrophic bacteria. After analysis of the situation, the guidelines recommend that appropriate actions should be taken to correct the problem and special sampling should continue until consecutive samples comply with the recommended level. Originally, the HPC guideline was established not to directly protect human health; instead, it was based upon the knowledge that higher counts of heterotrophic bacteria interfered with the lactose-based detection methods used for total coliform bacteria. New total coliform methods, such as those using media containing chromogenic substrates, are not affected by high numbers of heterotrophic bacteria and therefore do not require a set upper limit for HPC. Under these circumstances, water treatment plant operators are encouraged to use HPC bacteria as a quality control tool.

Bottled water in Canada falls under the jurisdiction of the Canadian Food Inspection Agency and is regulated by the *Food and Drugs Act* (Health Canada 2000). These regulations do not require monitoring of HPC bacteria in water

represented as mineral water or spring water. Mineral water and spring water are defined as potable waters obtained from an underground source, but not obtained from a public community water supply, that have undergone no chemical modification with the exception of allowable addition of carbon dioxide, fluoride and ozone. All bottled water not designated as mineral water or spring water must contain no more than 100 cfu/ml of heterotrophic bacteria (referred to as total aerobic bacteria within the *Food and Drugs Act*). The official testing method is outlined in method MFO-15 (Health Canada 1981).

12.6.6 Regulations in the USA

Regulations for drinking-water quality from both private systems and public water utilities in the USA are provided by the US EPA. Drinking-water is under federal jurisdiction, so these regulations are enforceable across the country.

In the USA, acceptable HPC levels in municipal drinking-water have been set at less than 500 cfu/ml. Historically, as is the case in Canada, this level was recommended because higher colony counts interfered with the detection of total coliforms in lactose-based tests. During the development of the Surface Water Treatment Rule, it was decided that maintaining an HPC concentration below the allowable 500 cfu/ml limit could be used as a substitute for maintaining a detectable disinfection residual (US EPA 1989). More recently, the US EPA's National Primary Drinking Water Standards (US EPA 2001) express HPC as a method of measuring the variety of bacteria present in a water sample but with no health significance. In this secondary standard, no maximum contaminant level goal is set, but the maximum contaminant level is still 500 cfu/ml. This is not an enforceable federal standard.

Other agencies, such as the American Water Works Association, have not recommended an operating level or goal for HPC bacteria in drinking-water. They do recommend minimizing HPC levels in water leaving the treatment plant and for water in the distribution system. It is suggested that each utility should establish baseline data for their water source based on at least two years of sampling of plant effluent, points of mean residency time in the distribution system and problem areas, such as dead-end reservoirs and sites downstream from pressure-reducing valves (AWWA 1990).

In the USA, bottled water is monitored by the Food and Drug Administration, and no HPC standards have been established (FDA 2001).

12.6.7 Australian guidelines

As in other countries mentioned previously, HPC is used as an indicator of general water quality. HPC results can be used to assess the water treatment process specifically for assessing coagulation, filtration and disinfection, since these processes reduce the bacteria present. Measuring HPC is also useful for determining the cleanliness and integrity of the water distribution system and for determining the suitability of the water for processing food and drinks where high bacterial content could lead to spoilage. The Australian drinking-water guidelines (National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand 1996) have set acceptable HPC (incubation at 35–37 °C for 48 h) limits at less than 100 cfu/ml for disinfected supplies and at less than 500 cfu/ml for undisinfected supplies. If colony counts exceed these recommended limits, remedial action (including cleaning storage tanks and inspection and repair of distribution systems) should be taken. The Australian guidelines also recommend identifying dominant bacterial species in the case of regrowth problems in the distribution system.

Bottled water in Australia is the responsibility of the Australian New Zealand Food Authority (2001), and it has set no HPC limits.

12.6.8 Regulations in other countries

Many countries, in addition to those described in detail above, include HPC testing as a routine method for measuring water treatment efficiency and, therefore, water quality. For example, the Netherlands has set limits for HPC bacteria in drinking-water of 100 cfu/ml following 48 h of incubation at 22 °C (Anonymous 2001). The Japanese drinking-water quality standard also includes a numerical limit of 100 cfu/ml (National Institute of Health Sciences 2002).

12.7 CONCLUSIONS

The role of HPC measurements has changed since the method was first introduced in the 1800s as a public health indicator. As science advanced, specific indicators of health risk were introduced, and HPC monitoring became more useful as an operational rather than a health-based indicator. At present, within the water treatment plant, HPC results can be used for validation and verification of drinking-water production. Abnormal changes in HPC bacteria can be an indicator of problems in the treatment process. When this occurs, the quality of the finished drinking-water is questionable, and appropriate actions should be taken to ensure that the problem is identified and corrected. In the distribution system, in both the complex network supplying treated drinking-water and in the internal plumbing of buildings, HPC can

identify problem areas for regrowth. Regrowth can cause aesthetic problems involving tastes and odours, discoloured water and slime growths. Drinking-water within the distribution system should comply with applicable standards and guidelines. All of the guidelines or standards reviewed in this chapter for private and public drinking-water recommend HPC bacteria levels of no more than 100 or 500 cfu/ml or no appreciable change in the concentration of heterotrophic bacteria in the system.

As mentioned previously, HPC is not an indicator of health risk, but can indicate problem areas for regrowth. In plumbing systems of buildings such as health care facilities, where the clientele includes immunocompromised individuals, some regrowth organisms, such as *Legionella*, are a health concern. Although high HPC measurements have not been found to correlate with illness incidence, they do indicate favourable conditions for bacterial growth and should be remedied.

Bottled water, for the purpose of drinking-water, does not follow the same guidelines as those set out for municipal and private water supplies. In many countries, bottled water is considered under food and drug regulations. Monitoring for HPC in bottled water products depends on the specific nation and on the source of the bottled water.

12.8 REFERENCES

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Future Smiles - Clark High School
Radiation Protection Program

This program is applicable to all persons working under Nevada Radiation Machine Registration Number(s):

- 00-02-4546-01

Purpose:

To protect employees, patients, visitors and the public from unnecessary exposure to radiation; to limit all exposures below the thresholds specified in Chapter 459 of the Nevada Administrative Code

To follow the principle of ALARA. Consistent with NAC 459.0205 all operators within Future Smiles will follow the principles of ALARA, As Low as Reasonably Achievable. To that end, we will make every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical. Their diligence will be consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety and other societal and socioeconomic considerations.

Methods of Compliance:

Our office will, at no charge to the employee, provide the following:

- Personnel monitoring equipment if the potential level of radiation exposure to the worker is as much as 10% of the annual dosage limit specified in the regulations
- Personnel monitoring devices to women who have declared their pregnancy consistent with NAC 459.1156
- Protective clothing including, but not limited to:
  - Lead Aprons
  - Thyroid Shields

A survey consistent with NAC 459.337 shall be completed using personnel or area monitoring devices to determine exposure levels. These monitoring devices will be used according to manufacturer's recommendation.

In addition, our staff will employ shielding and distance measures to minimize the exposure potential. Finally, our staff will take all necessary measures to prevent any member of the public from entering a restricted area, and from being unnecessarily exposed to radiation or radioactive material.

Note: The patient is not a member of the public when undergoing a procedure involving the diagnostic or therapeutic use of radiation or radioactive materials.

Employee Responsibilities:

Each employee of Future Smiles will, at minimum, assume the following responsibilities in accordance with NAC 459.5595:

- Study and learn the instructions provided by Future Smiles, as the registrant or licensee
- Implement all safety procedures in daily work to avoid unnecessary exposure to radiation
- Prevent, to the extent possible, any unnecessary radiation exposure to a fellow worker, or to a member of the public
- Sign a statement that he/she is required to:
  - Study the instructions provided by Future Smiles and associated regulations
  - Reviewed the operating potential and exposure time for each procedure and for each piece of equipment
  - Operator protection
  - Patient shielding and positioning
  - Had any questions about these matters answered to his/her satisfaction by the registrant or licensee

Pregnancy:

The declaration of a woman who has declared her pregnancy remains in effect until the woman making the declaration:

- Withdraws the declaration in writing; or
- Is no longer pregnant.

Except as otherwise provided in NAC 459, Future Smiles shall ensure that the dose equivalent to an embryo during the entire pregnancy, resulting from occupational exposure of a woman who has declared her pregnancy, does not exceed 0.5 rem (5 millisieverts).

Our office will make efforts to avoid any substantial variation from a uniform monthly exposure rate to a woman who has declared her pregnancy so as to satisfy the limits specified NAC 459.

The dose equivalent to an embryo is the sum of:

- The deep-dose equivalent to the woman who has declared her pregnancy
- The dose equivalent to the embryo resulting from radionuclides in the embryo and radionuclides in the woman who has declared her pregnancy.

If, by the time a woman declares her pregnancy to Future Smiles, the dose equivalent to the embryo has exceeded 0.5 rem (5 millisieverts), or is within 0.05 rem (0.5 millisievert) of that dose, Future Smiles shall be deemed to be in compliance with subsection 1 if the additional dose equivalent to the embryo does not exceed 0.05 rem (0.5 millisievert) during the remainder of the pregnancy.

All records of personnel monitoring results will be kept indefinitely.

Handheld Portable Equipment

In addition to the aforementioned requirements, if hand held portable equipment is used and the following will also be implemented:

- If portable equipment is used, and the device is hand held, the following will always be provided
  - Thyroid shields
  - Whole body and extremity monitoring devices (e.g. collar and ring dosimeters)
- All records of personnel monitoring results will be kept indefinitely.
- All employees of Future Smiles who operate hand held portable equipment will receive specific training on their use and operation during annual training. This training will include, but is not limited to the following:
  - Proper positioning of the device to ensure adequate protection positioning
  - Limitations of the use of position indicating devices that require longer distances to the face of the patient
  - Diagrams of the protected position and location in relationship to the device
  - Diagrams of the effect of improper distance or removal of the shielding device
  - Diagrams of the common examples of improper positioning of the device or location of the operator

Our office has developed a written security policy to ensure the safe use and storage of our hand held portable equipment. This policy will include, at minimum the following:

- Each device will be stored in a secured location when not in use
- Each device will only be used for its designed purpose as specified by the manufacturer
- Each device will be maintained and serviced in accordance with the manufacturer's recommendations
- Each device will only be used at the location where it is registered
- Each device that is hand held must comply with the applicable performance standards of 21 CFR 1020 to 1020.40, inclusive which were in effect at the time that our unit was manufactured

Our hand held portable equipment will be secured in file cabinet in the bottom drawer when not in use. The equipment will be secured with Hygienist on duty. all staff is in charge of access to this equipment.

If at any time Future Smiles should sell, lease, transfer, lend, or dispose of our hand held portable equipment, we will notify the Division within 15 days and provide the information required by NAC 459.166.

ProSeal II™
Portable Sealant Unit
ProQuest I and II™
Portable Delivery Units

OPERATION MANUAL

DNTLworks Equipment Corporation
7300 South Tucson Way
Centennial, Colorado 80112 USA

Toll Free: (800) 847-0694
Main: (303) 693-1410
Fax: (303) 693-6189

Contents

Introduction

Thank you for purchasing the ProSeal II™ or ProQuest I or II™ Portable Delivery Unit from DNTLworks Equipment Corporation. The information contained in the manual should answer any questions regarding service and operation of your ProSeal II™ or ProQuest I or II™ unit.

All authorized personnel who operate, maintain, or service your ProSeal II™ or ProQuest I or II™ unit should carefully review this manual before attempting to operate, perform maintenance on or service the unit. Your ProSeal II™ or ProQuest I or II™ unit should be operated and maintained by trained personnel only. Should questions or problems arise, contact our Customer Service Department.

Although your ProSeal II™ or ProQuest I or II™ unit has been designed and tested for maximum safety and optimum performance, it is sold with the express understanding that DNTLworks, its subsidiaries, agents and representatives will not accept any responsibility for the following, including, but not limited to:

1) Operator's lack of knowledge, negligence or carelessness in the operation of this equipment.
2) Equipment not properly maintained or serviced.
3) Injury to personnel or patients from improper use.
4) Modification or tampering of any kind.

Customer Service

In the event you require assistance with your unit, please call 1-800-847-0694 or 303-693-1410 and speak with one of our customer service representatives. Our service hours are from 8:00 a.m. to 5:00 p.m., Mountain Standard Time, Monday through Friday.

In most instances, service problems may be solved over the telephone. If service is required, you may ship the unit to our manufacturing facility for repair. Warranty service will be performed in accordance with the DNTLworks' Limited Warranty. Non-warranty service will be provided at reasonable parts and labor costs.

DNTLworks Limited Warranty

DNTLworks warrants to the purchaser that these products are free of defects in materials and/or workmanship for three (3) full years from date of delivery, on a "parts only" basis. In addition, DNTLworks extends a ninety (90) day labor warranty from the date of delivery for all products we manufacture. Shipping charges incurred to the factory under warranty purposes will be the responsibility of the owner.

During the warranty period, all parts which, upon inspection and examination by DNTLworks, are proven to be defective, will be replaced free of charge. All decisions concerning whether a part will be repaired or replaced and the manner, method, and extent of such repair or replacement will be at the sole discretion of DNTLworks. The responsibility of DNTLworks does not include repair and replacement cost resulting from misuse, abuse, improper maintenance, or normal wear and tear.

DNTLworks will pay for labor costs for warranty service for a period of 90 days from the date of purchase. DNTLworks sole obligation under said warranty is to repair, or, at its option, replace the defective part. The buyer will have no options.

Warranties for products not manufactured by DNTLworks, but sold in combination with DNTLworks products, will be honored by DNTLworks for the entire duration of the original manufacturer's warranty period.

The warranty will be voided by alterations, tampering with, improper installation or maintenance, accident or modification of the equipment, with the exception of work performed by DNTLworks or one of its authorized service agents. This warranty expressly excludes all damage to the products resulting from careless or neglectful transportation. DNTLworks will in no event be responsible for any work done without first obtaining DNTLworks' written consent.

This warranty is made expressly in lieu of all other warranties, expressed or implied, including any implied warranties of merchantability or fitness for a particular purpose. No employee, agent, franchise, dealer or other person is authorized to give any warranties of any nature on behalf of DNTLworks. Except as provided herein, DNTLworks will have no liability or responsibility to the customer or any other person or entity with respect to any liability, loss or damage caused or alleged to be caused directly or indirectly by equipment sold, leased, or furnished by DNTLworks, including, but not limited to, any interruption of services, loss of business or anticipatory profits or consequential damage arising out of or connected with the sale, lease, use, or anticipated use of equipment. Notwithstanding the above limitations and warranties, DNTLworks liability hereunder for damages incurred by customer or other will not exceed the amount paid by customer for the particular equipment involved.

Returns

Purchased goods may not be returned without the express written consent of DNTLworks and a Return Goods Authorization Number (RGA#). All items must be returned within 14 days of initial delivery and are subject to a 15% restocking charge. Special order items cannot be returned for credit consideration. Freight charges on approved return items shall be borne by the customer.

Description of Unit

The ProSeal II™ is a lightweight, powerful sealant, prophy, and vacuum unit which allows the operator to irrigate and dry prepared surfaces, perform prophy treatments, and quickly aspirate liquid dental waste. This unit includes a non-water-capable lowspeed handpiece.

While visually similar to the ProSeal II™, the ProQuest I or II™ is equipped with a highspeed electric handpiece with water adjustment, enabling the operator to perform most dental procedures. The ProQuest II™ features fiber-optic capability. ProSeal II™ or ProQuest I or II™ units may be upgraded with a piezo-electric scaler.
The diagrams in this manual are of a ProQuest I™, and you will see notes of differences between the units.

Air System

The internal air compressor will activate when main power switch is turned on, filling the water container. The compressor will deactivate when air pressure reaches 80psi and will recycle at 50psi.

Water System

Water container should be filled 1/2 full. Water to handpieces is controlled by the foot control and the valves on the side of the unit (ProQuest I or II™ only). The water for the air/water syringe is controlled by depressing the water button on the syringe.

Vacuum System

The internal vacuum system is activated by removing saliva ejector valve or HVE from the holder. You may use either the saliva ejector or HVE as needed. Inside the vacuum container is an automatic shut down system to prevent spillage.

Electrical System

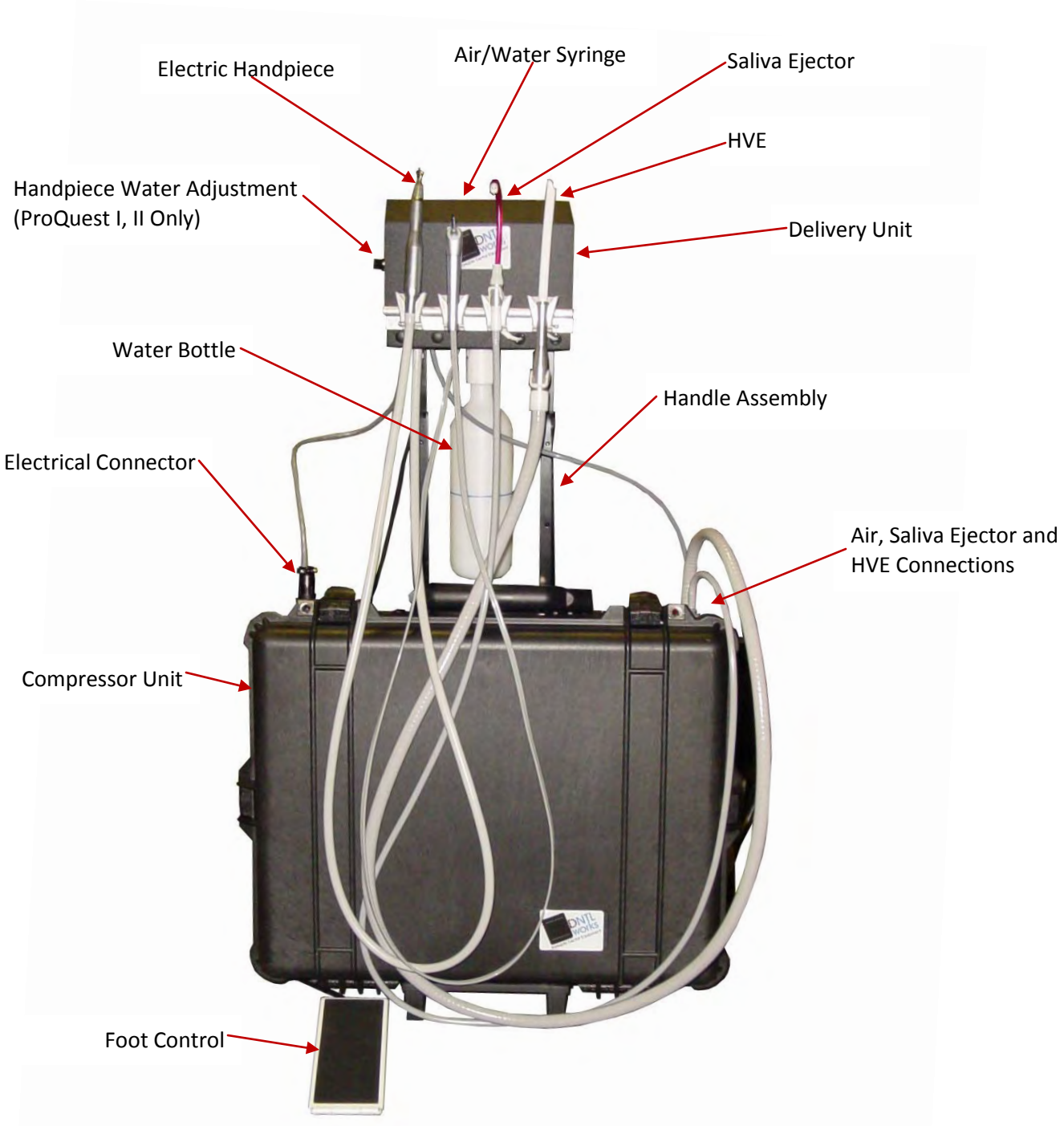
You may use a maximum of 3 amps on the optional external outlet. The unit is protected by a 15 amp circuit breaker.

Specifications

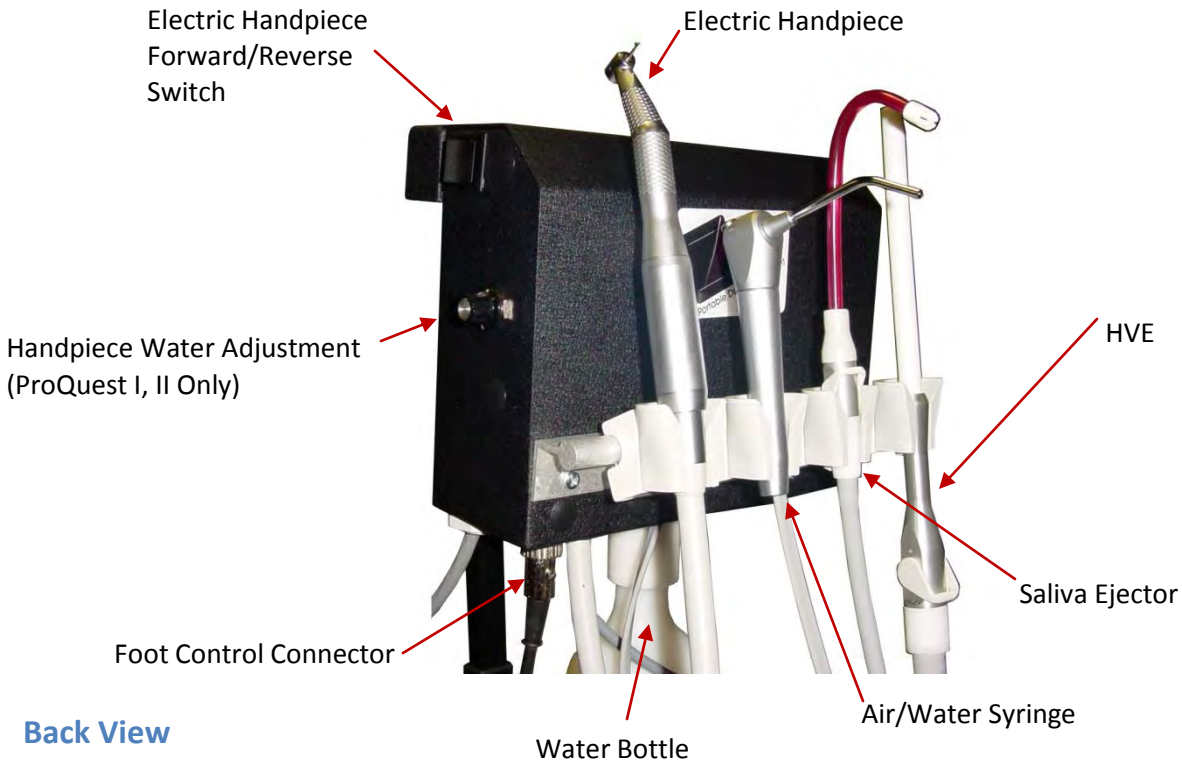
Description	ProSeal II	ProQuest I, II
Length	21.9” (55.6cm)	21.9” (55.6cm)
Width	8.4” (21.3cm)	8.4” (21.3cm)
Height	18” (45.7cm)	18” (45.7cm)
Total Weight	58lbs (26.3kg)	60lbs (27.2kg)
Voltage	115 or 220Vac	115 or 220Vac
Frequency	60 or 50 Hz	60 or 50 Hz
Wattage	1100 to 1440 W	1100 to 1440 W
Water Container	34oz (1liter)	34oz (1liter)
Sound Level Full Load	46dB @ 3’	46dB @ 3’
Case Type	Polypropylene	Polypropylene
Electric Handpiece	0-40,000rpm	0-160,000rpm
Compressor		
Horsepower	1/16 Hp	1/16 Hp
Working Pressure	50 to 80psi	50 to 80psi
Vacuum Pump		
Horsepower	1/3 Hp	1/3 Hp
Pressure	10 inHg	10 inHg
Flow Rate	4.6 scfm	4.6 scfm

Unit Features

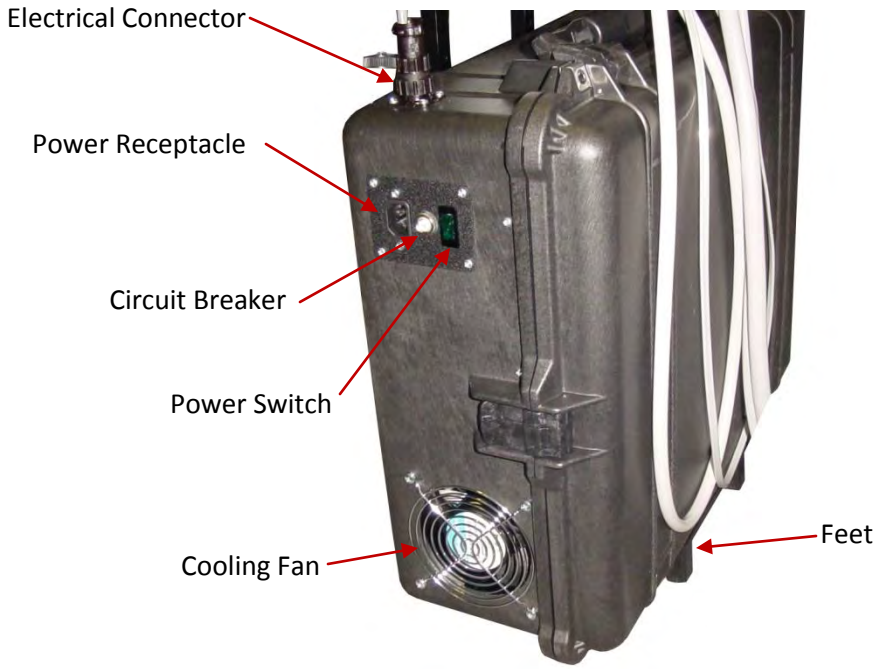
Front View



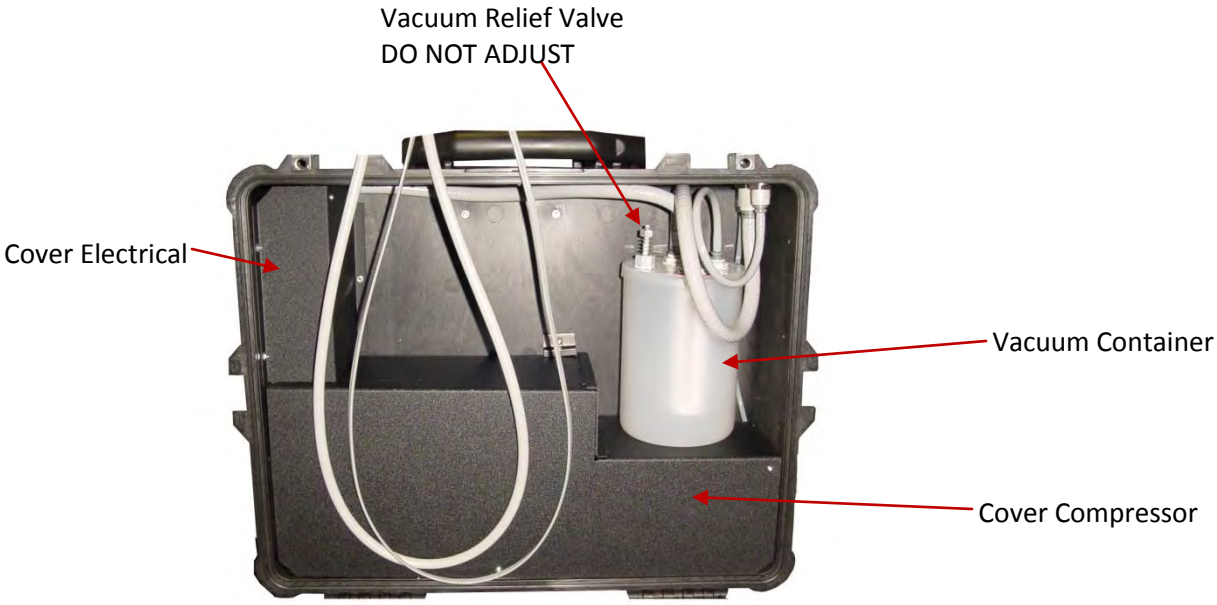
Front View



Back View



Inside View



Operation

Setup

 Unpack delivery unit.	Unpack water bottle. 
 Unpack foot control.	 Unpack power cord.

Unpack HVE and saliva ejector lines. 	Unpack handpieces. 
 Connect small vacuum line.	Connect large vacuum line. 
Close lid and extend handle. 	Install delivery unit. 
Connect electrical connector. 	 Connect air line.
 Place handpiece tubing and syringe in handpiece holders.	 Connect saliva ejector tubing.

Place saliva ejector in holder.

Connect HVE line.

Place HVE in holder.

Connect foot control.

Place foot control near the operator.

Fill water bottle to the blue line.
We recommend distilled water.

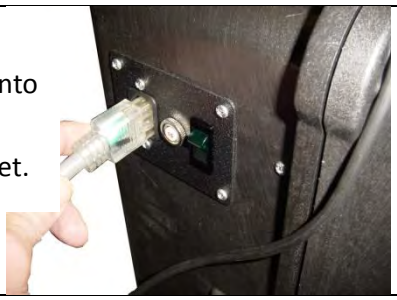
Install water bottle.

Connect handpiece motor to handpiece tubing.
Be careful not to cross thread handpiece tubing too handpiece motor.

Connect handpiece attachment to handpiece motor.

Place handpiece in handpiece holder.

Plug power cord into power receptacle and into wall outlet.



Turn on power switch.

Handpiece Operation

Remove handpiece from holder.

Depress foot control.

For handpiece coolant water, adjust water valve while depressing foot control. (ProQuest I,II Only)

You can change rotation of handpiece motor

Always clean handpieces between patients.
See Dental Office Infection Controls Guidelines CDC, below.

Three-way Syringe

Water only.

Air only.

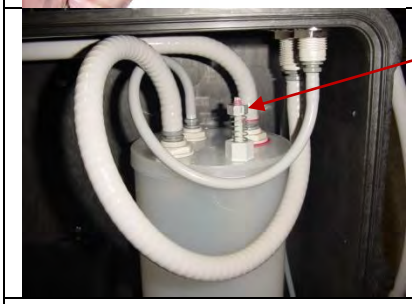
Air and water (mist).
You can use disposable syringe tip kits. (A-dec type disposable tip kit)
Always clean syringe between patients.
See Dental Office Infection Controls Guidelines CDC, below.

Vacuum System

When using either saliva ejector or HVE, make sure the other valve is closed.
Always clean vacuum system between patients.
See Dental Office Infection Controls Guidelines CDC, below.

Open valve.

Before using saliva ejector always check screen.



Never adjust vacuum relief valve.
When using saliva ejector, vacuum relief valve will have an air leak sound.

Cleaning Between Patients and End of Day

1) Remove any waste in vacuum container by purging and disposing of contents in a CDC-approved manner. See Dental Office Infection Control Guidelines CDC, below.
2) Mix one quart of evacuation cleaner, turn on evacuation system and suction cleaner into waste bottle using the HVE valve, and the saliva ejector.
3) Dispose of cleaner waste in CDC-approved manner.
4) Wipe down outside of the bottle and tubings with a surface cleaner.
5) Clean tubings and handpieces in CDC-approved manner.
6) Clean unit surfaces CDC-approved manner.

Water Bottle

Disconnect air line. Push plunger down to remove pressure from water bottle.

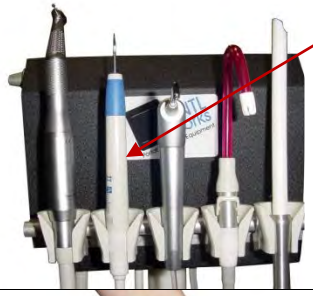
Remove water bottle.

Fill water bottle to the blue line.
We recommend distilled water.

Install water bottle.

Connect air line.

Accessories



Optional Scaler: To operate scaler, remove from holder and depress foot control.

Make sure scaler tip is screwed on

Dental Office Infection Control Guidelines (CDC)

DENTAL OFFICE INFECTION CONTROL GUIDELINES FOR THE PROTECTION OF PATIENTS AND DENTAL CARE PERSONNEL AS RECOMMENDED BY THE UNITED STATES CENTERS FOR DISEASE CONTROL (CDC)

NOTE: A medical history should be taken at the initial patient visit and on recall, updated with notations made on the chart.

Barrier Techniques

1) Dentists, hygienists and assistants should wear new gloves for each patient treated. Hands should always be washed with liquid soap before and after treatment, contact with patients or after touching inanimate objects likely contaminated by blood or saliva, and before leaving the operatory. Remove torn, cut or punctured gloves immediately, wash hands, and re-glove before completion of dental procedures.
2) During all treatment procedures, dentists, hygienists and assistants should wear face masks and protective eyewear, or in lieu of both of these, a chin-length plastic face shield.
3) Reusable and/or disposable gowns, laboratory coats or uniforms should be worn when street clothing may be soiled with blood or other body fluids. Gowns should be changed at least daily or when visibly soiled with blood.

Cleaning and Disinfection of Dental Unit and Environmental Surfaces

1) After treatment of each patient and at the completion of daily work activities, countertops and dental unit surfaces that may have become contaminated with patient material should be cleaned with disposable toweling, using an appropriate cleaning agent and water as necessary. Surfaces then should be disinfected with a suitable chemical germicide.
2) A chemical germicide registered with the EPA as a "hospital disinfectant" and labeled for "tuberculocidal" (i.e., mycobactericidal) activity is recommended for disinfecting surfaces that have been soiled with patient material. These intermediate level disinfectants include phenolics, iodophors, and chlorine-containing compounds. Because mycobacteria are among the most resistant groups of microorganisms, germicides effective against mycobacteria should be effective against many other bacterial and viral pathogens. A fresh solution of sodium hypochlorite (household bleach) prepared daily is an inexpensive and effective intermediate-level germicide. Concentrations ranging from 500 to 800 ppm of chlorine (a 1:100 dilution of bleach and tap water or 1/4 cup of bleach to 1 gallon water) are effective on environmental surfaces that have been cleaned of visible contamination. Caution should be exercised, since chlorine solutions are corrosive to metals, especially aluminum.
3) Low-level disinfectants - EPA registered "hospital disinfectants" that are not labeled for "tuberculocidal" activity (e.g., quatemary ammonium compounds) - are appropriate for general housekeeping purposes such as cleaning floors, walls and other housekeeping surfaces. Intermediate and low level disinfectants are not recommended for reprocessing critical or semi-critical dental instruments.

4) Before high-level disinfection or sterilization, and while wearing heavy duty rubber (household) gloves, ultrasonically clean (preferably) or scrub instruments in order to remove debris.

Use and Care of Handpieces and Other Intra-oral Dental Devices

1) Routine between-patient use of a heating process capable of sterilization (i.e., steam under pressure (autoclaving), dry heat, or heat/chemical vapor) is recommended for all highspeed dental handpieces, lowspeed handpiece components used intra-orally, and reusable prophylaxis angles. Manufacturers' instructions for cleaning, lubrication, and sterilization procedures should be followed closely to ensure both the effectiveness of the sterilization process and the longevity of these instruments. According to manufacturers, virtually all highspeed and lowspeed handpieces in production today are heat tolerant and most heat-sensitive models manufactured earlier can be retrofitted with heat-stable components.

2) Internal surfaces of highspeed handpieces, lowspeed handpiece components, and prophylaxis angles may become contaminated with patient material during use. This retained patient material then may be expelled intra-orally during subsequent uses. Restricted physical access - particularly to internal surfaces of these instruments - limits cleaning and disinfection or sterilization with liquid chemical germicides. Surface disinfection by wiping or soaking in liquid chemical germicides is not an acceptable method for reprocessing highspeed handpieces, lowspeed handpiece components used intra-orally, or reusable prophylaxis angles.

3) Highspeed handpieces should be run to discharge water and air for a minimum or 20-30 seconds after use on each patient. Handpieces, in addition, should be heat sterilized between uses on patients. This procedure is intended to aid in physically flushing out patient material that may have entered the turbine and air or water lines. Use of an enclosed container or high-velocity evacuation should be considered to minimize the spread of spray, splatter, and aerosols generated during discharge procedures. Additionally, there is evidence that overnight or weekend microbial accumulation in water lines can be reduced substantially by removing the handpiece and allowing water lines to run and to discharge water for several minutes at the beginning of each clinic day. Sterile saline or sterile water should be used as a coolant/irrigation when surgical procedures involving the cutting of bone are performed.

Other Important Issues

1) A "no-touch" technique (e.g., hemostats or needle holders), should be utilized when using "sharps" (needles, scalpels, blades, etc.).

2) In the operatory, sterilized and decontaminated instruments, charts, and other objects should be protected from patient contact.

3) "Sharps" should be disposed of in puncture proof containers; hazardous and/or infectious waste materials, which include "sharps," should be disposed of in a manner consistent with prevailing local laws.

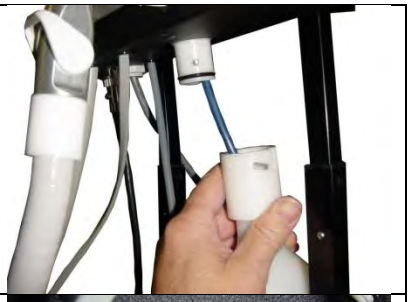
4) All dental personnel should be encouraged to receive immunization protection whenever possible, e.g., hepatitis B immunization.

5) All impressions, models and devises should be disinfected before submission and upon receipt from the dental laboratory.

Shut Down Instructions

Depressurize and remove water bottle.

Remove water bottle.



Empty water bottle.

Install water bottle.

Connect air line.

Turn on handpiece coolant water. (ProQuest I, II Only)

Place handpiece over container and depress foot control until all water is purged. (ProQuest I, II Only) Purge Scaler (Optional)

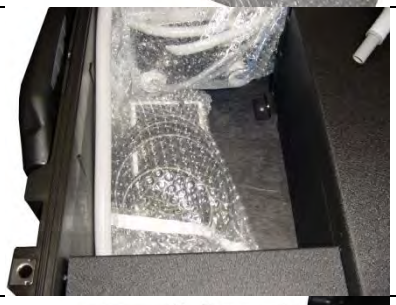
Depress syringe water button until all water is purged.

Mix non-foaming vacuum system cleaning solution and run solution through HVE valve.

Run cleaning solution through saliva ejector valve.

	Remove any waste in vacuum container and disposing of contents in a CDC-approved manner. See Dental Office Infection Control Guidelines CDC, above.

Packing Instructions

	Disconnect vacuum container and remove from unit.		Wrap tubing around handpiece holders.
	Pack delivery unit into case.		Pack foot control.
	Pack water bottle.		Pack vacuum container.
	Pack power cord.		Pack manual.

	Pack saliva ejector and HVE lines.		Pack handpiece motor an attachment.

Maintenance

The following visual checks should be performed before operating the unit:

1) Look for mechanical damage that could affect safe operation, including, but not limited to, the following:
   a. Cracks in power cord.
   b. Splits or kinks in air or water lines.
   c. Check for cracks in water container.
   d. Cracks, kinks or splits in handpiece tubing, syringe tubing and vacuum tubings.
2) Look for loose or missing items, including, but not limited to, the following:
   a. Loose or missing screws, nuts and/or bolts.
   b. Loose handles.

Should mechanical or other damage be noted that would affect safety or operation, the unit should not be used until repair or replacement of defective items is completed. You may call Customer Service for help.

!!CAUTION!!

Handpieces:

Follow manufacturers' instructions for maintenance.

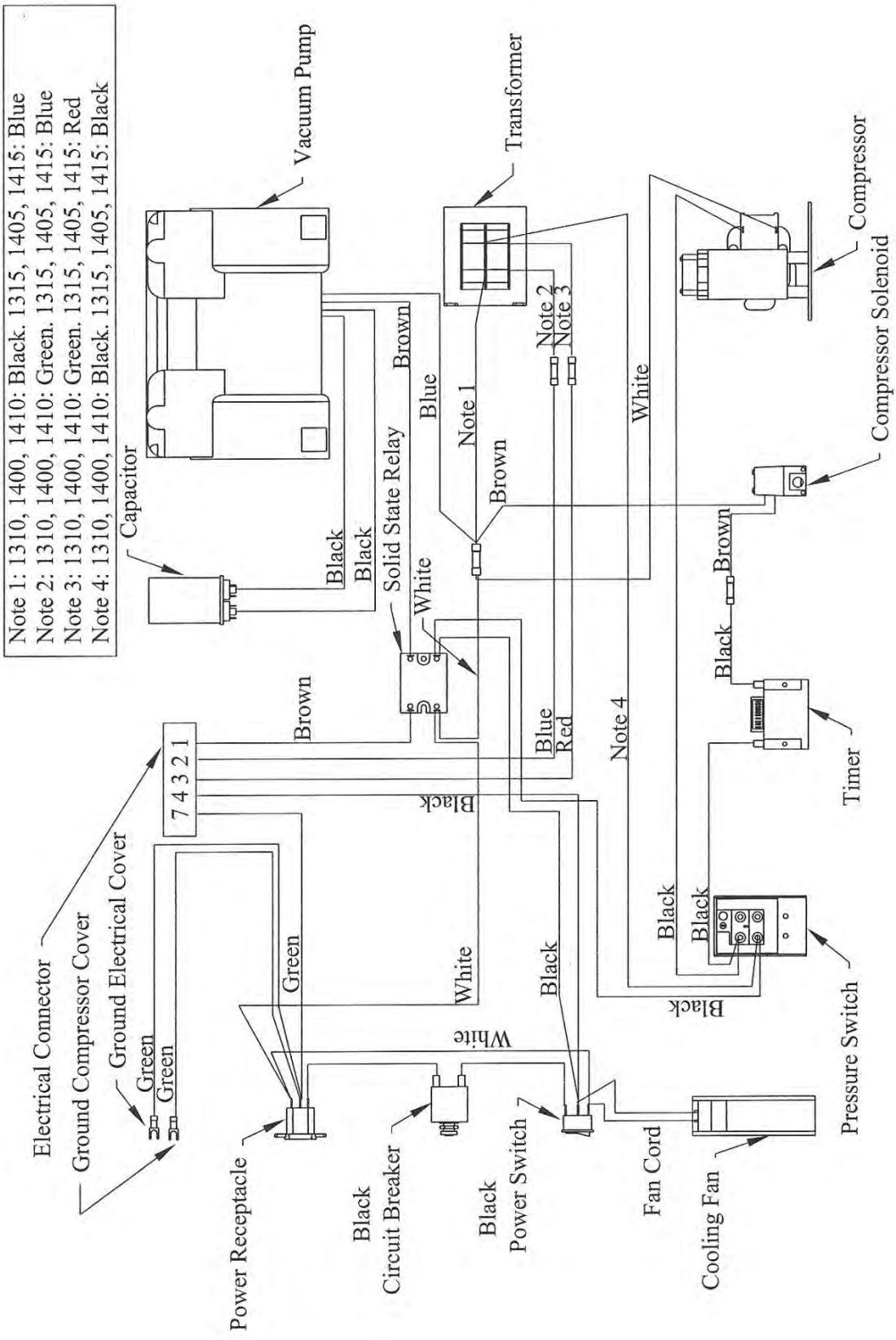
Syringe:

Follow manufacturer's instructions for maintenance.

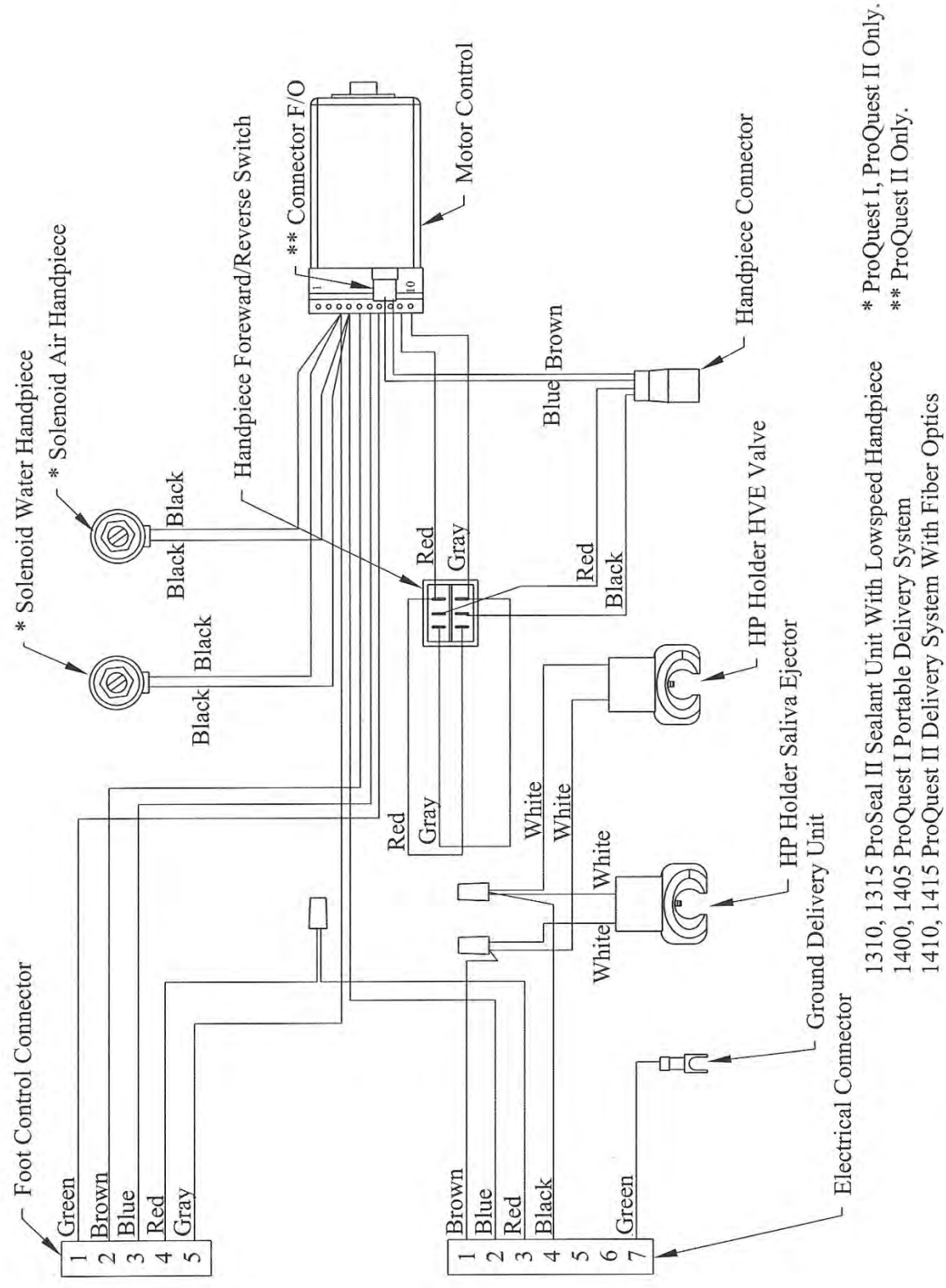
Air Pressure Source:

Do not exceed 125 psi.

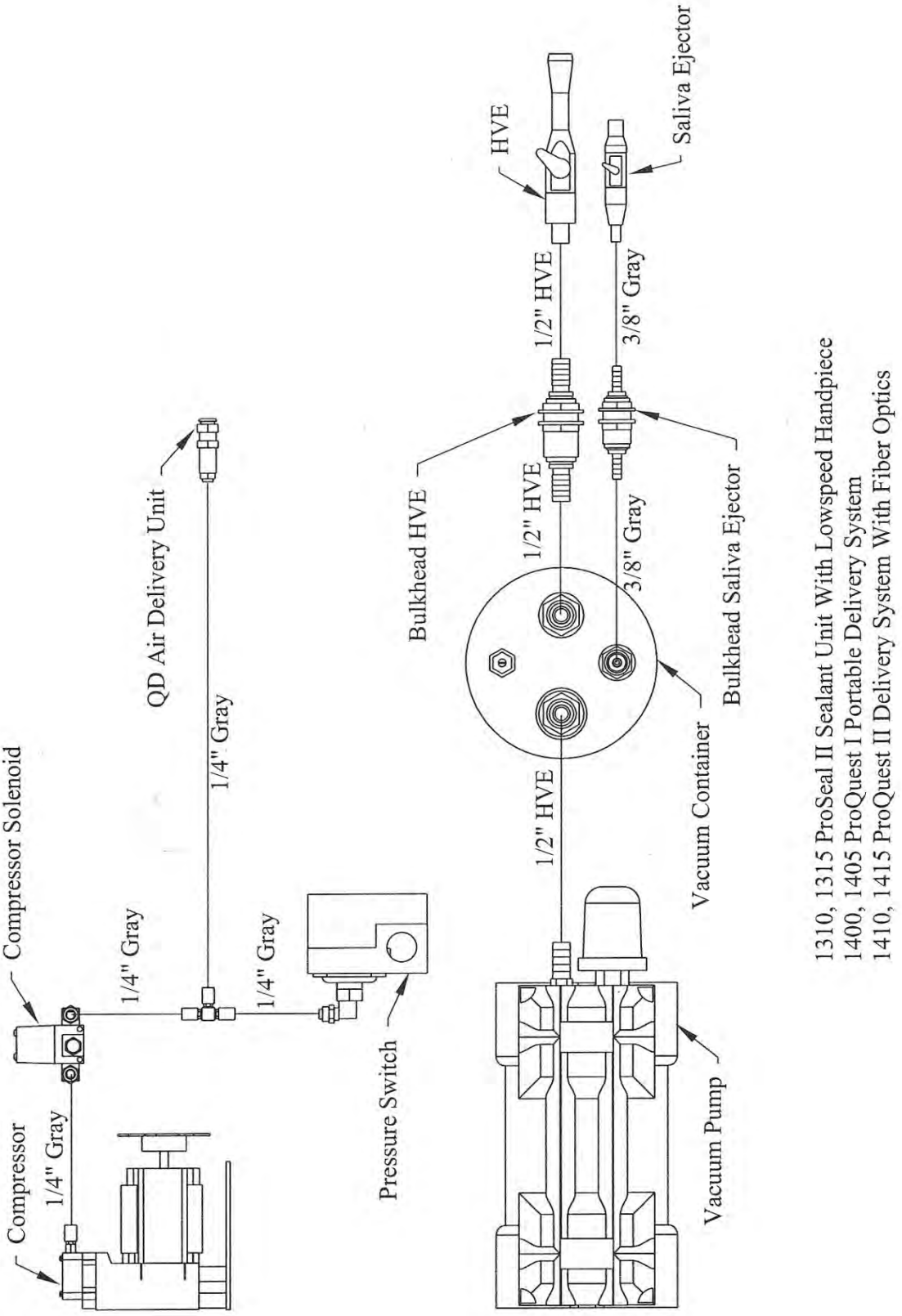
Electrical Diagram Compressor Unit



Electrical Diagram Delivery Unit



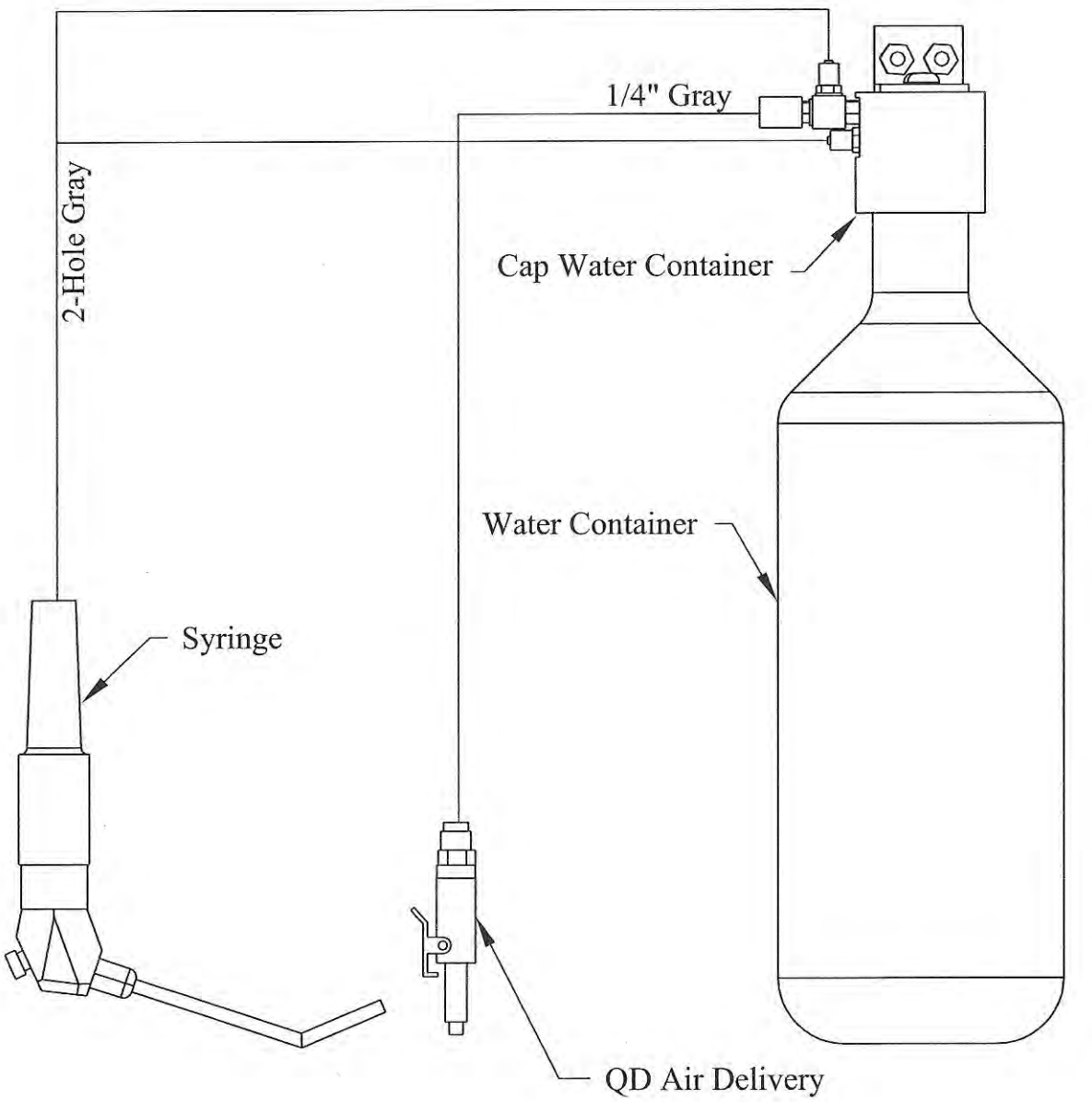
Tubing Diagram Compressor Unit



1310, 1315 ProSeal II Sealant Unit With Lowspeed Handpiece
1400, 1405 ProQuest I Portable Delivery System
1410, 1415 ProQuest II Delivery System With Fiber Optics

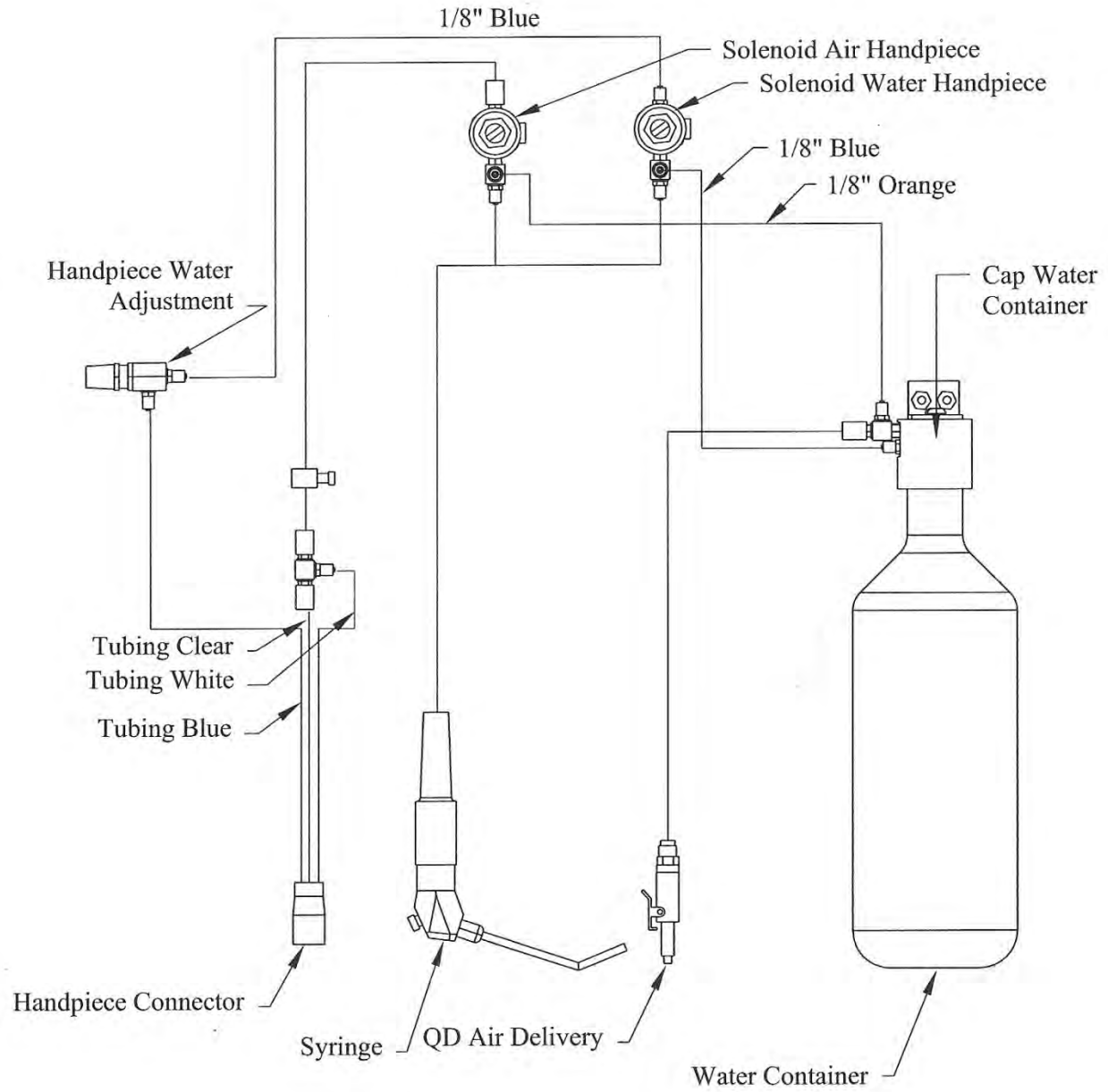
Tubing Diagram Delivery Unit ProSeal II

1310, 1315 ProSeal II Sealant Unit With Lowspeed Handpiece

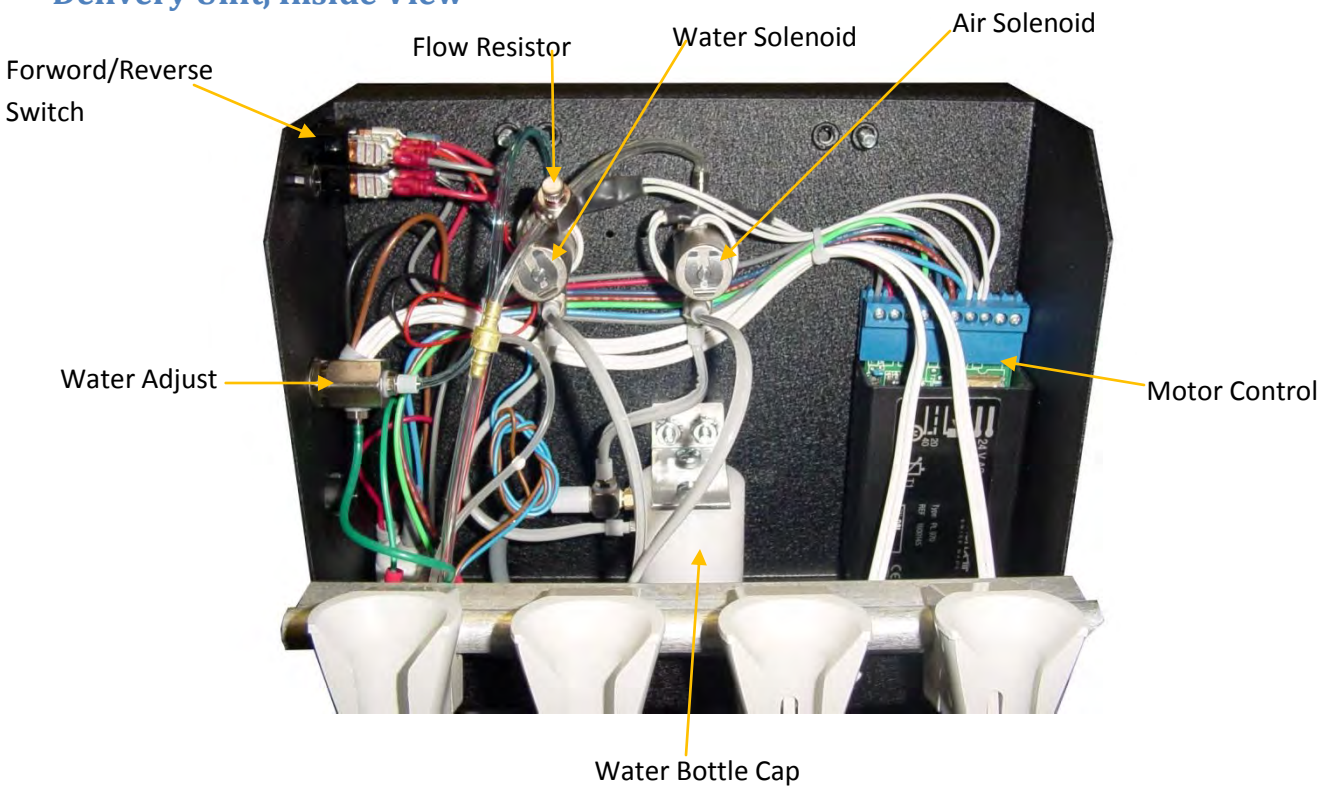


Tubing Diagram Delivery Unit ProQuest I, II

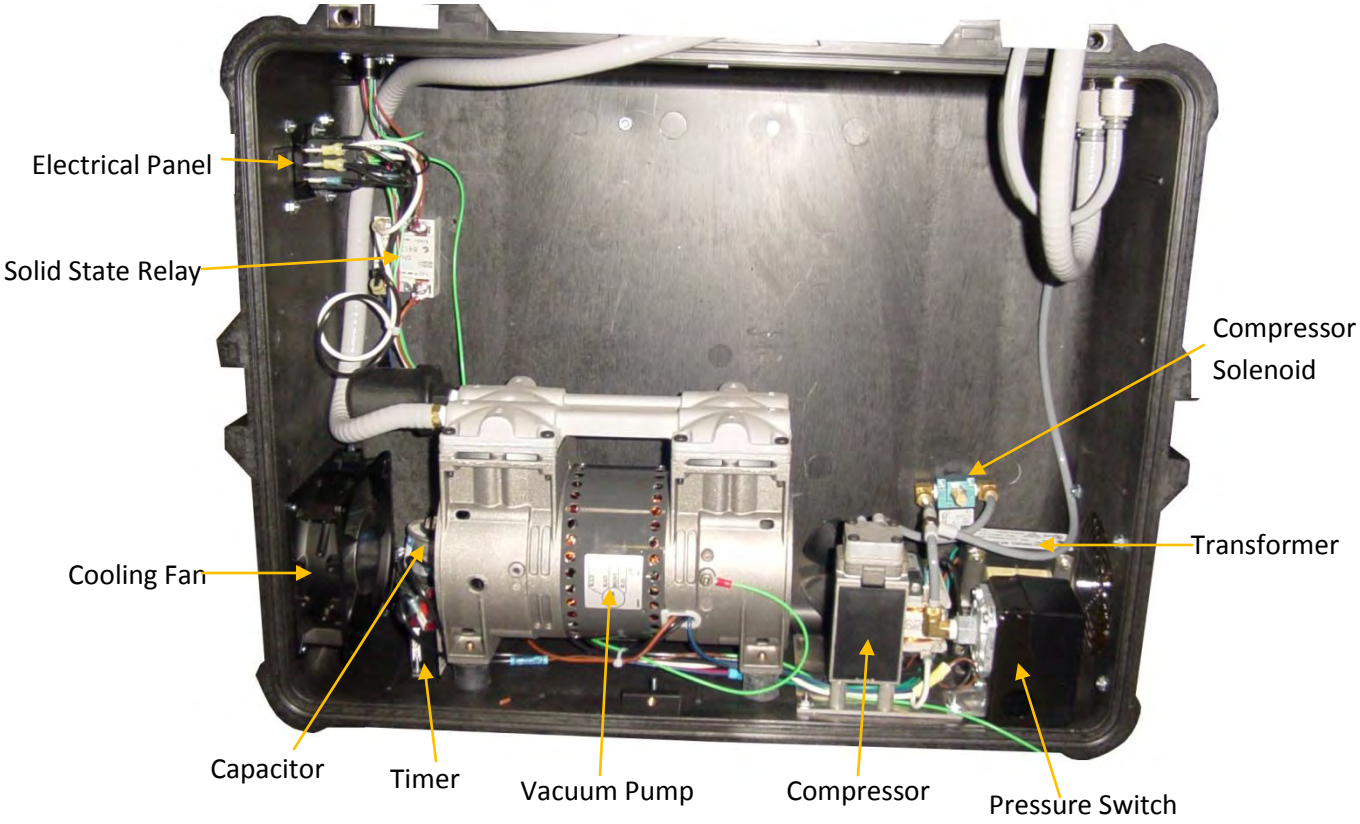
1400, 1405 ProQuest I Portable Delivery System
1410, 1415 ProQuest II Delivery System With Fiber Optics



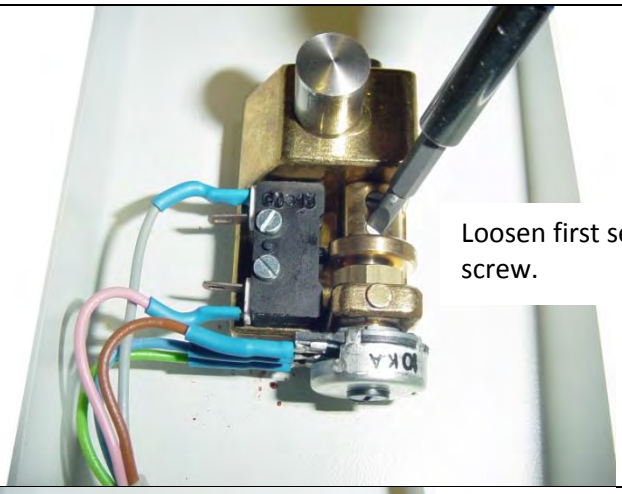
Delivery Unit, Inside View



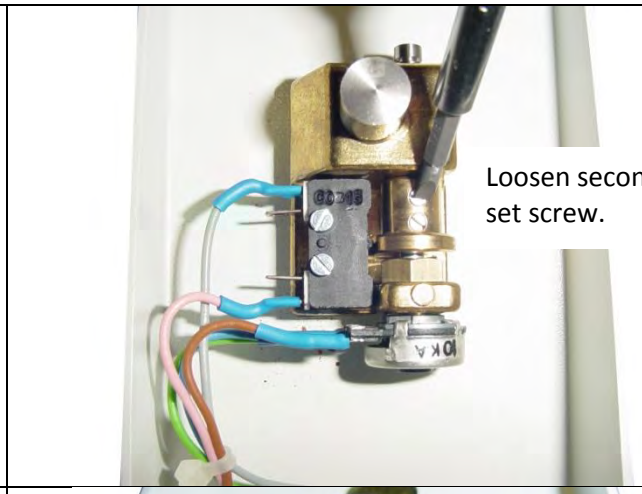
Compressor Unit, Inside View



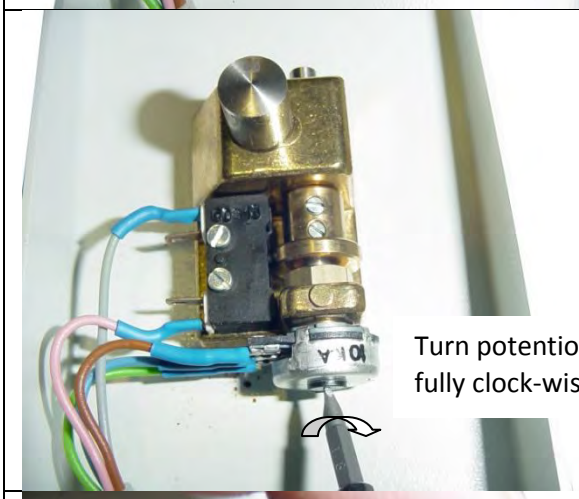
Foot Control Adjustment



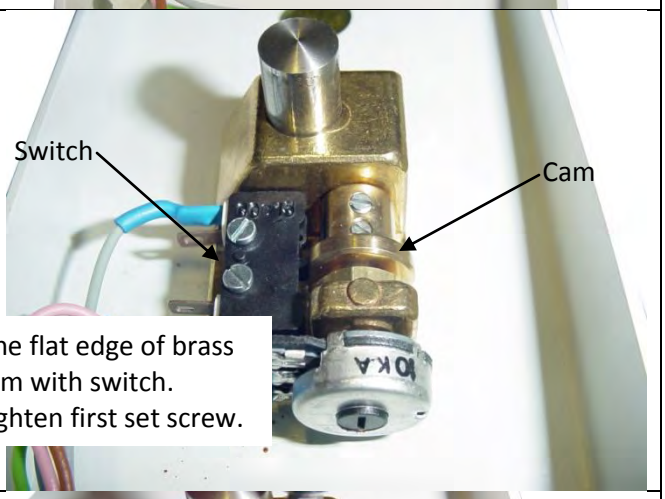
Loosen first set screw.



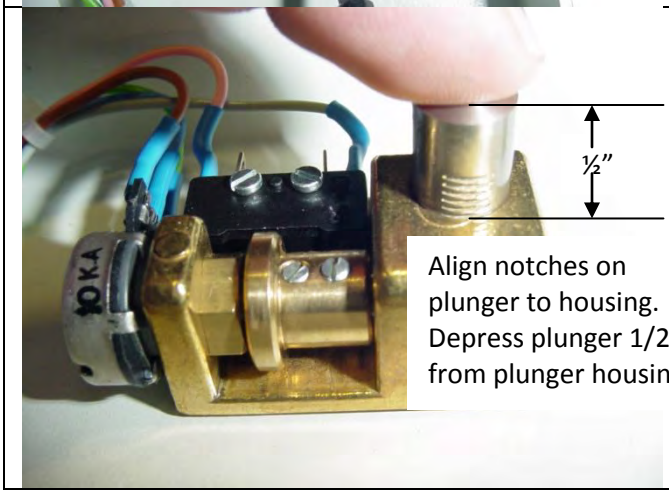
Loosen second set screw.



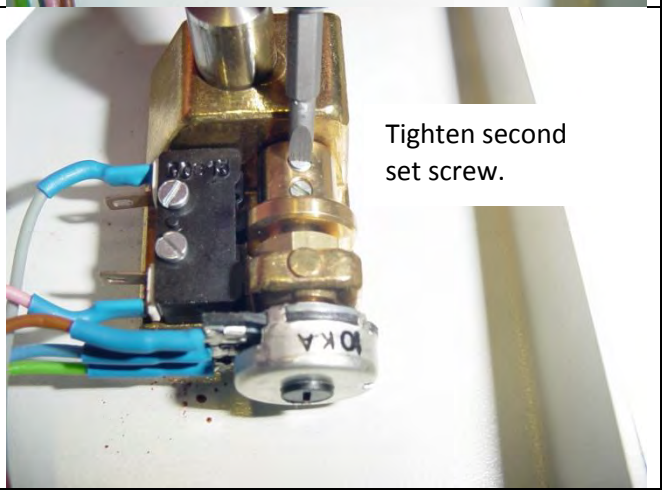
Turn potentiometer fully clock-wise.



Line flat edge of brass cam with switch. Tighten first set screw.



Align notches on plunger to housing. Depress plunger 1/2” from plunger housing.



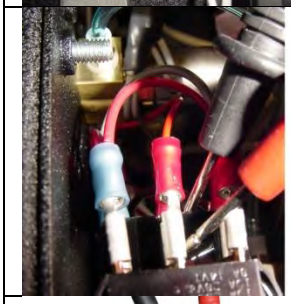
Tighten second set screw.

Handpiece Not Working

If at all possible, try handpiece on another unit. All tests are with the power on and foot control fully depressed.

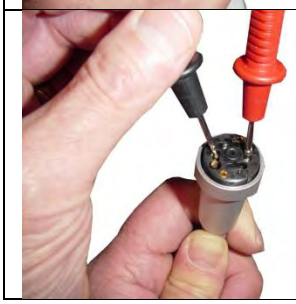
Voltage should be between 24 to 27Vac.
If voltage is around 0Vac then contact Customer Service.

Voltage should be between 22 to 24Vdc.
If voltage is around 0Vdc then replace motor control.
If voltage is between 5Vdc to 22Vdc then adjust foot control.



Voltage should be between 22 to 24Vdc.
If voltage is around 0Vdc then check wires from motor control to foreword/reverse switch.

ProQuest I, II
Voltage should be between 22 to 24Vdc.
If voltage is between 22 to 24Vdc. Handpiece motor is bad.
If voltage is around 0Vdc replace handpiece tubing.



ProSeal II
Voltage should be between 22 to 24Vdc.
If voltage is between 22 to 24Vdc. Handpiece motor is bad.
If voltage is around 0Vdc replace handpiece tubing.

Medical Histories and Medical Emergencies:

"Vital Signs" for the Dental Team

Arizona State Dental Hygienists' Association
2015 Scientific Conference
August 21, 2015

Cindy Kleiman, RDH, BS
Oral Care Consultant and Speaker

Many thanks to my sponsor:

Team Member Duties

Member #1: Stay with the patient

Member #2: Call 911, bring emergency kit and AED

Member #3: DOCUMENT

H

Emergency Management New CPR Guidelines 2010

P Position
C Circulation
A Airway
B Breathing
D Definitive Care
- **Diagnosis**
- **Drugs**
- **Defibrillation (for CPR)**

H

Basic Emergency Kit

Injectables:	Epinephrine
	Histamine blocker
Non-injectables:	Oral Histamine Blocker
	Vasodilator
	Aspirin (Baby)
	Anti-hypoglycemic (Sugar)
	Bronchodilator
	Ammonia Inhalant
Equipment:	O_2, BP Cuff, Barrier Mask, AED

H

Basic Emergency Kit

Injectables:	Epinephrine
	Histamine blocker
Non-injectables:	Oral Histamine Blocker
	Vasodilator
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	Bronchodilator
	Ammonia Inhalant
Equipment:	O_2, BP Cuff, Barrier Mask, AED

H

Chest Pain

Causes Of Chest Pain

Cardiac Related	Non-Cardiac
Angina pectoris	Muscle strain
Myocardial infarction	Esophageal reflux
	Hiatal hernia
	Indigestion
	Gas pain

H

Indigestion is similar to the pain of angina or MI and should not be ignored. Seek medical assistance if chest pain persists for 2 minutes or longer, if episode is the first.

H

Angina Pectoris

- **A transient chest pain caused by insufficient supply of oxygenated blood to the heart**
- **Often brought on by exertion or emotion**
- **Relieved by rest or nitroglycerin**

H

Medical History Interview

- **How frequently do you suffer angina attacks?**
- **How long do the attacks last?**
- **What precipitates your attacks?**
- **How quickly does nitroglycerin relieve your attacks?**
- **When was your last attack?**

* Phone patients day prior to treatment requesting them to bring their nitroglycerin

H

Angina Pectoris Management

P Comfortable, usually upright

C
A
B } Usually not needed

D Nitroglycerin
Oxygen

H

Basic Emergency Kit

Injectables: Epinephrine
Histamine blocker

Non-injectables: Oral Histamine Blocker
Vasodilator
Aspirin (Baby)
Anti-hypoglycemic (Sugar)
Bronchodilator
Ammonia Inhalant

Equipment: O_2, BP Cuff, Barrier Mask, AED

H

Consider Myocardial Infarction if…

- No prior history of chest pain
- Patient with history of angina
  - Pain more intense than usual
  - Nitroglycerin x 3 fails to alleviate pain
  - Nitroglycerin resolves pain… then pain returns

H

Myocardial Infarction

Symptoms
- Pain
  - Severe to intolerable
  - Crushing, choking
  - Radiates: L arm, hand, shoulders, neck, jaw
- Nausea, weakness, dizziness
- Palpitations
- Cold perspiration
- Sense of impending doom

Signs
- Restlessness
- Acute distress
- Skin
  - Cool, pale, moist
- Heart rate
  - Bradycardia to tachycardia

H

Women's Signs and Symptoms

- Shortness of Breath
- Weakness
- Unusual fatigue
- Indigestion
- Disturbed Sleep
- 50% of women have no chest pain

H

Myocardial Infarction Management

P Comfortable

C
A
B — As Needed

D
- Call 911
- Nitrous Oxide
- Oxygen
- Nitroglycerin
- Aspirin (4 Baby, chewed)

H

Cardiac Arrest: Basic Life Support - CPR

P Position
C Circulation
A Airway
B Breathing
D **Defibrillation**

H

Basic Emergency Kit

Injectables:	Epinephrine
	Histamine blocker
Non-injectables:	Oral Histamine Blocker
	Vasodilator
	Aspirin (Baby)
	Anti-hypoglycemic (Sugar)
	Bronchodilator
	Ammonia Inhalant
Equipment:	O_2, BP Cuff, Barrier Mask, AED

H

Diabetes Mellitus

Hypoglycemia

Hypoglycemia occurs when the body's blood sugar, or glucose, is abnormally low. The term insulin shock is used to describe severe hypoglycemia that may result in unconsciousness.

H

Diabetic Emergency: Hypoglycemia

Causes

- Too much insulin
- Too little food

Signs and Symptoms

- Shaking
- Sweating
- Anxiety
- Palpitations
- Restlessness
- Mental Confusion

H

Medical History Interview

- Do you use oral medication or insulin?
- How well controlled is your diabetes?
- What was your last blood sugar and how long ago was it taken?
  (Fasting: 80-110 normal)
- What is your A1C reading?

H

Dental Treatment Guidelines For Diabetic Patients

Hemoglobin A_{1c} measurement (%)	Blood glucose (mg/dL)	Comment
	<70	May accept for treatment but increased likelihood of hypoglycemia
<6.5	70–110	May accept for treatment
6.5–7.5	110–175	May accept for treatment
7.5–8.5	175–240	Evaluate carefully before treatment
8.5–9.5	240	Evaluate carefully before treatment; medical consultation suggested
>9.5	>400	Medical consultation before treatment; elective dental care not indicated; emergency care only

Stanley F Malamed "Medical Emergencies in the Dental Office" 7th Edition 2015

H

- When did you last eat and when are you due for your next snack or meal?
- Do you have a sugar source readily available; if so, could you please get it out?
- Are you feeling okay at this time for treatment? (If they are unsure, ask them to please check their blood sugar before you proceed.)
- What signs do you exhibit with a low blood sugar?

H

Hypoglycemia Management

Conscious

P Comfortable

C
A
B
} As Needed

D Administer "sugar"

- Glucose gel
- Fruit juices (Orange preferred by many)
- Hard candy
- Soft drinks (non-diet)

H

Hypoglycemia Management
Unconscious

P Supine
C
A
B — As Needed
D Call 911

- Absorbable sugar (gel)
  —Under lips, canine to canine ?
- Sugar IV by EMS

H

Final Word

All insulin diabetic patients should monitor their blood glucose levels at the end of each dental appointment prior to driving.

H

Basic Emergency Kit

Injectables:	Epinephrine
	Histamine blocker
Non-injectables:	Oral Histamine Blocker
	Vasodilator
	Aspirin (Baby)
	Anti-hypoglycemic (Sugar)
	Bronchodilator
	Ammonia Inhalant
Equipment:	O_2, BP Cuff, Barrier Mask, AED

H

The Asthma Attack

Constriction of the airways and formation of thick mucus makes it progressively more difficult to inhale and exhale

- This leads to one or more of the following symptoms
  - Tightness in the chest
  - Shortness of breath
  - A chronic or recurring cough
  - Wheezing, particularly when trying to exhale
  - Anxiety

H

Medical History Interview

- What brings on an attack?
- How often do you get an attack and how long does it typically last?
- What drugs do you use to prevent acute episodes?
- What is the usual number of doses needed?
- Have you ever been hospitalized for your asthma?
- Do you have your inhaler with you?
- When was your last attack?

*Call asthmatic patients prior to day of treatment, requesting them to bring bronchodilator

H

Asthma Attack Management

P Upright
C
A
B — Usually not needed
D Inhaler
Oxygen
Epinephrine if critical

H

Asthma Attack Management

Summon EMS if…

Patient requests

Episode is continuing with 2 doses of bronchodilator (Status Asthmaticus)

H

Basic Emergency Kit

Injectables:	Epinephrine
	Histamine blocker
Non-injectables:	Oral Histamine Blocker
	Vasodilator
	Aspirin (Baby)
	Anti-hypoglycemic (Sugar)
	Bronchodilator
	Ammonia Inhalant
Equipment:	O_2, BP Cuff, Barrier Mask, AED

H

Syncope: Predisposing Factors

Psychogenic Factors

- Fright/Anxiety
- Extraction
- Injections
- Pain, especially of a sudden and unexpected nature
- The sight of blood or of surgical or other dental instruments (such as a local anesthetic syringe)

Non-psychogenic Factors

- Sitting upright or standing
- Hunger
- Exhaustion
- Hot, humid, crowded environment
- Male sex
- Age between 16 and 35 years

H

Syncope Management

P Supine, slight elevation of legs

C
A
B } **As needed**
D

- **Ammonia inhalant**
- **Oxygen**

H

Recovery

- **May continue to be light-headed, weak, pale**
- **May be disoriented/confused**
- **Pulse & blood pressure should return to normal**
- **Takes 24 hours to completely recover**
- **Discharge in custody of responsible adult**

H

Basic Emergency Kit

Injectables:	Epinephrine
	Histamine blocker
Non-injectables:	Oral Histamine Blocker
	Vasodilator
	Aspirin (Baby)
	Anti-hypoglycemic (Sugar)
	Bronchodilator
	Ammonia Inhalant
Equipment:	O_2, BP Cuff, Barrier Mask, AED

H

Allergy Facts

- The faster the onset of signs and symptoms after exposure to the allergen, the more severe the reaction
- Allergy involving only skin is NOT life-threatening and requires milder, less aggressive management
- Allergy involving difficulty with breathing IS life-threatening, requiring immediate, aggressive management

H

Allergic Reactions

What to look for:

- Sneezing, coughing, or wheezing
- Shortness of breath
- Tightness and swelling in the throat, face, tongue, or chest
- Itching, burning, or rash
- Dizziness and weakness
- Nausea and vomiting

H

Allergy Management
Delayed Onset Skin Reaction

P Comfortable

C
A
B — Usually not needed

D Oral histamine blocker
Continue for 2-3 days prn

H

Anaphylaxis

A severe, and sometimes fatal, allergic reaction characterized by respiratory distress and hypotension, leading to cardiovascular collapse

H

Usual Progression of Anaphylaxis

Skin
↓
Eyes, nose, GI
↓
Respiratory System
↓
Cardiovascular System

H

Anaphylaxis Management

P Based upon primary complaint:
- "Can't breathe" – upright
- "Feel faint" – supine, feet elevated

C
A
B — As Needed

H

Anaphylaxis Management

D Call 911
Oxygen
Epinephrine
−Every 5 minutes or until EMS arrives
−Multiple doses usually required
Histamine blocker IM

H

Why Epinephrine?

Reverses 2 components of anaphylaxis which lead to death
- Bronchospasm – epinephrine is bronchodilator
- Hypotension – epinephrine is vasopressor (BP↑)

Works quickly
- IM top of thigh (EpiPen®), works in 1-2 minutes

H

Seizure

- An event of altered brain function caused by abnormal or excessive electrical discharges in the brain
- Most seizures cause sudden changes in behavior or motor function

H

Causes of Seizures

- Epileptic patients
  - Stress induces seizures
- Cerebral anoxia
  - Neonatal injury
- CVA (stroke, 'brain attack')
- Tumor
- Previous head injury
- Idiopathic

H

Tonic-Clonic Generalized Seizure

- Prodromal Phase
  - Can be several minutes to an hour
  - May have an aura
- Ictal Phase (The Actual Seizure)
  - Tonic rigidity (10-20 seconds)
  - Evolves into clonic contraction relaxations (2-5 minutes)

H

Tonic-Clonic Generalized Seizure

- Is self-limiting
- Lasts not more than 2 - 5 minutes
- Usually does not require IV anticonvulsant therapy
- Usually does not result in injury

H

Post-Ictal

- Tonic-clonic movements stop
- Respiration returns to normal
- Consciousness gradually returns
  - Patient may be disorientated/confused
- Sphincter relaxation may cause incontinence

H

Medical History Interview

- What type of seizure do you have?
- How often do you have seizures?
- What is your aura?
- How long do your seizures last?
- Did you take your medicine today?

H

Tonic-Clonic Seizure Management

P – Supine
Protect victim:
Rescuer 1: arms – gently!
Rescuer 2: legs – gently!
C
A
B As needed
D – Call 911
Remove "pillow" or "donut" from headrest of chair
Do not put anything into the mouth

H

Post-Ictal Phase

- ABC as needed
- Patient is disoriented, sleeping
- Position
  - Turn on side, if possible
    - Aids in airway maintenance
  - Dental Chair
    - Maintain supine, maintain airway as needed

H

Medical Emergency Kits, AED, BP

- Health First
  - www.healthfirst.com
- Core Medical – CLAM Drug Kit
  - www.clammedical.com
- Sina Health
  - www.sinahealthmed.com
- Physio-Control AED
  - www.physio-control.com
- Omron 7 Series
  - BP652 [N]

H

Thank you!

Cindy Kleiman, RDH, BS
Oral Care Consultant and Speaker

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www.cindyspeaking.com
cindy@cindyspeaking.com

Blood pressure (mm Hg or torr)	ASA classification	Dental therapy considerations
<140 and <90	I	1. Observe routine dental management. 2. Recheck in 6 months.
140 to 159 and/or 90 to 94	II	1. Recheck blood pressure before dental treatment for three consecutive appointments; if all measurements exceed these guidelines, medical consultation is recommended. 2. Observe routine dental management. 3. Implement stress reduction protocol as indicated.
160 to 199 and/or 95 to 114	III	1. Recheck blood pressure in 5 minutes. 2. If still elevated, perform medical consultation before beginning dental therapy. 3. Observe routine dental therapy. 4. Implement stress reduction protocol.
>200 and/or >115	IV	1. Recheck blood pressure in 5 minutes. 2. Perform immediate medical consultation if pressure is still elevated. 3. Do not perform dental therapy, routine or emergency,* until elevated blood pressure is corrected. 4. Perform emergency dental therapy with drugs (analgesics, antibiotics). 5. Refer to hospital if immediate dental therapy indicated.

*When the blood pressure of the patient is slightly above the cutoff for category IV and when anxiety is present, the use of inhalation sedation may diminish the blood pressure (via the elimination of stress) below the 200/115 level. The patient should be advised that if the nitrous oxide and oxygen succeeds in decreasing the blood pressure below this level, the planned treatment can proceed. However, if the blood pressure remains elevated, the planned procedure must be postponed until the elevated blood pressure has been lowered to a more acceptable range.

Stanley F. Malamed "Medical Emergencies in the Dental Office" 7th Edition 2015

MEDICAL EMERGENCY ACTION PLAN

Emergency Kit Item	Present?	Exp. Date	Directions?	Trainer?
Epinephrine (EpiPen)				
Diphenhydramine injectable (Benadryl)				
Diphenhydramine oral (Benadryl)				
Inhaler				
Nitroglycerin (Tabs or Spray)				
Aspirin				
Glucose				
Ammonia inhalants				

Additional Must Have Items

Blood pressure cuffs
CPR Barrier
Oxygen tank
Automated external defibrillator (AED)

Items to Eliminate

_____

_____

_____

_____

SUMMARY OF HIGHLIGHTS OF THE

2010 CPR GUIDELINES

	ADULT	CHILD	INFANT
Responsiveness	**Unresponsive – Tap & Shout**		
Recognition	No Breathing or no normal breathing ... i.e. Gasping (agonal Breathing)		
	Pulse check for Medical Level ONLY		
CPR Sequence	***Compression – Airway – Breaths (C- A - B)***		
Compression Rate - C	At least 100 compression /minute		
Compression Depth	***At least 2 inches***	At least 1/3 AP diameter ***About 2" in depth***	At least 1/3 AP diameter 1 ½ " in depth
Airway/Breathing - A	Head tilt – Chin lift (Medical – suspected trauma – jaw thrust)		
Breathing -- B	Give Two Breaths		
Compression/Breaths Ratios	30 Compression to 2 Breaths for Single Rescuer		
MEDICAL - 2 PERSON CYCLES- 2 PERSON	Same 30:2 5 cycles / 2 minutes	15:2 10 cycles / 2 minutes	15:2 10 cycles / 2 minutes
Rescue Breaths	1: 5-6 sec	1:3-5 sec	1: 3-5 sec
AED	Attach and use AED as soon as possible. Minimize interruptions in chest compressions before and after shock; Resume CPR beginning with compressions immediately after shock		

NEW -- Chain of Survival

Immediate Recognition of Cardiac Arrest – Early CPR – Rapid Defibrillation – ACLS – *Post Cardiac Arrest Care*

DIABETES

How do you manage your diabetes?

When did you last eat and when are you due for your next snack or meal?

Do you have a sugar source readily available; if so, could you please get it out?

Are you feeling okay for treatment at this time?

What signs do you exhibit with a low blood sugar?

ASTHMA

What brings on an attack?

How often do you get an attack and how long does it typically last?

What drugs do you use to prevent acute episodes?

What is the usual number of doses needed?

Have you ever been hospitalized for your asthma?

Do you have your inhaler with you?

SEIZURES

What type of seizure do you have?

How often do you have seizures?

When was your last seizure?

What is your aura?

How long do your seizures last?

Did you take your medicine today?

ANGINA

How frequently do you suffer angina attacks?

How long do the attacks last?

What precipitates your attacks?

How quickly does nitroglycerin relieve your attacks?

When was your last attack?

EMERGENCY EQUIPMENT MONITORING
EMERGENCY KIT – AED – O_2

JAN _____	**JUL _____**
FEB _____	**AUG _____**
MAR _____	**SEP _____**
APR _____	**OCT _____**
MAY _____	**NOV _____**
JUN _____	**DEC _____**

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Continuing Education
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Management of Medical Emergencies in the Dental Office

Sue Protzman; Jeff Clark, MS, REMT-P; Wilhemina Leeuw, MS, CDA

Continuing Education Units: 5 hours

This course is designed to improve your ability to plan for, manage and handle office medical emergencies as part of the dental team. Also includes a discussion of the importance of a thorough health history in dealing with medical emergencies, background information on emergencies, vitals and what should be included in office emergency equipment. Also provides scenarios of medical emergency situations and how to handle them.

Conflict of Interest Disclosure Statement

- The authors report no conflicts of interest associated with this work.

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Overview

Improve your ability to plan for, manage and handle office medical emergencies as part of the dental team. Includes discussion of the importance of a thorough health history in dealing with medical emergencies, background information on emergencies, vitals and what should be included in office emergency equipment. Also provides scenarios of medical emergency situations and how to handle them.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Describe emergency preventive procedures and preparedness in the dental office.
- Explain the importance of obtaining a pretreatment health history from each patient.
- Describe the procedure for obtaining a blood pressure, pulse, respirations, and temperature.
- Demonstrate the initial sequence of patient assessment in an emergency.
- Identify how stress and anxiety can lead to medical emergencies.
- Recognize the signs or symptoms of impending or developing emergencies.
- List the general steps to be taken when a medical emergency arises in a dental office.
- Identify the type of emergency when given a patient situation and describe the necessary emergency care.
- Identify the contents of an emergency kit.
- Describe the medicolegal implications of medical emergencies.

Course Contents

Glossary

Acetone – waste product of cellular metabolism

Acidosis – acid condition in the blood or body fluids

AED – automatic external defibrillator

Agitation – mental confusion caused by hypoxia

Allergen – substance capable of causing an allergic reaction

Anaphylaxis – severe allergic reaction affecting respiration and heart function

Aneroid gauge – gauge or dial on a blood pressure cuff

Angina – chest pain related to exertion, emotion or exercise

Angioneurotic edema – allergic swelling of the pharyngeal structures

Antecubital space – elbow space

Antibody – body chemical produced on exposure to germs or allergens

Antigen – substance capable of stimulating antibody formation

Antisialagogue – drug used to decrease secretion of salivary glands

Aphasia – inability to speak

Apnea – not breathing

Arrhythmias – irregularities or abnormal heart rhythms

Ascites – fluid accumulation in the abdomen

Aspiration – act of inhaling fluid or vomit into the lungs

Atherosclerosis – build-up of fatty deposits in the arteries

Benzodiazepines – class of drugs used to reduce anxiety

Brachial artery – artery which can be palpated on the inside of the antecubital space

Bradycardia – slow heart rate, less than 60 beats per minute

Bronchioles – small airway tubes within the lungs

Bronchitis – inflammation of the bronchi caused by irritation

Bronchodilator – drug capable of relaxing (dilating) the bronchioles

Bronchospasm – constriction or narrowing of the bronchioles due to muscle constriction

Carpopedal spasm – painful claw-like appearance of the hands seen in hyperventilation

Cerebral cortex – outer layer of the brain controlling higher functions (motor function, consciousness, sensation)

Circumoral – around the mouth

Clonic – repetitive muscle contraction and relaxation phase of a seizure

COPD – chronic obstructive pulmonary disease, a combination of emphysema and bronchitis

Cyanotic – bluish discoloration of the skin caused by low oxygen levels in the blood

Dehydration – condition caused by the abnormal loss of fluid from the body

Diabetes – disorder of sugar metabolism due to a lack of insulin

Diaphoresis – sweating

Diastole – relaxation phase of the heart cycle

Diastolic – the lower, or second, of the two pressures making up the blood pressure; the force of blood against the blood vessel walls during ventricular relaxation

Dyspneia – shortness of breath

Emphysema – chronic, progressive disease of the lung involving the smaller airways and air sacs

Epigastric – the upper portion of the abdomen

Epilepsy – neurological disorder associated with seizures

Exhalation – movement of air out of the lungs

Fibrinolysis – process when a clot or coagulation is broken down

Gingival hyperplasia – an overgrowth of gingival tissue often requiring surgery to reduce

Glaucoma – increased pressure in the anterior chamber of the eye which may lead to blindness

Glucose – form of sugar preferred by the body as an energy source for metabolism

HEPA respirator – High Efficiency Particulate Arresting; air respirator used for personal protection when working with patients with known or suspected tuberculosis

Hepatomegaly – swelling or enlargement of the liver seen in right heart failure

Histamine – potent chemical released by body cells in response to infection or allergy

Hypertension – elevated blood pressure exceeding 140/90

Hyperventilation – increased rate and/or depth of breathing leading to excessive excretion of carbon dioxide

Hypoglycemia – low blood sugar

Hypopharynx – lower portion of the pharynx (throat) at openings of trachea and esophagus

Hypotension – lower than normal blood pressure

Hypoxia – body is deprived of adequate oxygen supply

IM – intramuscular; drug administration into a muscle

Inhalation – movement of air into the lungs

Ischemic – decreased or inadequate blood supply to an organ or tissue

IV – intravenous; drug administration into a vein

Jaundice – yellow discoloration of the skin and sclera due to liver disease

Kussmaul respirations – rapid deep ventilations seen in diabetic ketoacidosis

Laryngoscope – instrument used to view the larynx

Laryngospasm – spasm (constriction) of the vocal cords

Larynx – the voice-box

Magill forceps – instrument used for manipulation of structures or tubes in the pharynx

Metabolic – relating to metabolism; chemical reactions that happen within the body to maintain life

Myocardial infarction (MI) – heart attack; portion of heart muscle becomes ischemic and dies

NTG – abbreviation for nitroglycerin; blood vessel dilator

Orthopnea – difficulty breathing only when lying flat

Orthostatic hypotension – decreased blood pressure caused by rapid movements from supine to standing posture, or loss of body fluids

Osmotic – pressure on water exerted by dissolved substances in a fluid separated by a semipermeable membrane

Pallor – pale appearance to the skin due to decreased blood flow in the skin

Palpated – feeling a body part or structure

Pharynx – the throat

Pitting edema – swelling of the ankles and feet due to heart failure

PO – by mouth; administration of drugs by mouth (per os)

Polyuria – excessive urination

Post-ictal – the time period immediately following a seizure

Prodromal – initial symptom or sign

Pruritus – itching

Pulmonary edema – fluid build-up in the lung due to left heart failure

Rales – crackling or bubbling sounds heard in the chest with pulmonary edema

Respiratory rate – number of respirations per minute

Sphygmomanometer – inflatable blood pressure cuff with Velcro closure

SQ – subcutaneous; injection of drugs into subcutaneous (fat) tissue

Sternocleidomastoid – muscle of the side of the neck

Stethoscope – instrument for listening to breath or heart sounds

Stridor – high pitched breathing sound caused by partial collapse or obstruction of the upper airway during inhalation

Supine – lying on the back in a horizontal plane; subsupine positioning is when the head is slightly lower that the knees to return more blood flow to the brain

Syncope – fainting

Systole – contraction phase of the heart cycle

Systolic – top, or first, of the two pressures making up the blood pressure; the force of blood against the blood vessel walls during ventricular contraction

Tachycardia – a rapid heart rate, faster than 100 beats per minute

Tonic – phase of seizure where all muscles of the body remain contracted

Umbilicus – navel or belly button

Urticaria – raised wheals (hives) of the skin seen in allergic reactions

Ventricular fibrillation – disorganized heart rhythm that does not result in a pulse

Xiphoid process – lower-most pointy part of sternum

Introduction

During root canal therapy, a 68-year-old male patient becomes pale, perspires profusely, and clutches his chest. He appears confused, seizes briefly, and is now unresponsive to verbal stimuli. He is not breathing and no pulse can be felt in the carotid artery. Do you know how to handle this situation?

Medical emergencies can occur at any time in the dental office. They can happen to anyone, from the anxious patient in the reception room to the elderly diabetic who was told to skip breakfast prior to coming to her appointment. They can happen to the receptionist with a seizure disorder or to the dentist experiencing prolonged chest discomfort. In a survey of 4,000 dental offices, 75 percent said they had treated medical emergencies in the last ten years.[1] It is estimated that the average dentist will have to deal with one or two life-threatening medical emergencies in their office during their career.[2] Knowing how to handle medical emergencies will make the dental assistant more confident in his or her ability to handle all aspects of the job.

The best way to handle an emergency is to be prepared in advance.[3] Whether the medical emergency occurs years in the future or this afternoon, preparation is the key. All health care providers should be prepared to recognize and handle medical emergencies in the office. Staff should be trained and frequently updated in first aid and cardiopulmonary resuscitation procedures. A written emergency plan should be available, and all staff members should be thoroughly familiar with it and their responsibilities in an emergency. This includes training of office personnel in handling emergencies, development and posting of office emergency guidelines, and maintenance of an emergency kit or "crash cart," fully equipped and ready for immediate use.[4]

Preparation for Emergencies

Most emergencies can be prevented by adequate preparation of the patient and staff. The following are suggested guidelines:

1. Obtain a medical history on every patient and update it at each visit. Obtain physician consultation where necessary.
2. When confirming appointments, remind patients to take their normal medications on the day of their appointment. Procedures should be scheduled around meal times for diabetics. Patients using inhalers or nitroglycerin should have these with them in the event an asthma or angina attack is precipitated by the stress of dental treatment.
3. Staff members should be trained to monitor and interpret vital signs. These should be taken at the initial visit as a "baseline reading" and at each subsequent visit for those patients whose medical history indicates they may be "at risk."
4. All staff members should be trained in basic first aid procedures and basic life support (CPR).
5. The office should have a written emergency plan. Each staff member should know

and practice their particular function in an emergency, and emergency telephone numbers should be posted at each phone.
6. Staff members should be aware of the signs of stress and ways these can be alleviated.
7. Office personnel should be aware of the signs and symptoms indicating an emergency. Each office should have an emergency kit readily available and each staff member should know where it is located.
8. All staff should be aware of their legal responsibilities when responding to an office emergency.

Remember—the "best handled" medical emergency will always be the one that never happened.

Health Assessment

The increasing numbers of older patients with significant medical problems requiring dental care, longer dental appointments, and the increasing use of new medications with complex interactions all increase the risk of a life-threatening problem occurring in the dental office. The majority of medical emergencies in the dental office, however, can be anticipated and avoided with appropriate risk reduction. One key to reducing risk is to take a health history and vital signs to identify the "at risk" patient. In some cases, extensive procedures on "at risk" patients might are best performed in a hospital setting.[5]

Health History

Prevention and preparation are often the best antidotes for an emergency. Begin by obtaining a good health history at the patient's first visit; a sample health history form is shown in Figure 1. Other sample forms can be obtained from the American Dental Association, from dental office supply companies, the Internet, and may even be included with computer software designed for the dental office. Each office may choose to review a number of forms or develop a health history form which works best for the practice.

The health history should include information regarding the patient's past and present health status. It should also include questions indicating problems the patient may not be aware of, but which may alter treatment. A number of medical problems which may alter dental treatment are indicated in Figure 2. The health history form should be completed in its entirety, and the assistant should obtain additional information on questions answered in the affirmative to a health concern. The completed questionnaire should then be reviewed and signed by the dentist prior to treatment.

A list of medication names and dosages that are currently prescribed to the patient should be ascertained. A list of common prescription medications and their usefulness is shown in Figure 3. Additional questions should be asked regarding the use of herbal or street medicines.

Every staff member who may be involved with the treatment of a particular patient should be familiar with that patient's health history and should review it before each appointment.

To keep the health history current, the patient should be questioned about any changes in their general health since their last visit. This information may be obtained while they are seated in the operatory. Figure 4 is a sample medical history update form that could be used at each appointment and then attached to the patient's chart. The form should be signed or initialed by both the patient and the dentist.

Vital Signs

Obtaining vital signs provides a baseline measurement from which alterations in the patient's condition can be determined. This is a practice not frequently seen in dental offices. Vital signs-blood pressure, pulse, respirations, and temperature-should be measured prior to each treatment.

Temperature

Taking a temperature as part of the vitals check will often indicate if the patient has an infection. An oral temperature in excess of 99.6° Fahrenheit (37.5° Centigrade) is a good indicator of the presence of a viral or bacterial infection.

The other vitals-pulse, blood pressure, and respirations-can be taken while the thermometer is in the patient's mouth, thus using little additional chair time.

MEDICAL QUESTIONNAIRE

Patient Name_____ **Date Today** _____

Please check if you have any of the following problems:

- ☐ AIDS / HIV Positive
- ☐ Alcoholism
- ☐ Allergies

Describe _____

- ☐ Anemia
- ☐ Arthritis
- ☐ Artificial heart valves
- ☐ Artificial joints
- ☐ Asthma
- ☐ Back problems
- ☐ Blood disease
- ☐ Cancer
- ☐ Chemotherapy
- ☐ Circulation problems
- ☐ Cortisone treatments
- ☐ Cough, persistent
- ☐ Cough, up blood
- ☐ Diabetes
- ☐ Epilepsy
- ☐ Fainting
- ☐ Food allergies
- ☐ Glaucoma
- ☐ Headaches, frequent
- ☐ Headaches, migraines
- ☐ Heart murmur
- ☐ Heart, any problems

Describe_____

- ☐ Hemophilia
- ☐ Herpes
- ☐ Hepatitis A B C
- ☐ High blood pressure
- ☐ Jaw pain
- ☐ Kidney disease
- ☐ Liver disease
- ☐ Mitral valve prolapse
- ☐ Nervous problems
- ☐ Pacemaker
- ☐ Psychiatric care
- ☐ Radiation treatment
- ☐ Respiratory disease
- ☐ Rheumatic fever
- ☐ Seizure disorders
- ☐ Shingles
- ☐ Shortness of breath
- ☐ Skin rash
- ☐ Stroke
- ☐ Surgical implants
- ☐ Swelling, feet or ankles
- ☐ Thyroid problems
- ☐ Tobacco use
- ☐ Tuberculosis
- ☐ Ulcers/colitis

Known Allergies:

- ☐ Local anesthetic
- ☐ Aspirin
- ☐ Penicillin
- ☐ Codeine
- ☐ Sulfa
- ☐ Iodine
- ☐ Latex
- ☐ Other:_____

List any medications you are currently taking:

_____

_____

_____

_____

Pre-medication required _____

Consulting Physician _____

Pharmacy _____

Check if you have had any problems with the following:

- ☐ Bad breath
- ☐ Bleeding, sensitive gums
- ☐ Clicking or popping jaw: right or left
- ☐ Food trapped between teeth
- ☐ Grinding or clenching teeth
- ☐ Loose teeth
- ☐ Broken fillings
- ☐ Periodontal treatment
- ☐ Sensitivity to cold
- ☐ Sensitivity to hot
- ☐ Sensitivity to sweets
- ☐ Sensitivity to biting
- ☐ Sores in mouth
- ☐ Staining

Authorization:

I have reviewed the information and answered all questions to the best of my knowledge. I understand this information will be used to determine the dental treatment I receive at this office and may be shared with other medical offices only as necessary. I will notify the office should any information change in the future.

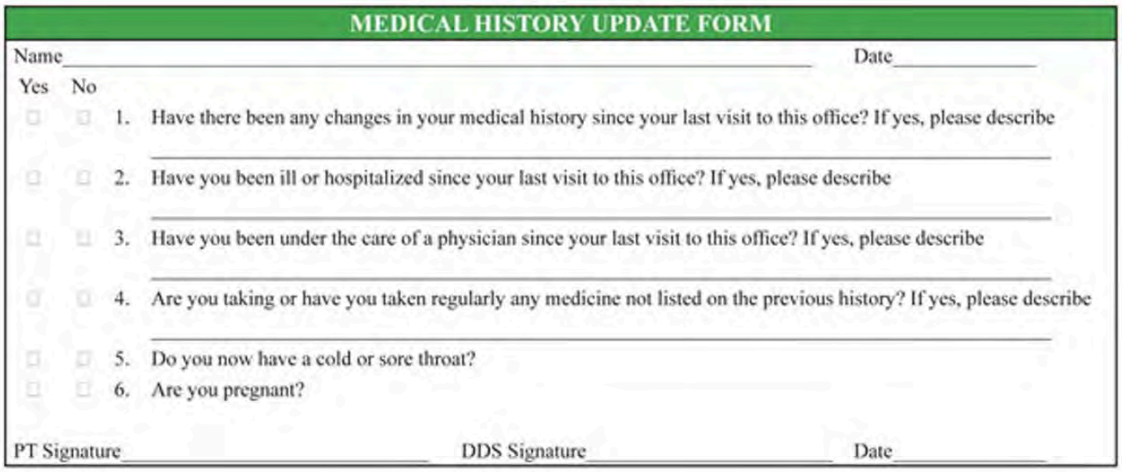
Signature of patient, or parent if a minor: _____

Reviewed by: _____

Figure 1. Sample Health History Questionnaire

Figure 2. Medical Problems Which May Alter Dental Treatment	
Adrenal Insufficiency	If the patient is lacking cortisol, or on extensive steroid therapy, stress can induce a crisis.
Allergies	Patient with any type of allergic condition is more prone to drug allergies.
Asthma/COPD	Patient should bring their inhaler and keep it available during treatment, may need puff before treatment. Nitrous oxide sedation should be used with caution.
Breathing Problems	Patient may have difficulty lying supine.
Chemotherapy / Radiation Therapy / Organ Transplants	Consult any treating physicians before treatment, may be prone to infection or bone disorders.
Chest Pain	Sublingual nitroglycerin tablets should be available chairside.
Diabetes	If appointment is scheduled in morning, patient should be asked if they have eaten and taken their medication. Instant glucose should be available for hypoglycemic reactions.
Glaucoma	Atropine used as an antisialagogue could increase pressure in the anterior chamber of the eye. Caution must be used when prescribing medicines that could increase eye pressure.
Heart Problems	Noted chest pain, angina, or heart problem history should put the team on alert. Sublingual nitroglycerin tablets must be available chairside. Certain heart problems require antibiotic prohylaxis before any dental treatment.
Hemophilia	Consult M.D. before treatment which may result in bleeding.
High Blood Pressure / Hypertension	Anesthetics with epinephrine could elevate blood pressure.
Hyperventilation	Having patients breathe into a paper bag is no longer the preferred treatment. The patient should be talked through it and calmed while counting the number of breaths.
Jaundice	This should alert the team to complications such as hepatitis, liver disease, alcoholic cirrhosis.
Low Blood Pressure	Orthostatic hypotension may develop when moving patient from supine to sitting or standing position.
Pregnancy	Shield patient from radiation. Caution about drugs prescribed and anesthetics used due to placental transfer. Patient cannot be laid supine in the third trimester, may develop supine hypotension.
Psychiatric Problems	Prone to syncope, anxiety, bizarre reactions to common events. Nitrous oxide sedation may cause problems.
Seizure Disorders	Often associated with epilepsy, prepare for "triggers" to induce a seizure. Phenytoin prescribed meds will cause gingival hyperplasia.
Sinus Problems	Drainage and breathing difficulties can develop during treatment.
Syncope	Stress may provoke fainting spells, an ammonia inhalant should always be available at chairside.
Tuberculosis	Treatment should only be completed in a hospital setting and only for emergency procedures.

Figure 3. Patient Medications Which May Alter Treatment	
acetylsalicylic acid (Aspirin) and warfarin (Coumadin®)	Blood thinner, increased risk of bleeding
antibiotics (pencillins, cephalosporins, macrolides, sulfonamides)	Prescribed for preventative measures and to treat oral infection, can cause xerstomia
Digitalis (Digoxin®, Lanoxin®)	Treats abnormal heart rate and arrhythmias, irregular pulse, ankle swelling and fluid retention indicating heart failure
insulin	Identifies Type I diabetes, prone to hypoglycemia
Nitroglycerin (Nitrostat®, Nitro-Bid®)	Chest pain—angina and heart attack
phenytoin (Dilantin®)	Prescribed to treat seizures, gingival hyperplasia



MEDICAL HISTORY UPDATE FORM

Name_____ Date_____

Yes No

1. Have there been any changes in your medical history since your last visit to this office? If yes, please describe _____
2. Have you been ill or hospitalized since your last visit to this office? If yes, please describe _____
3. Have you been under the care of a physician since your last visit to this office? If yes, please describe _____
4. Are you taking or have you taken regularly any medicine not listed on the previous history? If yes, please describe _____
5. Do you now have a cold or sore throat?
6. Are you pregnant?

PT Signature_____ DDS Signature_____ Date_____

Figure 4. Medical History Update Form

Figure 5. Normal Variation in Body Temperature by Location	
Location	**Normal Reading**
Oral	98.6°F
Tympanic (ear)	98.6°F (oral equivalent)
Rectal	99.6°F
Auxiliary	97.6°F

Body temperature varies with location, and may be measured where most convenient. Figure 5 lists these temperature variations by location.

In the dental office, the oral reading is most frequently used. The four most common types of thermometers include:

1. Digital oral thermometer, used with plastic probe covers.
2. Tympanic (ear) thermometers give a reading equivalent to the oral temperature.
3. Disposable thermometer tapes.
4. Standard glass thermometer with a mercury column inside, used with plastic probe covers.

Digital thermometers are popular due to their convenience and fast reading. The battery must be checked regularly for proper use and accurate readings. The digital reading is displayed on a small LCD screen after approximately 30 seconds.[16]

A tympanic thermometer registers the body's temperature by bouncing an infrared signal off the eardrum. The reading is accurate and received within a few seconds. One drawback is the initial price, ranging from $40 to $100 and higher.

Disposable thermometer tapes or strips can be used orally or axially. The strips are convenient

but will give inaccurate readings if improperly stored near a heat source. To receive a reading, the strip is placed in the mouth or against the forehead and the liquid crystals change color to indicate temperature.

The standard glass thermometer is the least expensive and may be calibrated in either degrees Fahrenheit or degrees Centigrade. These thermometers use mercury inside the glass cylinder to measure the temperature. Many states have banned their use because if broken, exposure to toxic mercury vapors can occur. Before taking the patient's temperature, the mercury should be shaken down to give a reading below 95°F. Shake the thermometer with a snapping downward motion, but take care to avoid striking it against a counter top or cabinet. If a glass thermometer is accidentally broken, a mercury clean-up kit should be used to prevent contamination. For this reason many offices are choosing to use thermometers without mercury.

Whenever the temperature is taken, the reading is recorded in the patient chart on the date of service. If the temperature is significantly elevated (>100°F), circle it in red to draw the dentist's attention to it. A typical chart entry might read: 98.6°F oral 11-5-XX.

Pulse

The pulse is the pressure wave that can be felt as the heart contracts and propels a volume of blood forward in the arterial system. For routine measurement, the pulse in the radial artery in the wrist is most commonly used. Figure 6 indicates the locations of other pulse points. The radial artery can be palpated on the thumb side of the anterior aspect of the wrist. Apply gentle pressure to the artery until the pulsations can be felt. Two or three fingers should be used to assess the pulse. Avoid using your thumb; you may be feeling (and counting) your own pulse rate and not that of the patient.

Three assessments can be made concerning the pulse; rate, strength, and regularity. The number of pulsations in fifteen seconds is counted and then multiplied by four to obtain the pulse rate. For adults, the pulse is usually in the 60-100 range. Normal pulse rates for other age groups are given in Figure 7. In adults, a pulse exceeding

Figure 6. Location of Pulse Points

Artery (Pulse Point)	Location
Carotid artery	Neck
Brachial artery	Medial aspect of antecubital fossa
Radial artery	Thumb side of anterior wrist
Ulnar artery	Little finger side of anterior wrist
Femoral artery	Medial aspect of thigh in groin area
Dorsalis pedis artery	Top of foot
Posterior tibial artery	Behind inside of ankle bone

100 beats per minute is termed tachycardia and bradycardia if less than 60 beats per minute. Variations from this range are common. A person who exercises or runs regularly may normally have a resting heart rate less than 60, while a patient anxious about dental treatment may have a rapid pulse. Retaking the pulse in a few minutes often results in a more accurate value.

Figure 7. Normal Pulse Rates

Age or Fitness Level	Beats per Minute
Babies to age 1	100-160
Children ages 1 – 10	60-140
Children ages 10+ and adults	60-100
Well-conditioned atheletes	40-60

The strength of the pulse is a rough measurement of the amount of blood ejected by the heart and the amount of constriction in blood vessels. A "weak, thready (small)" pulse is an indication of shock and low blood pressure, while a "bounding (strong)" pulse is an indication of anxiety or high blood pressure. Regularity is indicated by even spacing between the beats. An irregular pulse, which indicates a rhythm disturbance of the heart, is seen in some patients and is usually not severe.

The patient's pulse rate, strength, and regularity should be recorded on the patient's chart, for example: 86 strong and regular.

In hypotensive or unresponsive patients, the carotid artery should be used to check for the presence of a pulse. To find the carotid artery, palpate the larynx in the midline and slide your

fingers toward you into the groove formed by the border of the sternocleidomastoid muscle.

Blood Pressure

The circulatory system is a closed system. When the heart contracts, a volume of blood is propelled into the arterial system and is measured as the systolic blood pressure (systole means cardiac contraction). During relaxation of the heart, the amount of constriction (or squeeze) applied to the arteries and the volume of blood in them is measured as the diastolic pressure.

An instrument called a sphygmomanometer (blood pressure cuff) is used to measure blood pressure. The aneroid gauge (or mercury column) is calibrated in even numbers. When measuring blood pressure, it is important to select the proper cuff, as cuffs come in various sizes, including obese adult, adult, child and infant. Cuffs that are too small for the patient may give falsely high readings. In addition, remember that cuffs should not be placed over heavy or tight clothing.

With the patient seated, and their arm resting comfortably on a level surface (the cuff should be at the same level as the heart), apply the cuff to the upper arm about one inch above the flexion crease at the elbow. Center the bladder of the cuff over the brachial artery (usually an arrow marked "artery" can be found on the cuff label). Palpate the medial aspect of the antecubital space to detect the pulsation in the brachial artery. Place the stethoscope in your ears with the earpieces pointing toward the front of your head.

Next, place the diaphragm side of the stethoscope over the spot you have located and inflate the cuff rapidly until sounds are no longer heard in the artery. Inflate the cuff 20 mm Hg beyond this point, then gradually deflate the cuff while listening for "tapping" sounds in the artery. When the sounds are first heard regularly, this level is the systolic blood pressure. Note the reading on the gauge. Continue to deflate the cuff slowly.

The character of the sounds will change and finally abruptly disappear; this is the diastolic blood pressure. Again, note the reading indicated on the gauge. With the test completed, fully open the valve to deflate the cuff and remove it from the patient's arm.

The blood pressure is recorded on the patient's chart as the systolic pressure over the diastolic pressure and also indicates the arm in which it was taken. A slight variation in blood pressure can occur between the arms; this is normal. A typical chart notation might be: 120/80 ® arm.

Blood pressure classifications are shown in Figure 8. Systolic pressures less than 20 mm Hg of the patient's normal reading may indicate hypotension. Since the diastolic pressure is the "resting" pressure of the heart, it is closely monitored for the development of hypertension. Several factors, including stress and anxiety, can raise the blood pressure and variations in blood pressure can be noted throughout the day. Before a diagnosis of hypertension is made, blood pressure should be taken on different days at different times.

Lowering blood pressure to less than 120/80 may help prevent other serious health problems as well.

Respirations

The respiratory rate is determined by the number of breaths in six or fifteen seconds. One breath or respiratory cycle consists of one inhalation and one exhalation. In many cases, if a patient knows someone is counting their respirations, he or she will unconsciously alter them. One easy method to measure the respiratory rate is to begin counting the rise and fall of the patient's chest immediately after taking their blood pressure or pulse. With the stethoscope still in your ears, glance at the clock, shift your gaze toward the patient's chest and begin counting. To obtain the respiratory rate, multiply the number of breaths in six seconds times ten (or the number of breaths in fifteen seconds times four).

Figure 8. Blood Pressure Classifications

Normal	120/80 or lower
Pre-hypertension	Between 120-139 systolic and/or 80-89 diastolic
Hypertension	Anything over 140 systolic and/or 90 diastolic

A normal respiratory rate for an adult at rest is between twelve and twenty times per minute. Respiratory rates for other age groups are listed in Figure 9. Factors that can increase the respiratory rate include anxiety, fever, and hypoxia. Respiratory rates can increase with age due to decreasing lung elasticity. The respiratory rate will decrease with the use of narcotics, including Demerol® and morphine, as well as with the use of the benzodiazepines such as Valium® and Versed®. Note the rate, depth, and regularity of respirations on the patient's chart; for example: 16 normal and regular.

Figure 9. Average Respiratory Rates for Various Age Groups

Age Group	Respiratory Rate
Adults	12-20
Teenagers	15-25
Toddlers	20-30
Infants	25-40

Emergency Training

Every member of the dental team should have completed a basic first aid course and have annual training in cardiopulmonary resuscitation from the American Heart Association or American Red Cross.[7] The CPR course for health care providers is recommended because it includes two-person CPR, child and infant CPR, and the use of a mask. Although in some states CPR refresher courses are required only every two years, they should be taken on an annual basis. Retention studies have shown that if CPR skills are not used regularly, they are soon forgotten.

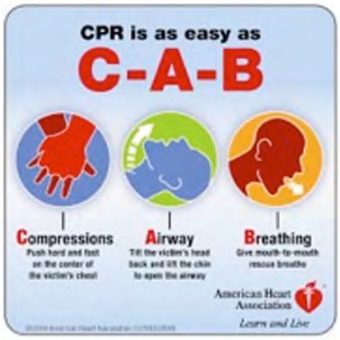
Ideally, the entire staff should take the CPR refresher course together, so they will feel comfortable working with each other if the need arises. Masks with one-way valves should be used in training and supplied to office personnel for actual patient use as specified by OSHA regulations. Bag-valve-mask devices are more difficult for the occasional user to actually ventilate a patient with such a device. Pocket masks are much easier to use, provide effective ventilations, and have ports for the addition of supplemental oxygen.

A basic first aid course provides the staff with information on emergency care in common injury situations. Topics such as the control of bleeding, treatment of burns, and the handling of sprains and fractures are covered in the course.

An automatic external defibrillator (AED) is an adjunct piece of equipment every office should consider having available as part of the office emergency kit. Some states require all dental facilities to have one, be sure to check your state law. The AED is a computerized defibrillator that recognizes the presence of ventricular fibrillation or rapid ventricular tachycardia and then allows the operator to administer "shocks" to convert the patient's heart rhythm back to normal. For every minute that lapses before defibrillation, the survival rate decreases by 10%.[17] The AED is equipped with a voice prompt to lead the operator through its usage and requires no special training. CPR CAB image

Other more advanced emergency courses (such as those for first responders and emergency medical technicians) are available and, depending on the type of practice and location, may be advisable for the dentist and staff. Oral surgeons should be encouraged to take the Advanced Cardiac Life Support Provider course (ACLS) offered through the American Heart Association.

The 2010 AHA Guidelines for Cardiopulmonary Resuscitation (CPR) recommend a change in the Basic Life Support (BLS) sequence of steps from A-B-C (Airway, Breathing, Chest compressions) to C-A-B (Chest compressions, Airway, Breathing) for adults, children, and infants (excludes newborns). This fundamental change in the CPR sequence will require reeducation of everyone who has ever learned CPR, but the consensus of the experts is that the benefit will justify the effort.



Here is a step-by-step guide for the new CPR:

1. Call 911 or ask someone else to do so.
2. Try to get the person to respond; if he doesn't, roll the person on his or her back.
3. Start chest compressions. Place the heel of your hand on the center of the victim's chest. Put your other hand on top of the first with your fingers interlaced.
4. Press down so you compress the chest at least 2 inches in adults and children and 1.5 inches in infants. "One hundred times a minute or even a little faster is optimal," Sayre says. (That's about the same rhythm as the beat of the Bee Gee's song "Stayin' Alive.")
5. If you've been trained in CPR, you can now open the airway with a head tilt and chin lift.
6. Pinch closed the nose of the victim. Take a normal breath, cover the victim's mouth with yours to create an airtight seal, and then give two, one-second breaths as you watch for the chest to rise.
7. Continue compressions and breaths – 30 compressions, two breaths – until help arrives.[14]

Office Emergency Plan

Because it is impossible to know when an emergency may occur or what form it may take, it is important that every dental office have an established, written, and practiced routine for handling emergencies.

Emergency numbers such as 911, or a seven digit ambulance or rescue squad number in those areas without 911 services, should be posted conspicuously at every phone in the office. Other phone numbers for emergencies might include the hospital emergency department, an oral surgeon, a physician, and so forth.

A code word or phrase indicating an emergency should be determined. This will alert other staff to the existence of an emergency and avoid possible upset to patients in nearby operatories or in the reception area. The office communication system will determine the type of code to be used; four buzzes on the intercom, flashing lights, or "Page for Dr. Blue" are some examples.

Every member of the dental staff should have a specific assignment in an emergency. To compensate for staffing variations, such as occurrences with part-time staff or during employee vacations, assignments should be doubled–up to assure all areas are covered. The number of assignments and specific functions will be determined by staff size and training. Large offices may have several people manning an area, while smaller staffs may have multiple areas to cover. Figure 10 shows some typical emergency assignments.

The office emergency plan should be updated and practiced regularly at periodic staff meetings or following annual CPR training sessions. Mock scenarios of various emergency situations can be developed which will allow each staff member to act out their assigned roles; some samples are given in Figure 30. Later, staff members can evaluate their performance and develop modifications to the office emergency plan as needed.

Additions to the office staff should be included in the emergency plan, and their role should be covered as part of their orientation to the office. New staff should (1) review the written office emergency manual; (2) be given a specific emergency assignment; (3) be shown the location of all emergency equipment; and (4) participate in practice situations.

With careful planning and frequent practice of the office emergency plan, confusion and panic can be significantly reduced during an actual emergency.[8]

Anxiety Reduction

Stress is the major factor causing medical emergencies in the dental office. Syncope, hyperventilation, seizures, asthma attacks, and angina are some of the more common emergencies and they share one common thread– all can be precipitated by stress and anxiety.

Anxiety related problems are fairly easy to prevent. The first step is to identify the patient likely to experience anxiety. Anxious patients tend to startle easily, have a rapid heart rate, exhibit pale and clammy skin, and appear apprehensive. In pre-treatment conversations, they may relate worry about the appointment or indicate a fear of pain.

Once identified, steps can be taken to manage the anxiety proactively. A first step is to minimize the

Figure 10. Sample Emergency Assignments for a Dental Office

Receptionist

- Call EMS (911) or local emergency number
- Calm persons in reception area
- Direct rescue squad to patient

Dental Assistant 1

- Maintain C-A-B of CPR
- Place patient in appropriate rescue position
- Assess and record vital signs; relay to emergency personnel

Dental Assistant 2 or Hygienist

- Bring emergency kit/oxygen to chairside
- Prepare medications for dentist
- Turn to appropriate page in emergency reference

Dentist

- Direct other team members and overall treatment
- Administer emergency medications

amount of waiting prior to any procedure. The procedure should be explained to the patient in a thorough and detailed manner, so that he or she experiences no surprise in the operatory. In more extreme cases, patients may need to be premedicated with anti-anxiety agents. Adequate pain control should be used and longer procedures should be divided into shorter dental appointments.

Recognition of an Emergency and Initial Emergency Procedures

Physical signs and symptoms that may indicate an incipient medical emergency include chest pain, pale skin, sweating, vomiting, irregular respiratory rate, altered or unusual sensations, hemorrhage, and changes in pulse and blood pressure.[9,10]

When an emergency situation is recognized, dental treatment should be stopped immediately and assistance summoned. If the patient was receiving nitrous oxide, it should be discontinued. 100% oxygen should be given in its place in every case but hyperventilation. Establish patient responsiveness by shaking and asking in a loud voice "Are you okay?" Lay the patient in a supine position. If the situation appears serious, call 911 immediately.

Check for the presence of a carotid pulse for 5–10 seconds. If no pulse is present, lay the patient flat in the chair with a board behind the chest. If this is not possible move the patient to the floor and begin chest compressions on a bared chest. Leaving the patient in the chair with a board behind the chest lessens the chance of injury that may happen by moving the patient to the floor. If the pulse is present, check the rate and strength. Begin fast chest compressions according to the new CPR guidelines. Apply the defibrillator pads of the AED as soon as it arrives, turn the unit "on" and follow the voice prompt directions. In a pulseless patient, defibrillation takes precedence over chest compressions.

Open the patient's airway using the head-tilt chin-lift, remove any dental materials from the patient's mouth, and suction as necessary. Assess for spontaneous breathing for three to five seconds. If the patient is not breathing, give two slow breaths via a pocket mask.

The initial emergency steps are summarized in Figure 11.

Handling Specific Medical Emergencies

What types of emergencies can be expected in the dental office? In over 30,000 medical

Figure 11. Initial Emergency Procedures

Recognition

- Stop dental treatment
- Call for help and emergency kit
- Assess consciousness; if unconscious, recline chair with legs above head
- Discontinue nitrous oxide, administer 100% oxygen in all cases but hyperventilation

Assess *Circulation*

- Check for pulse
- If NO pulse, lay the patient flat with board beneath chest or move patient to floor and begin chest compressions
- Apply the AED
- If pulse is present, check rate and strength

Assess *Airway*

- Open airway
- Use head tilt-chin lift
- Suction as necessary

Assess *Breathing*

- Check for breathing
- If not breathing, give two breaths via pocket mask (100% O_2 if possible)
- Insert oral airway if apneic
- Call for the AED

Assess *Patient and Situation*

- Manage situation as appropriate to diagnosis
- Take and record vital signs for patient breathing with pulse
- **Never attempt to transport the patient yourself**
- **Call 911 immediately for any of the following:**
  - **Cardiac arrest**
  - **Respiratory arrest**
  - **Unconsciousness > one minute**
  - **Prolonged confusional state**
  - **Chest pain > five minutes not relieved by nitroglycerin**
  - **Respiratory difficulty**
  - **Seizures**
  - **Blood pressure < 100 systolic or pulse > 120**
- Use judgment for conditions not covered above
- Treat patient supportively until rescue squad arrives
- Have medical history and patient medications available for rescue squad
- Inform rescue squad of recorded vital signs, initiated treatments, and any meds given
- Fill out office medical emergency report

emergencies reported by private practice dentists in a ten year period, the major problem seen was syncope (fainting)! The other findings of this survey are summarized in Figure 12. Over half of the problems occurred during or immediately after the administration of local anesthesia and were most commonly seen in the settings of tooth extractions or root canal therapy. This underscores the need to remain with and closely monitor patients in the operatory after administration of an anesthetic.[11]

Airway Obstruction

Foreign bodies falling into the hypopharynx can lead to partial or complete airway obstruction. The patient may complain of a foreign body sensation in the throat, be coughing and dyspneic, exhibit stridor, or become apneic and cyanotic. They may grasp their throat with their hand (universal choking symbol) and, in the case of complete airway obstruction, will be unable to speak. If not corrected immediately, respiratory arrest will lead to cardiac arrest within minutes.

Figure 12. Emergencies in Dental Private Practice Over a Ten Year Period

Type of Emergency	Percentage
Syncope	50.3%
Mild allergic reactions	8.4%
Angina pectoris	8.3%
Postural hypotension	8.0%
Seizures	5.2%
Asthma attack (bronchospasm)	4.5%
Hyperventilation	4.3%
Epinephrine reaction	3.0%
Hypoglycemia	3.0%
Cardiac arrest	1.0%
Anaphylactic reaction	1.0%
Myocardial infarction	1.0%

Dental materials should be eliminated as potential airway obstructions by appropriately securing the operative area.

If the patient is coughing forcefully, allow them to continue to cough, as this is their best chance for clearing their airway. If the patient is conscious, but continues to choke and is unable to breathe, abdominal thrusts should be used. Stand behind the patient, and place the thumb side of the fist into the abdomen above the umbilicus and below the rib cage. Administer slow, inward and upward thrusts until the object pops free or the patient loses consciousness.

With loss of consciousness, help the patient to the floor, open the airway and sweep out any obstructions which can be reached with the finger. Attempt to ventilate. If the patient cannot be ventilated, the airway is still obstructed. Continue the steps for CPR - checking mouth and ventilating at the appropriate time.

With persistent airway obstruction, a laryngoscope and Magill forceps can be used to visualize the lower airway and under direct visualization, remove the obstruction.

Asthma/Bronchospasm/COPD

Asthma is an allergic response of the small airways (bronchioles). Asthma affects people of all ages, but is more common in younger people.

Figure 13. Signs, Symptoms and Treatment of Airway Obstruction

Signs and Symptoms

- Sensation of obstruction, stridor, coughing, dyspnea, cyanosis

Treatment

- Allow patient to cough forceful
- Administer abdominal thrusts
- Use laryngoscope for direct visualization of obstruction and remove with Magill forceps
- Call 911 if obstruction not cleared

Chronic obstructive pulmonary disease (COPD) is a mixture of emphysema and bronchitis seen in older adults. Common to both is the propensity of the small airways to spasm (bronchospasm). In patients with COPD, the retention of carbon dioxide (CO_2) is a complicating factor.

In both cases, patients may respond to anxiety and aerosolized particulate matter with bronchospasm. Many cases can be prevented by pretreatment with the patient's metered dose inhaler (puffer) of bronchodilator medication. The inhaler should also be readily available at chairside.

The patient may abruptly develop bronchospasm as evidenced by wheezing, coughing, and difficulty breathing, and may also complain of chest tightness and develop cyanosis.

The patient should be placed in an upright position with arms forward to facilitate breathing and oxygen should be administered by mask or nasal cannula. The patient should use their inhaler and self administer one puff with instructions to inhale and exhale slowly. If the patient recovers well, treatment can continue. If the patient does not improve within five minutes, a second dose should be administered and it is recommended that treatment be postponed to another date.

Cardiac Arrest

Of all the emergencies which may occur in the dental office cardiac arrest is certainly the most serious. Cardiac arrest may result from an abnormal heart rhythm or be secondary to respiratory arrest. In either case, time and immediate intervention is of the essence.

Immediately upon assessing unconsciousness in a patient, call 911. The rescuer should open the airway, look, listen, and feel for respirations. Next, check the carotid pulse for five to ten seconds. If a pulse is absent, lay the patient flat with board beneath chest or move patient to floor.

Figure 14. Signs, Symptoms and Treatment of Asthma, Bronchospasm, and Chronic Obstructive Pulmonary Disease

Signs and Symptoms

- Wheezing, chest tightness
- Stridor, coughing, dyspnea, and cyanosis

Treatment

- Position patient upright with arms forward
- Administer oxygen
- Administer one puff from inhaler; repeat in five minutes if necessary
- Assess and record vital signs; relay to emergency personnel
- Call 911 if no improvement in five minutes

Figure 15. Signs, Symptoms and Treatment of Cardiac Arrest

Signs and Symptoms

- Unresponsiveness, apnea, and pulselessness

Treatment

- Call 911
- Lay patient supine with board beneath chest or move to the floor
- Attach AED and follow voice prompts
- Begin basic life support (CPR)
- Ventilate with 100% oxygen if possible
- Assess and record vital signs; relay to emergency personnel

Begin the fast compressions for CPR as outlined earlier. Open the patient's airway using the head-tilt chin-lift, remove any dental materials from the patient's mouth, and suction as necessary. Assess for spontaneous breathing for three to five seconds. If the patient is not breathing, give two slow breaths via a pocket mask.

When possible, use the two-rescuer technique. Attach AED if available and follow the instructions. Continue to monitor all vital signs and give that information to emergency personnel when they arrive.

Cerebrovascular Accidents/Transient Ischemic Attacks

A cerebrovascular accident (CVA or stroke) or a transient ischemic attack (TIA) is caused by an interruption of blood flow to the brain. These episodes are usually seen in older patients as a consequence of atherosclerosis or untreated hypertension. The interruption in flow may be due to a blood clot, spasm of the arteries, or even to rupture of a blood vessel in the brain. Blood flow to the cerebral cortex is insufficient and the patient will exhibit symptoms within seconds. The signs and symptoms may be of short duration (TIA) which resolve spontaneously or persist for months or years. A transient ischemic attack is a forewarning of a major ischemic CVA; these patients must be evaluated by a physician to prevent such an occurrence.

F.A.S.T. signs can be used quickly to determine if a patient may be experiencing a

CVA. The patient may have an altered level of consciousness or periods of confusion. Weakness or paralysis in one half of the body (right or left side) may be obvious. The patient may also be unable to speak or understand speech. When these severe symptoms occur without warning, they are likely to alarm both the patient and staff.

When faced with a TIA or CVA, 911 should be called immediately. Place the patient on their side to maintain their airway, and suction oral secretions to prevent aspiration. These are both necessary as the patient frequently loses control of the facial muscles. Calm and reassure the patient and monitor their vital signs. Oxygen

Figure 16. Signs, Symptoms and Treatment of Cerebrovascular Accidents (CVA) and Transient Ischemic Attacks (TIA)

Signs and Symptoms

- Altered level of consciousness, confusion
- Aphasia
- Unilateral muscle weakness or paralysis

Treatment

- Maintain airway
- Positions patient in semi-supine position
- Suction as necessary
- Monitor vital signs
- Assess and record vital signs; relay to emergency personnel
- Call 911

may also be administered if the patient is having trouble breathing.

If an ischemic stroke is confirmed, and the onset of symptoms has been less than 3 hours, a medication will be administered to help remove the clot and restore blood flow to the affected brain areas.

Chest Pain/Angina/Acute Myocardial Infarction

The development of central chest discomfort frequently results from stressful situations in patients with coronary artery disease. In angina episodes, the coronary artery narrowed by atherosclerosis is unable to supply the heart muscle with adequate amounts of oxygenated blood, causing chest pain. The onset of

Figure 17. Signs, Symptoms and Treatment of Angina and Acute Myocardial Infarction

Angina

Signs and Symptoms

- Central, substernal chest discomfort
- May radiate into shoulders, arms, neck, jaw, or epigastric region
- Dull, heavy, pressure sensation of short duration (< 5 min)
- Prompt relief with rest and/or nitroglycerin

Treatment

- Position patient semi-upright or upright
- Administer oxygen
- Administer nitroglycerin 0.4 mg SL every five minutes
- Assess and record vital signs; relay to emergency personnel
- **Call 911 if pain not relieved with 2 doses of nitroglycerin over a 10 minute period**

Acute Myocardial Infarction (AMI)

Signs and Symptoms

- Central, substernal chest discomfort
- May radiate into shoulders, arms, neck, jaw, or epigastric region
- Dull, heavy, pressure sensation
- Dyspnea, syncope, diaphoresis, sudden death
- Pain not relieved by nitroglycerine or rest; long duration (hours)
- Women may experience different signs - upper abdominal pain and fatigue

Treatment

- **Call 911 immediately**
- Position patient semi-upright or upright
- Administer oxygen
- Administer nitroglycerin 0.4 mg SL every five minutes
- Initiate fibrinolysis; if possible, have patient chew 162 to 325 mg of aspirin
- Calm and reassure patient
- Assess and record vital signs; relay to emergency personnel

anginal chest pain is usually directly related to exercise, stress, and anxiety. The decreased oxygen supply to the heart muscle is usually of short duration (less than five minutes) and no permanent damage occurs.

In myocardial infarction (MI or heart attack), a blood clot develops in one of the coronary arteries completely cutting off blood supply to a portion of the heart muscle. Without a blood supply, the heart muscle dies within a few hours. The ischemic heart is very irritable and susceptible to cardiac arrhythmias. This is the patient most susceptible to sudden death. Whenever and wherever a myocardial infarction is recognized, 911 must be called immediately. This is critical, as about 50 percent of patients experiencing a myocardial infarction will die in the first two hours.

In both cases the patient will complain of chest pain usually described as a pressure or weighty sensation. This pain or numbness may radiate into either of their shoulders, arm, the neck, jaw, straight through to the back or to the upper part of the abdomen. Complaints of shortness of breath, nausea or vomiting are common, and the patient's skin may be pale and sweaty. If the patient has experienced angina in the past, they will be able to determine if this pain is different in character.

Place the patient in whatever position is most comfortable. It is recommended that out-of hospital patients are administered a single, chewed dose of 162 mg to 325 mg of aspirin to begin fibrinolysis. When chewed, the clinical effects are realized more quickly. Administer oxygen and monitor vital signs. Nitroglycerin 0.4 mg may be administered sublingually every five minutes but is usually more effective in treating the pain associated with an angina episode. If the patient has not previously had nitroglycerin, it is advisable to administer it while the patient is in a supine position, as hypotension is frequently seen in first time users. Calm and reassure the patient. The experience can be extremely frightening, with some patients voicing feelings of impending doom or death.

Heart Failure/Pulmonary Edema

Heart failure results when one of the ventricles is unable to completely pump all of the blood filling the chamber forward into the arteries. Heart failure may involve either the left ventricle (left ventricular failure-LVF) or the right ventricle (right ventricular failure-RVF). Of the two, left ventricular failure is the more serious and occurs first. In LVF, blood backs up into the lungs causing pulmonary congestion and shortness of breath, particularly when the patient is lying flat. In RVF, the blood backs up into peripheral circulation causing swollen legs and ankles resulting in pitting edema.

Left ventricular failure is frequently precipitated by an acute myocardial infarction. When this occurs, call the rescue squad (911) immediately and place the patient in whatever position is most comfortable for them, usually sitting bolt upright. Administer oxygen by mask and monitor vital signs. If the patient complains of chest pain, nitroglycerin may be given.

Hypoglycemia

Hypoglycemia occurs when there is insufficient glucose in the bloodstream to meet the metabolic demands of cells. True hypoglycemia is seen only in insulin dependent diabetics (Type I) or in Type II diabetics using oral hypoglycemic agents such as Diabeta®, Orinase®, or Glucotrol®. The lack of glucose in the neurons of the central nervous system results in immediate dysfunction, causing the patient to appear confused and restless. Patients may also complain of a headache or exhibit bizarre behavior. Their skin becomes pale, cool and clammy, and their heart rate increases. On occasion, a patient may exhibit seizure activity or transient stroke-like symptoms. If a source of glucose is not administered immediately, permanent damage may result.

Hypoglycemia occurs when blood sugar levels drop below 80 mg/dl and typically becomes more acute in the 20-30 mg/dl range.

Hypoglycemia can be prevented by making sure the insulin dependent diabetic has eaten before treatment, by scheduling appointments in the morning, and by having a glucose source readily available at chairside. If the patient exhibits signs and symptoms of hypoglycemia, administer an oral carbohydrate such as regular cola, table

Figure 18. Signs, Symptoms and Treatment of Heart Failure

Pathophysiology

- LVF (acute) secondary to AMI, pulmonary congestion
- RVF (chronic) secondary to LVF or lung disease, peripheral venous congestion

Signs and Symptoms

- LVF: pulmonary edema, orthopnea, cough, wheezing, rales, chest pain
- RVF: distended neck veins, ascites, hepatomegaly, pretibial pitting edema

Treatment

LVF:

- **Call 911**
- Place patient in comfortable position, usually sitting upright
- Administer oxygen
- Administer nitroglycerin 0.4 mg SL every five minutes
- Assess and record vital signs; relay to emergency personnel

RVF:

- Refer to physician for treatment

Figure 19. Signs, Symptoms and Treatment of Hypoglycemia

Signs and Symptoms

- Headache, confusion, restlessness, bizarre behavior
- Seizures, unconsciousness
- Tachycardia, pale, cool, clammy skin

Treatment

- Maintain airway
- Keep patient supine, turned on side to prevent aspiration
- Administer glucose in dependent cheek or beneath tongue
- Assess and record vital signs; relay to emergency personnel
- Call 911

sugar, or even a spoonful of honey or icing to raise blood glucose levels. For a patient who becomes unconscious, maintain their airway, turn the patient on their side to prevent aspiration and administer glucose in the dependent cheek. This will usually provide sufficient glucose to allow the patient to regain consciousness. The patient should then drink a liquid high in sugar to increase their blood glucose level. Following a hypoglycemic reaction, advise the patient to eat a meal to maintain blood sugar levels and prevent a recurrence of the hypoglycemic episode.

Diabetic Ketoacidosis

Diabetic ketoacidosis occurs when there is not enough insulin available to move glucose into cells. This causes the cells to use fats and proteins for energy, leaving behind waste

products which build up in the blood. Over time, from hours to days to sometimes weeks, the blood sugar level continually increases. Frequently an underlying medical problem such as heart attack, infection, or stroke may precipitate diabetic ketoacidosis even in diabetics who are normally in good control.

The signs and symptoms of diabetic ketoacidosis are related to the osmotic effects of the very high blood sugar, the cellular acidosis, and the body's attempt to compensate for the acidosis. Patients may hyperventilate and have a fruity odor to their breath; extreme thirst due to severe dehydration and polyuria are also common. Because of the loss of fluids, the skin is warm, red, and dry to the touch. As the dehydration and acidosis become more severe, blood sugar levels will exceed 300 mg/dl, and the patient finally may lose consciousness.

Maintain airway and ventilations by placing the patient on their side to prevent aspiration. Treatment of hyperglycemia will require hospitalization of the patient.

Allergy/Anaphylaxis

An allergic reaction is the result of an antigen-antibody reaction to a substance to which the patient has been previously sensitized. Histamine and other complex chemicals are released from body cells causing symptoms in the patient. These symptoms may be confined to a single organ system or become generalized (anaphylaxis).

In the dental office, the most likely culprits are exposures to latex, local anesthetics, or antibiotics, but foods the patient may have eaten prior to their visit such as nuts, shellfish, milk products, and strawberries can also trigger this syndrome.

The allergic reaction is frequently seen only in the body system which first came into contact with the allergen. Wheezing may be the result of something the patient may have inhaled which affects the lungs. A reaction may also be due to an injection of local anesthetic or antibiotic, resulting in a skin rash with intense itching. In other cases, ingested foods may lead to swelling of the upper airway and stridor. In its most severe form, an allergic reaction can progress to anaphylaxis, a condition in which several body systems are affected simultaneously.

The treatment of allergic reactions and anaphylaxis is the same-provide supportive care and administer epinephrine. Maintain the patient's airway, administer oxygen, and monitor the vital signs. Administer epinephrine 1:1000 0.3-0.5 mg SQ, often into the upper arm or thigh. Every office should include at least 3 auto injector epinephrine pens in their office emergency kit. Twinject® and Epi-Pen® are the most common pens for kits. Epinephrine is the treatment of choice for allergic reactions, as it reverses all the histamine induced symptoms and blocks the further release of histamine. Benadryl® 50 mg IM or PO may be administered to treat the hives and relieve itching of the skin. Call 911 immediately

Figure 20. Signs, Symptoms and Treatment of Diabetic Ketoacidosis

Signs and Symptoms

- Hyperventilation (Kussmaul respirations)
- Acetone odor on breath
- Warm, red, dry skin
- Unconsciousness (late finding)

Treatment

- Maintain airway
- Keep patient supine; turn on side to prevent aspiration
- Assess and record vital signs; relay to emergency personnel
- Call 911

Figure 21. Signs, Symptoms and Treatment of Allergic-Anaphylactic Responses

Pathophysiology

- Antigen-antibody reaction
- May be system specific or generalized
  - angioneurotic edema (pharynx and upper airway)
  - asthma (respiratory tract)
  - urticaria-pruritus (integumentary system)
  - anaphylaxis (all of above with circulatory collapse)

Prevention

- Careful appraisal of patient's allergies

Signs and Symptoms

- Apprehension, anxiety
- Angioneurotic edema (pharynx and upper airway), swelling of neck, hoarseness, stridor asthma (respiratory tract) (see Figure 14)
- Urticaria-pruritus (integumentary system), hives, itching, red skin
- Anaphylaxis (all of above, with circulatory collapse)
- Hypotension, cool, pale, clammy skin
- Extreme respiratory distress
- Unconsciousness, respiratory and cardiac arrest

Treatment

- Place patient in supine position
- Maintain airway
- Administer oxygen
- Assess and record vital signs; relay to emergency personnel
- Administer epinephrine 1:1000 0.3-0.5 mg SQ for all reactions
- Administer Benadryl® 50 mg deep IM for skin reaction or Benadryl® 50 mg PO
- **Call 911 for severe reaction**

as anaphylaxis may be a life-threatening emergency.

Accidental Overdose

Rapid administration, excessive dosing, or inadvertent intravascular administration may all result in increased drug effects. Prevention is the key in avoiding adverse drug reactions. Question the patient before treatment about allergies and hypersensitivity.

If the drug is to be injected IV, administer it slowly, and use the minimum amount required to achieve the desired effect. When administering blocks, use an aspirating syringe. A child's body size and weight should be considered during dosing and anesthetic administration.

Most drugs have a few specific antidotes available. There are two notable exceptions. Narcan® (naloxone) is the antidote for accidental overdose of narcotics given IV such as Demerol® (meperidine).

Narcan® can be used to reverse the hypotension, respiratory depression, and decreased level of consciousness caused by these narcotics. In the case of the benzodiazepines such as Valium® (diazepam) and Versed® (midazolam), a specific antidote-Romazicon® (flumazenil)-is also available.

The patient should be treated supportively until the effects of the drug wear off. Stop the administration of the drug, maintain the airway and ventilations, monitor vital signs, and contact 911 if the patient fails to show prompt improvement.

All of the toxic effects of lidocaine are due to its effects on the central nervous system and the conduction of nerve impulses. The signs and symptoms of lidocaine toxicity are shown in Figure 22. As there is no specific antidote for lidocaine toxicity, provide supportive care. Maintain the airway, administer oxygen, and treat other problems as they arise.

Hyperventilation Syndrome

Anxiety, fear, and pain in susceptible individuals can result in a conscious overdrive of ventilation called hyperventilation. The excessive excretion of carbon dioxide that occurs due to the greatly increased respiratory rate can cause unpleasant symptoms which exacerbate the situation. Apprehension, air hunger (a sense that they "can't catch their breath") coupled with numbness and tingling in the arms and legs, give the patient the sensation (although erroneous) that something is seriously wrong. The hyperventilation may progress to the point where the patient develops painful carpopedal spasm and may even have a syncopal episode. As soon as the patient faints,

Figure 22. Signs, Symptoms and Treatment of Lidocaine Toxicity/Overdose

Signs and Symptoms

- Ringing or buzzing in ears
- Restlessness, agitation, confusion
- Blurred vision
- Muscle fasciculations, tremors, seizures
- Hypotension, bradycardia
- Respiratory or cardiac arrest

Treatment

- Maintain airway
- Administer oxygen
- Assess and record vital signs; relay to emergency personnel
- Call 911
- Treat problems as under other sections

Figure 23. Signs, Symptoms and Treatment of Hyperventilation

Signs and Symptoms

- Air hunger, apprehension
- Rapid respiratory rate (may be subtle)
- Circumoral, hand, and foot numbness or tingling
- Carpopedal spasm
- Syncope

Treatment

- Make patient aware of how fast they're breathing
- Coach the patient to take slower breaths
- Calm and reassure the patient
- **Call 911 if attack cannot be broken**

however, the respiratory rate immediately returns to normal.

Hyperventilation is the only emergency when oxygen administration is not called for in the treatment plan. The old treatment which involved use of a paper bag should be avoided, as it may increase carbon dioxide to dangerously high levels in patients with a metabolic cause for their hyperventilation, such as diabetic ketoacidosis. Instead, make the patient aware of how fast they are breathing and assure them that all of their symptoms are related to their fast respiratory rate. Coach the patient to take slow, regular breaths on a breath by breath basis. If necessary, use a detached oxygen mask which has holes for the release of excessive carbon dioxide to help reassure and calm the patient.

Respiratory Arrest

The end result of bronchospasm, hypoxia, airway obstruction, aspiration, and laryngospasm may be respiratory arrest. Patients who stop breathing will be unresponsive. Instruct someone to call 911 immediately. Open the patient's airway, and look, listen, and feel for airflow over the mouth and nose. If the patient is not breathing, place a pocket mask over the patient's mouth and nose, maintain the head tilt, and deliver a slow ventilation until the patient's chest rises. Repeat this ventilation and check the patient's pulse. If the pulse is present, ventilate an adult twelve times per minute (one breath every five seconds); for children or infants, ventilate twenty times per minute (one every three seconds). Be careful to ventilate only until the patient's chest rises, as overventilation will distend the stomach with air and cause vomiting. Continue ventilations with periodic checks of the pulse until the rescue squad arrives.

Seizures

Convulsions or seizures are caused by waves of abnormal electrical activity in the brain. As these waves spread across the surface of the brain, they stimulate other cells which are responsible for motor activity, sensation, or consciousness.

Seizures are most commonly seen in patients with known seizure disorders such as epilepsy. Such patients may have stopped taking or missed a dose of their anti-seizure medication or they may experience a seizure as a result of exposure to a triggered or stressful situation. It is important to note that otherwise "normal" patients may seize if the conditions are right, particularly with hypoglycemia or hypoxia.

In some cases, the patient may have a premonition they are about to have a seizure. This premonition, called an aura, may take the form of a strange smell, visual or auditory hallucination, or other strange sensation. This allows the patient some time-ranging from a few seconds to minutes-to prepare for the seizure. As a seizure begins, the patient typically loses consciousness and then becomes tonic as all the major skeletal muscles contract. The patient is apneic, becomes cyanotic, and may bite their tongue. This is followed by the clonic phase in which muscles contract and relax in waves. During this phase, these involuntary movements

Figure 24. Signs, Symptoms and Treatment of Respiratory Arrest

Pathophysiology

- Hypoxia, bronchospasm, obstruction, aspiration, laryngospasm

Signs and Symptoms

- Apnea

Treatment

- Maintain airway
- Ventilate with 100% oxygen (adults: 12/min.; children: 20/min.)
- Assess and record vital signs; relay to emergency personnel
- **Call 911**

Figure 25. Signs, Symptoms and Treatment of Seizures

Pathophysiology

- Primary idiopathic epilepsy (cause unknown)
- Hypoxia, hypoglycemia, acute arrhythmias, drug overdose
- Alcoholism (acute or withdrawal)
- May be precipitated by stressful situations

Signs and Symptoms

- Aura
- Loss of consciousness
- Tonic-clonic contractions
- Apnea, facial grimacing, tongue-biting, cyanosis
- Incontinence of urine and stool
- Vomiting
- Post-ictal coma and confusion

Treatment

During Seizure:

- Protect patient from injury, guide motions
- Loosen constrictive clothing
- **Do NOT force any object between patient's teeth**
- **Do NOT attempt to restrain patient**

After Seizure:

- Maintain airway
- Keep patient supine, turn on side to prevent aspiration
- Administer oxygen
- Assess and record vital signs; relay to emergency personnel
- Attempt to ventilate only in recurring seizures
- **Call 911 if first ever occurrence or if patient sustains an injury; or allow patient to recover and have an emergency contact drive them home**

make the patient susceptible to injuries to the head, arms, or legs, and they may become incontinent of urine and stool. A seizure is followed by a period of drowsiness, confusion and extreme fatigue called the postictal phase.

When observing a generalized motor seizure, knowing what not to do is as important as knowing what to do. Never attempt to place or force any object between the patient's teeth. Bite sticks are ineffective and may cause damage to oral structures. Do not attempt to restrain the patient's movements. Individuals experiencing a seizure exhibit incredible strength and attempts at restraint may result in fractures to the patient's bones. In addition, do not attempt to ventilate the patient during a seizure.

Loosen any constrictive clothing and turn the patient on their side to protect their airway from vomiting and aspiration. Place padding beneath the patient's head to prevent injury and let the seizure run its course. While seizures invariably last only one to two minutes, the time seems much longer as the event is being witnessed. After the seizure, continue to monitor the airway, administer oxygen, and obtain vital signs.

Syncope

Fainting or syncope results from either the psychologic response to fear, anxiety, stress, pain, or unpleasant situations or from poor autonomic adjustments to changes in the patient's posture. In some cases, syncope may be due to very rapid or slow cardiac arrhythmias. Syncope accounts for over 50% of reported emergencies in the dental office.

The psychologic reaction causes an abrupt slowing of the heart rate and pooling of blood in the extremities. Within seconds the patient may complain of a flushed sensation, followed rapidly by loss of consciousness.

Syncope can be prevented by identifying the patient prone to anxiety or who is using anti-anxiety agents. Fearful patients can be prescribed a premedication to help them relax for the dental visit. Keep the patient supine if possible; with older patients, allow them time to slowly adjust to an upright posture after procedures are completed. In the elderly, rapid changes in posture can result in postural (orthostatic) hypotension.

When faced with a fainting episode, help the patient to the floor or place them in a supine position in the dental chair with the legs elevated. Once supine, the patient will regain consciousness almost immediately. Administer oxygen and loosen any tight clothing. Do not allow the patient to sit up, as they will frequently faint again. Keep the patient supine for a few minutes while the team attempts to determine the cause of the episode. Monitor vital signs. Because the patient regains consciousness almost immediately, the use of ammonia inhalants is unnecessary. It is recommended that treatment be stopped and rescheduled for another date.

Emergency Kit

Every dental office should have an emergency kit.[12] Commercially available kits are expensive and contain drugs and equipment that will never be used; in fact, some of these kits contain drugs that have not been used in general medicine for twenty years. A kit can very easily- and inexpensively- be assembled, although the actual drugs in the kit should be selected by the dentist. Never include drugs or equipment that the dentist is not trained to use or comfortable in administering. Drugs can be purchased from a hospital pharmacy and the other supplies obtained from a local medical equipment company. Figure 27 lists the suggested contents of an emergency kit for the dental office.

Another general rule to kit supplies relates to how close the office is to emergency help. Rural offices may need to have more medicines in their kit to administer until help can arrive. Urban and suburban offices may be able to just have the basic supplies as help will reach them more quickly.

All of the materials (except the oxygen cylinder and AED) can be stored in a large tackle box for portability. The kit should be kept in a prominent, easily accessible location known to everyone in the office. Someone on the dental team should

Figure 26. Signs, Symptoms and Treatment of Syncope

Signs and Symptoms

- Prodromal pallor, light-headedness, dizziness or weakness
- Sudden collapse and unconsciousness

Treatment

- Lay patient supine; elevate lower extremities
- Consciousness should return immediately, but do not allow the patient to get up right away
- Monitor vital signs
- Use of ammonia ampules unnecessary
- Call 911 if symptoms do not resolve

Figure 27. Dental Emergency Kit

Supplies

- AED
- Oxygen cylinder with masks and cannulas
- Large bore suction tips
- Oral airways (small, medium, large)
- Pocket mask
- Blood pressure cuff and stethoscope
- Laryngoscope and Magill forceps
- Instant glucose or sugar packets

Drugs

- Aspirin 81 mg Chewable tablets (Children's Aspirin)
- Epinephrine 1:1000 prefilled syringe or EpiPen® Auto-Injector
- Diphenhydramine (Benadryl®) 50 mg prefilled syringe or 50 mg tablets
- Nitroglycerin (Nitrostat®) 0.4 mg tablets or spray (Nitrolingual® Spray)

AED on wall

AED off wall

be responsible to periodically check all items to ensure that none of the drugs have passed their expiration date and all equipment is operational.

A card which clearly states the indication, dosage, and administration of the drugs in the kit should be taped inside the lid. In an emergency situation, infrequently used doses can easily be forgotten. Each of the drugs listed is available in prefilled syringes so that no time will be lost drawing drugs up in syringes. A sample emergency drug card is shown in Figure 28. The drugs in the kit should be kept simple, as their purpose is only to handle life threatening problems until the rescue squad arrives.

Emergency Treatment Records and Evaluation

A record of an office emergency should be included in the patient's records. When an emergency occurs in the office be sure to note all details in the patient's chart. A sample emergency treatment form is shown in Figure 29.

Following the emergency event, a post-emergency assessment of the situation should be done with all those involved evaluating each other's performance. In this way, problems can be identified and corrections made to the office emergency plan as required.

Figure 28. Emergency Drugs: Indications and Doses		
Drug	**Indication**	**Dose**
Aspirin	Chest pain or discomfort	160-325 mg PO
Epinephrine 1:1000	Allergic Reactions Anaphylaxis Asthma	0.3-0.5 mg or ml SQ
Benadryl® (diphenhydramine)	Allergic Reactions (hives and itching)	50 mg IM or 50 mg PO
Nitroglycerin	Chest pain	0.4 mg SL
Glucose	Hypoglcemia	If conscious allow patient to drink sugar mixture; if unconscious place under tongue

EMERGENCY TREATMENT FORM

Patient Name: _____ Date : _____

Time Emergency Start: _____ Time Emergency End: _____

Description of Emergency Situation:

_____

_____

Who Attended: _____

What Was Done: _____

_____

Rescue Squad Called: _____

Patient Transported to _____ Hospital

Follow-up Treatment: _____

_____

DDS Signature: _____ Date: _____

Figure 29. Sample Emergency Treatment Form

When reviewing the emergency, the first part of the evaluation should consider the situation and address the following:

- How early was the emergency detected?
- Did the patient's history or chart indicate a problem might occur?
- Were any warning stickers or alerts messages posted within the patient's record?
- What preventive measures might have been taken?
- Were treatment recommendations followed?
- What could be done next time to avoid the situation?

The second part of the evaluation looks at the performance of the "team."

- How did the office staff respond?
- Did staff members complete their assignments efficiently or was there panic and confusion?
- Did any members of the team experience difficulties?
- Was the staff emotionally prepared to handle the emergency?
- Do the role assignments need to be modified?

The final part of the evaluation considers equipment and supplies.

- Was the equipment (emergency kit/cart) stored in the designated location?
- Was all equipment present and functional?
- Were drugs unexpired and correctly prepared?
- If CPR was performed, did the team follow the most recent accepted protocols?

The main goal of the evaluation is to define strategies to either avoid a crisis or if unforeseeable to provide appropriate patient care.

Figure 30. Sample Emergency Scenarios
Here are some examples of scenarios that can be used in your office for practice in handling medical emergencies.
• During root canal therapy, a 68-year-old male becomes pale and profusely sweaty. He clutches his chest, appears confused, seizes briefly and is now unresponsive to verbal stimuli. He is not breathing and no pulse can be felt in the carotid artery.
• An anxious patient in the reception room complains of numbness and tingling in her extremities. Her respiratory rate is 28.
• An elderly diabetic was told to skip breakfast prior to coming to her appointment. She is now confused, has a pulse of 110, and appears dizzy.
• A receptionist with a seizure disorder experiences a motor seizure and is now unconscious.
• The dentist reports prolonged chest discomfort.
• After receiving a local anesthetic, a patient develops respiratory difficulty, facial swelling, itching, and hives.

Legal Aspects

The legal obligations in the dental office rest principally with the dentist. However, assistants must be aware of state dental practice acts and any rulings which could involve the assistant. In many states current CPR status for auxiliaries is required. Always remember-ignorance of the law does not constitute immunity from liability.[13]

In addition to familiarity with state dental practice acts, the dentist should also be aware of accepted treatments and protocols for medical emergencies which often become the basis for a legal standard of care. The standard of care can be defined as "what the reasonable, prudent person with the same level of training and experience would have done in the same or similar circumstances."

The first component is a duty to act. There is no doubt that a health care provider is required to render necessary emergency care to an individual in an office, whether that individual is a patient, family member, or an employee. The expectation of the general public is that they are in a health care facility and that its employees should be trained for such emergencies.

The second part is an act of omission or commission. An act of omission would be failing to carry out some task that the "reasonable, prudent person" would have performed under the circumstances. An act of commission would be an attempt to provide care beyond what was normally accepted under the circumstances or by failing to have taken an action that would have prevented an emergency.

The third point that would have to be proven is that the patient was actually injured in some way. In most cases, this would be some type of physical injury, but it could also include emotional or economic damages.

The fourth point-that the assistant's failure to act as a reasonable, prudent person was the proximate cause of the patient's injuries-ties everything together.

Figure 31. Elements of Malpractice
Four elements must be proven in malpractice (negligence) cases:
1. Duty to act or render care in the situation
2. Acts of omission or commission
3. The patient was injured in some manner
4. The health care providers' failure to act was the proximate cause of the patient's injury

This cycle of potential malpractice can be avoided by safeguarding the patient's interests, performing as expected in an emergency, and acting within the scope of your practice.

Taking into consideration these legal aspects concerning emergency treatment, always keep in mind the following points:

1. When an emergency arises call for EMS (911) immediately. There are cases on record in which dentists have been sued for not calling an ambulance in a timely manner. In handling an office emergency, the goal should always be to maintain the patient and provide appropriate treatment until the rescue squad arrives. Rescue squad personnel will not mind if they arrive at the scene only to find a patient not requiring further treatment or transport. Once the rescue squad arrives, however, they and their medical control physician (via radio) are in charge of the patient's medical treatment.
2. If there is a problem, such as a dental dam clamp falling into a patient's throat, be honest with patients as to the nature of the problem.
3. Refer patients to medical professionals when necessary. Never attempt to treat situations which require physician or hospital management.
4. Be knowledgeable about state dental practice acts and your requirements for dealing with emergencies.
5. Take a complete health history for new patients and update it at each visit. Maintain adequate records. Document emergency treatment rendered; generally, courts have maintained that if it wasn't written down, it wasn't done.
6. Take vital signs, especially if an anesthetic is to be administered.
7. Having an emergency kit in the office does not prevent liability unless you know how to use it properly.

Summary

It has been estimated that one or two life threatening emergencies will occur in the lifetime practice of a general dentist. With the aging of the population generally and the more frequent appearance in the dental office of individuals with underlying medical conditions, the possibility of problems occurring will only increase. Obtaining a health history and a set of vital signs is the first step in identifying the patient likely to develop a medical emergency. With proper training, thorough preparation, and regular practice, the staff of the dental office will be able to provide appropriate medical care should the need arise.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to www.dentalcare.com and find this course in the Continuing Education section.

1. The most frequent medical emergency in the dental office is _____.

a. myocardial infarction
b. syncope
c. respiratory arrest
d. allergic reactions

2. The best office emergency kit is one _____.

a. purchased from a dental supply house
b. set-up by a local physician
c. prepared by the dentist based on his/her needs
d. containing medications and equipment to handle any emergency

3. The _____ artery is used when taking a patient's blood pressure.

a. brachial
b. carotid
c. radial
d. femoral

4. In an emergency, the best place to check the pulse is the _____.

a. carotid artery
b. brachial artery
c. radial artery
d. femoral artery

5. The best position in which to place a syncopal patient is _____.

a. seated with the patient's head between their legs
b. supine with the legs elevated
c. on their side
d. in a seated position

6. _____ best illustrates the "normal" vitals for an adult.

a. Pulse 108, BP 160/90, respirations 22, temperature 101°F
b. Pulse 50, BP 88/40, respirations 28, temperature 98.6°F
c. Pulse 80, BP 118/70, respirations 16, temperature 98.6°F
d. Pulse 98, BP 208/110, respirations 18, temperature 97.2°F

7. Most emergencies occur _____.

a. in the reception room
b. after treatment is completed
c. while under nitrous oxide sedation
d. during or immediately following local anesthesia administration

8. A conscious patient is unable to breathe or talk. When you ask if they are choking, they nod their head. You should administer _____.

a. oxygen
b. four back blows
c. fifteen chest compressions
d. abdominal thrusts

9. A 17-year-old anxious female suddenly develops shortness of breath, appears cyanotic around the mouth, and is audibly wheezing. Her problem is most likely _____ and the treatment is _____.

a. allergic reaction; epinephrine SQ
b. angina; nitroglycerin sublingually
c. asthma; use of her inhaler
d. syncope; lying patient flat and elevating legs

10. Immediately upon recognizing cardiac arrest in the office you should _____.

a. call 911
b. ventilate with a bag-valve-mask
c. begin chest compressions
d. administer oxygen

11. Mrs. Smith, a 57-year-old diabetic, is having extensive bridgework completed during her lunch break appointment. She begins acting strangely, her pulse is rapid, and her skin is pale, cool, and clammy. You suspect _____ and treat it with _____.

a. asthma; puff from her inhaler
b. hypoglycemia; oral sugar
c. angina; nitroglycerin
d. stroke; oxygen

12. While administering lidocaine anesthesia to a 21-year-old male, he becomes pale, pushes the dentist's hand away and passes out. You suspect _____.

a. lidocaine toxicity
b. allergic reaction
c. epinephrine reaction
d. syncope

13. A severe allergic reaction involving several body systems is called _____.

a. convulsions
b. syncope
c. anaphylaxis
d. angina pectoris

14. An older patient becomes restless during treatment. He seems unable to move one arm and his speech is slurred. He may be having _____.

a. cerebrovascular accident/transient ischemia attack
b. acute myocardial infarction
c. angina pectoris
d. epileptic seizure

15. During an episode of hyperventilation, the patient is losing too much _____.

a. oxygen
b. nitrogen
c. hydrogen
d. carbon dioxide

16. _____ may result in increased drug effects or hypersensitivity.

a. Rapid administration
b. Excessive dosing
c. Inadvertent IV administration
d. all of the above

17. The main cause of syncope is _____.

a. hypertension
b. stress
c. overexertion
d. hunger

18. Anxiety hyperventilation is best treated using _____.

a. a paper bag
b. high flow oxygen
c. coaching techniques to slow breathing
d. anti-anxiety agents

19. To reduce possible injury of the patient during a seizure, the assistant should _____.

a. seat the patient upright in the chair
b. hold the patient absolutely still
c. loosen tight clothing and place a pad beneath their head while turning them to their side
d. place a bite block between their teeth to prevent damage to oral structures

20. The medication most often used to relieve anginal pain is _____.

a. nitroglycerin
b. Dilantin®
c. epinephrine
d. insulin

21. A patient is administered an oral antibiotic one hour before their appointment. They now complain of difficulty breathing, with rash and itching of their skin. Their blood pressure is 80/40 and the pulse is 120. The most likely problem is _____ and the treatment would be _____.

a. hyperventilation syndrome; rebreathing carbon dioxide
b. allergic/anaphylactic reaction; epinephrine SQ
c. diabetic ketoacidosis; insulin
d. pulmonary edema; oxygen

22. Nitroglycerin is administered _____.

a. intravenously
b. intramuscularly
c. sublingually
d. by inhalation

23. A heart rate greater than 100 is called _____.

a. tachycardia
b. arrhythmia
c. hypertension
d. bradycardia

24. Signs and symptoms of a heart attack include _____.

1. central chest pain
2. pain radiation to arms
3. nausea and vomiting
4. pale, clammy skin

a. 1 only
b. 1 and 2
c. all of the above
d. none of the above

25. A patient who complains of chest pain should be positioned _____.

a. supine
b. seated with legs elevated
c. on their side
d. in a comfortable sitting position

26. During a post-emergency assessment, problems can be identified to improve the emergency plan. The goal of the evaluation is to avoid future crisis and provide appropriate patient care.

a. Both statements are true.
b. The first statement is true and the second statement is false.
c. The first statement is false and the second statement is true.
d. Both statements are false.

27. A patient health history should be taken _____.

a. at the patient's first visit and an update at each visit
b. in ink at the end of each treatment
c. only if surgery is required
d. at the patient's first visit and again if the patient mentions a medical problem

28. Record the patient's respirations _____.

a. after explaining the procedure
b. when the patient is unaware of what the assistant is doing
c. with the stethoscope
d. during administration of anesthetic

29. Lawsuits can be avoided by _____.

a. knowing your patient's health history, contraindications and vital signs
b. being aware of the state's Dental Practice Act and any rulings that involve assistants
c. referring patients to medical professionals when necessary
d. all of the above

30. The first step in identifying the patient likely to develop a medical emergency is _____.

a. obtaining a health history with a set of vital signs
b. one does not need to be concerned regarding medical emergencies since they rarely occur in a dental office
c. by identifying and thoroughly charting all existing oral conditions
d. by determining the patient's age

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