CDC 4Y052
Dental Laboratory Journeyman

Volume 1. Safety, Management, and Administration

Air Force Career Development Academy
Air University
Air Education and Training Command

4Y052 01 1908, Edit Code 06
AFSC 4Y052

Author: MSgt Emily E. Jones
381st Training Squadron
Joint Service Dental Laboratory School (AETC)
381 TRS/TXXWAA
3038 Hardee Road, Bldg 895
JBSA-Fort Sam Houston Texas 78234-7648
DSN: 420-1950
E-mail address: emily.e.jones.mil@mail.mil

Instructional Systems Specialist: Sherie A. Davis

Editor: Sherie A. Davis

Air Force Career Development Academy (AFCDA)
Air University (AETC)
Maxwell Air Force Base-Gunter Annex, Alabama

Material in this volume is reviewed annually for technical accuracy, adequacy, and currency. For Weighted Airman Promotion System (WAPS) Specialty Knowledge Test (SKT) purposes, the examinee should check the *Enlisted Promotions References and Requirements Catalog* to determine the correct references to study.

ENTRY INTO this 5-level career development course (CDC) 4Y052, Dental Laboratory Journeyman, marks the next phase in your education and training as an Air Force dental laboratory technician. During your 3-level training, you achieved various levels of proficiency in technical aspects of this career field. This course will to help you attain the necessary skills and knowledge to become a productive dental laboratory member. This CDC supports training for both the administrative functions and technical procedures common to dental laboratory.

This course comprises into five volumes, each devoted to a different aspect of your career field. Volume 1, Safety, Management, and Administration, has two units: Unit 1 discusses safety, health and infection control. Unit 2 presents information on laboratory management and administration.

Volume 2, Dental Sciences, has four units. Unit 1 discusses oral anatomy, Unit 2 expands your current knowledge of oral physiology, Unit 3 is a review of dental materials science with the introduction of some new products, and Unit 4 presents information on how dental materials react to chemical and functional changes.

The remaining three volumes are devoted to technical procedures associated with fabricating dental prostheses.

Volume 3, General Laboratory Procedures and Treatment Appliances, has four units. Unit 1 describes the procedures to inspect preliminary impressions and casts, Unit 2 discusses the fundamentals of orthodontic appliances, Unit 3 provides information on treatment appliances and articulators, and Unit 4 presents information regarding dental implants.

Volume 4, Removable Prostheses, is divided into three units. Unit 1 discusses the classification, components, and design of removable partial dentures; Unit 2 outlines the waxing and processing procedures for removable dental prosthesis frameworks; and Unit 3 presents information on record bases fabrication and acrylic repairs.

Volume 5, Fixed Prostheses and Computer-Aided Technology, has five units. Unit 1 presents information about all metal, metal-ceramic, and all-ceramic restorations; Unit 2 discusses wax pattern fabrication; Unit 3 presents the “how to” for processing and completing metal restorations; Unit 4 demonstrates procedures for fabricating and completing porcelain applications for metal-ceramic restorations and porcelain veneers; and Unit 5 discusses unique all-metal restorations, pressable all-ceramics, and concludes with computer-designed restorations.

A glossary of terms, abbreviations, and acronyms is included for your use.

Code numbers on figures are for preparing agency identification only.

The use of a name of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

To get a response to your questions concerning subject matter in this course, or to point out technical errors in the text, unit review exercises, or course examination, call or write the author using the contact information provided in this volume.

NOTE: Do not use Air Force Instruction (AFI) 38-402, *Airmen Powered by Innovation and Suggestion Program,* to submit corrections for printing or typographical errors. For Air National Guard (ANG) members, do not use Air National Guard Instruction (ANGI) 38-401, *Suggestion Program.*

If you have questions that your supervisor, training manager, or education/training office cannot answer regarding course enrollment, course material, or administrative issues, please contact Air University Educational Support Services at http://www.aueducationsupport.com. Be sure your request includes your name, the last four digits of your Social Security number, address, and course/volume number.

For Guard and Reserve personnel, this volume is valued at 8 hours and 2 points.

NOTE:
In this volume, the subject matter is in self-contained units. A unit menu begins each unit, identifying the lesson headings and numbers. After reading the unit menu page and unit introduction, study the section, answer the self-test questions, and compare your answers with those given at the end of the unit. Then complete the unit review exercises.

Page

Unit 1. Safety, Health, and Infection Control 1-1
1–1. Safety and Health 1-1
1–2. Infection Control 1-21
Unit 2. Management and Administration 2-1
2–1. Management 2-1
2–2. Administration 2-6

Glossary G–1

Unit 1. Safety, Health, and Infection Control

1–1. Safety and Health 1–1
001. Laboratory safety 1–1
002. Occupational hazards 1–3
003. Dental laboratory environment 1–9
004. Personal protective equipment 1–14
1–2. Infection Control 1–21
005. Infection process 1–21
006. Infection control methods 1–24

WORKING IN A LABORATORY is a rewarding experience. Remember, your actions affect not only your welfare, but the welfare, safety, and health of your coworkers. This unit begins with providing you with crucial information regarding safety and health and concludes with important infection control fundamentals.

1–1. Safety and Health

Safety in the dental laboratory is paramount and can have a positive or negative effect on the health of individual parties. Understanding how the laboratory technician plays a vital role in this arena is the first step in fostering a safe working environment.

001. Laboratory safety

This lesson addresses laboratory safety practices and begins with planning. Following planning, this lesson continues with attentiveness, safety hazards, and the importance of equipment knowledge.

Planning

Planning is an important first step in safely performing a task. It is important that you think about the safety aspects of each procedure before you conduct the task. Planning prepares you to better observe all necessary safety precautions. The amount of time spent planning varies with the complexity of the task. Always check the safety instructions of all materials and equipment involved. Pay particular attention to protective clothing, safety equipment, and equipment safety features.

Attentiveness

Be alert and pay attention to what you are doing. Constantly look for potential safety hazards. To avoid accidents, you must keep your mind on the job and not allow yourself to become distracted.

Duty hazards of Air Force Specialty Code 4Y0X2

Identify the safety hazards in the laboratory and take steps to eliminate, reduce, or avoid them. Be extremely careful around the moving parts of dental equipment. Observing proper precautions can eliminate or reduce the hazards you may encounter. Fire is a potential hazard in a laboratory. To prevent a fire, control all flame sources. Inspect your Bunsen burner, casting torch, and other flame sources for abnormal wear. Make sure all gas hoses, valves, and so forth are in good working order. Correctly adjust the Bunsen burner, casting torch, and other flame sources. If a fire occurs, extinguish it by removing one of its three elements—fuel, oxygen (O_2), or heat.

Equipment knowledge

Know where your equipment is located, how to operate and perform user maintenance. Know the appearance of your equipment—how it sounds and feels when you operate it. Any difference in either sound or feel can signal a potential hazard. When you receive a new piece of equipment, read the operating instructions and learn the new equipment’s safety and operational features.

Equipment maintenance

Keep your equipment and instruments in peak working condition. Inspect your equipment for loose or worn parts. Know when a part requires repair or replacement. The following table covers the maintenance of electrical switches and instruments:

Maintenance of Switches and Instruments	
Electrical Switches	**Replacing and Sharpening Instruments**
• Electrical switches should work properly. • If the equipment hesitates when switched on, there could be a problem. • Even though the machine runs, the switch may be defective and could cause electric shock.	• Replace dental instruments when necessary. • Keep cutting edges sharp. • Dull edges can cause slippage or breakage, capable of causing an injury.

Housekeeping

To reduce the chance of accidents, keep your instruments in their proper place. Keep floors, workbenches, instruments, and equipment clean. Use only the materials needed for a task. Put them away when you have finished the task. Arrange equipment and furniture so walkways are a minimum of 36 inches wide.

Self-discipline

Take the initiative to ensure your own safety. Your supervisor cannot observe every activity in the laboratory, so we all must share some of the responsibility. Discipline yourself to check for potential hazards—not just your own, but those with the possibility of involving others. Some examples of potential hazards include frayed wires, loose connections, and improper grounding of electrical equipment. Make a habit of checking for hazards before using any equipment, material, or instruments.

Avoid unsafe practices

Unsafe practices usually cause most injuries. If you do not follow proper care and procedures, the combination of chemicals, sharp instruments, heat, and rotating machines are a volatile mix of potential hazards with the potential to cause serious injuries.

Follow directions

When your supervisor or trainer discusses any laboratory procedure, carefully follow directions for use of personal protective equipment (PPE). Remember, it is your responsibility to protect your health and the health of those around you. If you see an unsafe practice, intercede and prevent an injury.

Basic guidance

There are many unsafe practices in the laboratory, and we cannot mention them all here; however, here are some basic guidelines to follow:

1. Cut away from yourself when using a knife. Make sure no part of your body or anyone else's is in the cutting path of the knife.
2. Always wear eye protection when appropriate.
3. Wear gloves and a mask when handling impressions.
4. Use proper ventilation when grinding dental materials or handling vapor-producing chemicals.
5. Disinfect your work area as prescribed by your infection control guidelines.

Following these principles on any task will reduce your chance of injury. Develop a personal checklist based on these principles; then, get in the habit of reviewing it before performing any task.

002. Occupational hazards

The occupational hazards you are subject to in the dental laboratory are injury and disease. Injury is an act inflicting anything detrimental to one's appearance, comfort, health, or success. Disease is a deviation from the normal state characterized by a series of symptoms. Diseases can form as an acute severe problem with a rapid development or it can be chronic, which is a slow progressing and long-term problem.

Injuries

Dental laboratory injuries run the whole gamut of traumas. These injuries can result in a personal trauma and loss of duty time. Common injuries include burns and lacerations.

Burns

Burns are the easiest injury to receive in a laboratory. They are usually caused by inattentiveness and rushing through a task. The two types of burns common in the laboratory are thermal and chemical.

	Common Laboratory Burn Types
Thermal	• Burns caused by open flames and hot surfaces. • Common dental items using open flames are Bunsen burners, torches, boil-out tanks, and casting torches. The following dental equipment can be hot: burnout and porcelain ovens, casting rings, boil-out tanks, and casting equipment. • To avoid thermal burns, wear heat-resistant gloves when appropriate, and always expect a flame to be present or a piece of equipment to be hot. Flames are difficult to see, so make a habit of keeping them away from flammable liquids, materials, and yourself. Remember, equipment can be turned off and retain heat.
Chemical	• Result from contact with caustic chemical agents that, unlike thermal burns, can continue to burn below the skin long after removing the agent from the skin's surface. • We must neutralize caustic chemical burns. Often, the neutralizer cannot penetrate the skin with the same efficiency as the caustic agent. • Immediate treatment by professional medical personnel is recommended.

Fumes

Hydrofluoric, hydrochloric, and other acid fumes can burn your skin and eyes. Fumes are extremely hazardous since they take a longer time to burn. You may work the rest of the day before noticing a red, itchy feeling in the affected area. Areas usually affected by fumes are the underside of fingernails, eyes, and the upper-respiratory tract. You can severely burn your sinuses by inhaling chemical fumes. If you must identify an unknown chemical by its odor, gently waft the fumes toward your nose with your hand. Do *not* stick your nose in the bottle and take a deep breath!

Acids

When using acids, work near a sink and an eyewash station. Ensure ventilation pulls fumes away from you—a specially designed fume box is ideal. Have a neutralizer, such as sodium bicarbonate (baking soda), easily accessible. If splashed, quickly remove the contaminated clothing and flush the affected body part with water. Then, soak the body part in a sodium bicarbonate solution. You can make this solution by putting a few tablespoons of sodium bicarbonate in tap water. After neutralizing the acid, seek medical attention.

Lacerations

It is possible to cut yourself with a variety of dental instruments. There are stories about finger amputations caused by a ring catching in a running lathe, or a coworker distracted while despruing a partial denture framework and cuts off a portion of a finger. Another amputation hazard is the pneumatic press. Many of these presses allow for one-handed operation—leaving the other hand susceptible to mutilation if left holding the flask. Make a conscious effort to know where your clothing and extremities are in relation to your equipment.

Eye injuries

In addition to the chemical fumes previously mentioned, eye injuries are caused by vapors, mists, dusts, grindings, flying objects, cyanoacrylate, compressed air, chemicals, thermal and chemical burns, ultraviolet and infrared radiation, and even sunlight. Actually, just about everything in the laboratory can cause an eye injury. To guard against these hazards, *always use eye protection*. Since contact lenses can increase the risk of injury by trapping foreign objects or chemicals between the cornea and lens, do not wear them while working in the laboratory.

Eye Injury Sources	
Source	**Effect**
Foreign objects	Foreign objects can abrade, burn, lacerate, or perforate the eye. Although these wounds usually heal, they are painful, and could become infected and leave scar tissue. Scar tissue on your cornea obscures your vision—a serious disability for a dental laboratory technician.
Chemical splashes	If chemical splashes to the eye occur, immediately flush the eye and examine for injury. If you suspect a chemical eye injury, seek treatment immediately.
Pain and irritation	Pain and irritation of the conjunctiva (the mucous membrane covering the eye) and eyelids are the first indications of a foreign substance in your eye. An eye care provider must examine recurring conjunctivitis (inflammation of the conjunctiva). A chronic irritation could be an allergy, an infection, or a particle lodged in the eye.

Toxic substances

Materials used in the dental laboratory environment can affect five major body systems. The following table identifies the systems and describes their components.

Human Body Systems	
System	**Body parts and organs**
Integumentary	Skin, nails, and hair.
Respiratory	Mouth, nose, sinuses, mucous membranes, tonsils, pharynx, larynx, trachea, bronchi, lungs, bronchiole, and alveoli.
Nervous	Brain, spinal cord, peripheral nerves, and sensory organs—eyes, ears, nose, tongue, and skin.
Digestive	Mouth, salivary glands, esophagus, stomach, small intestine, liver, gallbladder, and pancreas.
Urinary	Kidneys.

As long as the organs mentioned in the table above are working in harmony, the body metabolizes (or changes) incoming substances. A substance becomes toxic if its quantity is too large to metabolize. Excess toxic material travels through the body in its natural form. Let us use acetaminophen to demonstrate the difference between toxic and nontoxic materials. Take two tablets (nontoxic) and your headache goes away; take 100 tablets (toxic) and death occurs. The four types of toxic substances found in most laboratories are corrosive, irritating, neurodepressing, and gaseous.

Eliminating toxic substances

Some toxic substances travel through the body and eliminated. The kidneys, lungs, liver, gastrointestinal organs, skin, and salivary glands all play a part to eliminate toxic substances from the body.

Organs Involved in Eliminating Toxic Substances	
Organ	**Toxic Effects**
Lungs	The first system affected is the respiratory system. Dusts and fumes produced during laboratory procedures can irritate the respiratory tract. However, it is rare for laboratory personnel to suffer from chronic and acute lung damage.

Organs Involved in Eliminating Toxic Substances	
Organ	**Toxic Effects**
Liver	The liver plays a major part in eliminating toxic materials, but easily damaged if exposed to high concentrations of toxins.
Kidneys	The kidneys are also susceptible to damage. Toxic materials often collect in them and remain for long periods until eliminated. The kidneys retain mercury and gold for months. This hold time allows the toxic effects of these metals to damage the kidneys. When the metal is finally eliminated, there is no residue of the toxic substance remaining. This makes detection of a high-metal concentration difficult.

Exercise safety practices during job performance

Diligent safety practices can prevent damaging your health. The table below describes the acute effects of common dental materials on the body:

Acute Effects of Dental Materials	
Material	**Affected Areas**
Gypsum	Respiratory and eye irritation.
Chemical	Skin, respiratory, and eye irritation.
Metals	Skin, respiratory, and eye irritation.
Silica	Respiratory and eye irritation.
Waxes	Skin, respiratory, and eye irritation.
Compressed air	Eye injury, hearing loss, and air embolism.
Compressed gases—propane, O_2	Burns and lacerations from fire and/or explosion.

Pneumoconiosis

Pneumoconiosis, or dusty lungs, is a serious illness and can take decades to develop. Since it is a gradual process, you may not be aware of any problems for years. The best preventive procedures for this health risk include an effective high-velocity evacuation system (HVES) and the appropriate respiratory filtration or mask. Handling dust-producing materials in the laboratory is a complicated process. Dispersed smoke, aerosols, and fumes have dust particles ranging in size from a tenth of a micron (µm) (0.1 µm) to ten thousandths of a µm (0.0001 µm). A µm equals a thousandth of a millimeter (mm) (0.001 mm). A particle must be at least 100 µm in size to be visible to the human eye. Extremely small particles can remain airborne up to 10 hours. These particles are the most dangerous because they pass through the natural filtration of the upper-respiratory tract and lodge in the lungs.

Symptoms

Respiratory disease symptoms include shortness of breath, rapid breathing, coughing, and associated pain, caused by a gradual accumulation of particles in the lungs. Respiratory disease reduces respiratory function—the lungs' ability to exchange carbon dioxide (CO_2) for O_2. Eventually, scar tissue develops in the lungs and reduces their capability to exchange O_2 for CO_2. The type of disease depends on the material to which the person is exposed. The following table shows some common respiratory diseases along with their symptoms and causes:

Respiratory Diseases	
Disease	**Causes/Symptoms**
Silicosis	Caused by silica-containing materials like porcelain, abrasives, talc, stone, and investments. Silica dust causes nodule formation in the lungs. Continued exposure to silica dust leads to scarring and emphysema. Grinding porcelain, dental stone, and the abrasives themselves produce large amounts of silica dust. Other gypsum products, like refractory cast material and high heat-resistant investment, contain large percentages of silica. Respiratory protection during these procedures is a widely accepted necessity.

Respiratory Diseases	
Disease	**Causes/Symptoms**
Berylliosis	Caused by alloys containing beryllium. Coughing, difficulty breathing, pneumonia, and weight loss are all symptoms of berylliosis. Tumors develop in the lungs of berylliosis patients. Dental alloys containing beryllium are not a health hazard. As long as the laboratory ventilation is working properly, the small percentage of beryllium dust produced is not harmful.
Siderosis	Caused by materials containing iron—like red rouge and some alloys. Siderosis is a discoloration of the lungs caused by iron oxide dust. Rouge is a source of iron oxides; consequently, exposure to rouge dust must be limited.
Metal fume fever (MFF)	Inhalation of casting fumes and the absorption of dust through the lungs into the bloodstream is responsible for MFF. Dusts from nickel, silver, tin, zinc, copper, iron, magnesium, aluminum, antimony, cadmium, manganese, and selenium cause MFF. Melting high nickel-containing alloys or dental solders, or adding zinc to molten alloys, also creates fumes capable of causing MFF. The onset of MFF is slow. Symptoms include headache, nausea, fatigue, muscle pain, vomiting, thirst, and a dry mouth and throat. Symptoms last from 12 to 24 hours with recovery within 48 hours—if no recurring exposure occurs. Two significant factors differentiating MFF from other illnesses are eye and respiratory tract irritation, and onset of symptoms within 24 hours of casting any metal. MFF symptoms indicate dangerous exposure to possible cancer-causing metals. If you suspect MFF, request an environmental survey of the laboratory exhaust system. The exhaust ventilation may be inadequate.

Dermatitis

Dermatitis is a condition caused by the dust, fumes, vapors, or liquid of any irritating substance. Dental laboratory personnel can suffer from a wide array of skin irritation. The two common types are contact dermatitis and allergic dermatitis.

1. *Contact dermatitis* is caused by substances irritating practically everyone who is exposed to it.
2. *Allergic dermatitis* afflicts individuals who have developed sensitivity to a particular substance. These allergies can develop from years of exposure to certain substances. Sensitizers are any substances causing allergies.

Prevention

To prevent dermatitis, allergic or contact, limit your exposure to the irritant. There are several ways to do this. One is to make sure the exhaust system is operational and safety equipment is available. Keep the laboratory orderly and as dust-free as possible.

Respirators, glasses, and face shields

When grinding on dental prostheses, the grinder generates dust particulates the HVES may not evacuate and cause some particulates to become embedded in exposed skin, hair, and clothing. To minimize your exposure to corrosive or irritating dust, use a dust respirator, safety glasses, and/or a face shield, wear a laboratory coat or apron, and wash any exposed skin at the end of the day.

Prolonged and repeated contact

Prolonged and repeated contact can contribute to allergic dermatitis. Frequent handwashing, although necessary in the laboratory, removes natural oils. Skin oils protect the skin from drying and harmful substances. Without these oils, skin is more prone to drying from substances like methyl methacrylate (MMA). A simple solution is to replace the natural oils with a moisturizing skin cream. Wearing polyethylene gloves and using a barrier cream while handling these substances reduces their drying action.

Nervous system disorders

The one dental laboratory material in daily use affecting the nervous system is monomer, or MMA. MMA seriously affects both the central and peripheral nervous systems. It has the potential for serious damage to the liver and kidneys. Since we experience the first effects of mishandling MMA through the nervous system, we will concentrate on this system. However, we will discuss other body systems due to MMA's penetrating nature.

MMA is primarily absorbed through the skin with some absorption through the cornea. Benzoyl peroxide, a component of MMA, is a sensitizer known to dry and crack the skin, allowing rapid penetration of MMA to the blood and nerves. As the MMA penetrates the skin, it depresses the peripheral nerves of the fingertips. The blood carries it to the liver where it metabolizes. Unmetabolized MMA travels to the central nervous system where it depresses the brain and spinal cord. This is when the most serious symptoms of overexposure to MMA occur.

Symptoms

Symptoms of MMA overexposure include headache, dizziness, nausea, depression, drowsiness, low blood pressure, loss of coordination, and, in serious cases, unconsciousness. The presence of acetone in the urine confirms the overexposure to MMA. Overexposure can happen quickly, often while mixing a small amount of acrylic. A couple hours of exposure in a poorly ventilated laboratory produces symptoms.

Consequences

There are several consequences of chronic MMA overexposure. The least worrisome is eczema. The fingers itch and flake long after exposure to MMA stops. More serious is liver damage caused by unmetabolized MMA. However, most serious of all is irreversible damage to the nervous system. To prevent exposure, wear gloves designed to create a nonabsorbent barrier, and use MMA in a properly ventilated room.

Hearing loss

Long-term exposure to high noise levels causes hearing damage. Sudden exposure to high noise levels creates temporary hearing loss lasting seconds to weeks. Repeated unprotected exposure damages the auditory nerve. This damage is irreversible. Not only does loud noise damage hearing, it also creates physiological stress. Noise is annoying and the body reacts to it. Blood vessels—except those of the heart and brain—throughout the body constrict. In addition, the release of adrenaline increases the heart rate, respiration, and consequently, the blood pressure. The blood's clotting factor increases, and more fats release into the blood. Repeated exposure to excessive noise can lead to additional health-related problems.

Cancer

The two-body systems usually exposed to hazardous carcinogens are the skin and respiratory system. Carcinogens are cancer-causing substances. Two known carcinogens are nickel and chromium, both usually transmitted as dust, which can be absorbed through the skin and inhaled into the lungs. However, we can control exposure to these carcinogenic particulates by using an HVES and a dust respirator. In addition to cancer, exposure to chromium and nickel dust can cause severe dermatitis. Chromium is very corrosive to the skin and causes contact dermatitis if not removed. Nickel is a sensitizer and, through long-term exposure, can eventually cause allergic dermatitis. Contracting allergic dermatitis limits your ability to perform certain tasks or jobs. It is best to avoid exposure to these metals by taking necessary preventive measures.

Allergies

Dental materials irritate your skin, eyes, and mucous membranes if you are allergic to them. You can develop an allergic reaction, which can remain with you for life if you repeatedly expose yourself to certain materials. If sensitized, your skin can become inflamed and red, and if left untreated, your skin can dry and crack. Your eyes and sinuses are particularly sensitive to dust and vapors. When irritated,

the conjunctiva of your eyes becomes inflamed and red, while the mucous membranes of your sinus become irritated—you will be miserable. Consequently, you should not expose your skin, eyes, and mucous membranes to irritants. The best solution, if possible, is to remove the irritant or yourself from the environment. If not possible, use protective equipment to reduce your exposure to the material.

Allergic reaction

If you are not allergic to dental materials now, you could become allergic to them in the future. Constant exposure to some dental materials sensitizes you. Monomer, nickel, platinum, and zinc have this property and all classify as sensitizers. After a period of years, the slightest exposure to these materials will cause an allergic reaction.

Infectious agents

The dental laboratory is not free of infectious agents. Infectious agents are minute organisms known to invade and inhabit body tissues. These organisms, commonly called microorganisms, cause disease by producing toxic substances or by destroying cells within the body. However, not all microorganisms are infectious. Pathogens are those microorganisms known to cause infection and disease. Blood and saliva transmit the majority of pathogens. Saliva contains blood cells and microorganisms designed to infect through contact with the respiratory system, blood, or mucous membranes.

Fresh saliva and blood are not the only vehicles for pathogens. Some microorganisms survive outside the body for days, in the residue of blood, saliva, or food particles. Studies found a viable hepatitis B virus on dental casts several days after pouring. The vibrator used to pour the contaminated impression can pass the virus to other casts as well. The point is pathogens exist in a wide variety of places.

Stress

Stress is an unavoidable occupational hazard permeating into all aspects of your psychological and physiological health. Your ability to temper stress directly influences your health and wellness. The two types of stress are developmental and situational.

Types of Stress	
Developmental stress	As its name implies, developmental stress develops as an expected activity approaches—usually a deadline. For example, you may experience developmental stress as the due date on a case approaches. Developmental stress is controllable to some degree.
Situational stress	On the other hand, unplanned events cause situational stress. For example, you may experience situational stress for an appliance returned due to poor fit, or if you sustain an injury in the laboratory.

Most unexpected stresses of life are manageable, but you may have difficulty handling chronic (prolonged) stress of either type if unprepared. Stress places increased demands on your body. When prolonged, stress can jeopardize your health and job performance.

Stressors

Stressors are factors creating stress. External stressors include the environment and people around you—lighting, noise, temperature, duties, production schedule, personal safety, home life, and the many other stressors you deal with daily. In contrast, internal stressors stem from personal attitudes about you regarding a harmful event. For many, internal stressors create more problems than external ones. For example, you cannot stop a dentist from telling you an appliance did not fit, but you can accept his or her statement as a positive challenge to improve, rather than a negative reflection on your self-concept.

Factors

A dental laboratory can be a stressful environment. Working several days on a high-production schedule can cause you to feel trapped in the laboratory and cut off from the rest of the clinic—you may feel tempted to develop an "us-and-them attitude." Do not let this happen—take time throughout your workday to change your view. You can do this by leaving the laboratory and visiting other members of your team for a few minutes. This diversion can refresh your perspective, reducing some of the anxiety associated with an active workload.

Managing stress

The physical reaction to stress is a heightened nervous system, increased muscle tension, and a release of adrenaline. The heart beats quicker with more blood sent to muscles than skin, intestines, or kidneys. Blood pressure increases and respiration deepens. All of this activity is preparing you to confront the stressor or to run away.

Symptoms

Symptoms of chronic stress can be anxiety, fatigue, nervousness, frustration, excessive daydreaming, isolation, unwarranted hostility, dogmatism, indecision, loneliness, and hysteria. There will be times in your life when you will feel anxious, frustrated, or nervous. However, feeling these symptoms constantly is a clear sign of an overstressed individual. Long-term effects of chronic stress can be depression, loss of identity, personality change, substance abuse, ulcers, and heart disease.

Managing stress

To manage stress effectively, confront the stressor. This is a voluntary effort to adapt to a stressor. For example, adjusting your schedule to complete a rush case is stress management. Trying to reschedule a rush case to avoid rearranging your schedule is not an effective way to handle stress. An involuntary reaction to a stressor is a self-defense mechanism. Self-defense mechanisms include ignoring the problem or rationalizing your response to the problem. They are automatic and destructive responses.

Physical and psychological well-being

The ability to manage stress depends on your physical and psychological well-being and the application of certain behavioral approaches to your work. First, like your job. Dental laboratory work offers significant job satisfaction if you have the knowledge, skill, and attitude. Second, keep a positive attitude. You must realize that your personal values differ from others and affect your perception of what classifies as a stressor. If a case fails, honestly ask yourself what you can do to prevent a second failure. Do not immediately blame someone else. If others share the fault, tactfully communicate with them, using your chain of command. Do not make excuses or avoid a stressor. To manage stress effectively, you need to feel secure and respect yourself. Know your limits and recognize stress symptoms in yourself and others. Finally, relieve stress through sports and hobbies. Make time to relax and enjoy your off-duty time.

003. Dental laboratory environment

There are many factors to improve or detract from your work environment. In this lesson, we cover the impact lighting, noise, ventilation, and temperature can have on your ability to work.

Lighting

Poor lighting in the laboratory causes eyestrain, hazardous conditions, and creates a gloomy atmosphere. On the other hand, a work area too bright also causes eyestrain. Over illumination reduces shadows, reducing the contrast needed to contour restorations, and over stimulates the optic nerve.

Since shade matching is a critical function to the dental laboratory, color improved fluorescent lamps or overhead lighting may be beneficial.

Noise

Sound transmits as waves of pressure received and is interpreted by the ear. Sound is noise when it adversely affects your health. Adverse effects are caused by the three properties of noise—pressure, frequency, and duration.

Properties of Noise	
Pressure	Pressure is considered loudness and is measured as decibels (dB).
Frequency	Frequency is defined as units per second—the higher the frequency, the higher the pitch of the noise.
Duration	Duration is the length of exposure to noise.

Noise effects

Noise effects on your health include permanent and temporary hearing loss and other physiological effects. Lengthy exposure to noise is disruptive and annoying. For these reasons, noise control in the laboratory is critical. Currently, the Air Force considers noise levels over 85 dBs hazardous. Dental equipment often exceeding these levels includes air hoses, pneumatic chisels, high-speed lathes, steam cleaners, and handpieces.

Vibration

A vibration is a low-frequency noise. Although vibration is not a serious problem, it can be annoying. It can temporarily numb your fingers when you are working handpieces for extended periods. Vibrations inhibit the blood supply, reduce your control of the handpiece, and could lead to finger cramping. The best treatment to enhance the blood flow and relax your hands is to take a break and vigorously shake your hands. Vibration also affects you the way noise does. Actually, you will often encounter one with the other, as in grinding procedures. Constant exposure to vibration can make you uncomfortable, irritable, and tired. In other words, you will be a real grouch at work and home. To preserve your work and social relationships, take measures to limit your exposure to noise and vibration.

Ventilation

There are two types of ventilation in the laboratory—general and exhaust. *General ventilation* deals with a room's airflow. *Exhaust ventilation* extracts air contaminants from work areas. Both are important to your health. The laboratory needs a steady flow of fresh air for comfort and for the elimination of production odors.

General

Most general ventilation for a laboratory is mechanical. Mechanical ventilation is air forced through an outlet to a room. To maintain comfort, the air should have some place to go. Air should flow either outdoors or recycle through an inlet and back through the outlet. Inadequate or absent airflow should be reported for repair. A common problem in laboratories is the absence of either the inlet or outlet, or both. This usually results from modifying the laboratory without consulting with engineering experts.

Exhaust

This is the preferred type of ventilation for laboratory procedures. It removes contaminants from the atmosphere at the production source. Local exhaust is preferred because of its efficiency. The usual drawback is the noise produced by some systems.

Hoods

Hood design and location depends on the operation performed. Since the hood traps contaminants, it must be suited for the particular use. We typically use two types of hoods in the laboratory:

1. Canopy (or overhead) hoods remove heat.
2. Lateral hoods remove contaminants.

Hood designs and contaminants

To understand hood design, you must first understand the contaminants. Contaminants and the surrounding air travel at a variety of speeds. Hoods must be designed to provide airflow volume and speed sufficient to remove contaminates from the area and then to trap or exhaust them.

Contaminants and Unique Characteristics	
Contaminants	**Characteristics**
Dust particles and droplets	Dust particles and droplets release at different speeds during production.
Vapors	Vapors from a boil-out tank travel 50 to 100 feet per minute.
Keying casts dust	Dust from keying casts can travel 100 to 200 feet per minute.
Stone chips	Stone chips travel 500 to 2,000 feet per minute.
Small particles	Smaller particles travel at slower speeds than larger particles and need less airflow speed to trap them.

Grinding stone or porcelain

An interesting phenomenon occurs when grinding stone or porcelain. The airflow of a grinding wheel traps extremely small particles. Even with a high-speed exhaust, the particles circulate around the wheel. This tiny dust cloud remains in the breathing zone of the technician. This illustrates one principle of using a hood exhaust. The hood should be as close as possible to the contaminant's source. For grinding, a lateral or drawer hood should be as close as possible to the grinding instrument. This ensures a high-speed airflow and entrapment of contaminants by the hood.

Trap rising fumes

For chemical fumes, a canopy hood placed just above the source will trap rising fumes. Ideally, you should use monomer in a fully enclosed cabinet with the exhaust vented outdoors. Laboratories also use a canopy hood extending slightly below the top of burnout ovens to vent escaping heat and gases to the outdoors.

Canopy height and effectiveness

Canopy height and its effectiveness demonstrate themselves at the boil-out tank. Most laboratories have a canopy placed about 4 feet over the tanks. This height allows the technician room to work.

Keep steam and vapors away

Placing the hood directly above the operator violates another principle of hood use—do not pull vapors past the worker. The idea is to keep steam and wax vapors away from the technician, not force these contaminants past their breathing zone.

Add a vertical baffle

A solution is to add a vertical baffle to the existing hood. This baffle is a horizontal opening or slot at the rear of the boil-out tank. The canopy vents the upwardly rising heat, while the baffle draws the steam away from the technician.

Exhaust effectiveness

An exhaust system has four elements, which determines the effectiveness of the system:

Exhaust Systems	
Elements	**Affecting Exhaust System Effectiveness**
More hoods, less flow	First, the greater the numbers of hoods or ports open, the less exhaust capability of each hood. In other words, you can increase the exhaust by closing exhaust ports not in use.
Fewer angles, better flow	Second, the ducts should have as few angles as possible for efficient exhaust. Gradual bends allow better airflow than sharp angles.
Clean filter, better flow	Third, the most overlooked element is the filter. Timely cleaning or replacing of the filter keeps the air flowing efficiently and the fan from overheating.

Exhaust Systems	
Elements	**Affecting Exhaust System Effectiveness**
Good fan, better flow	Finally, the fan is the most important element. Both Air Force and dental company engineers ensure exhaust systems have the appropriate fan design to ensure the proper airflow.

Industrial hygiene surveys

Bioenvironmental engineers (BEE) survey the laboratory environment. Their goal is to provide a hazard-free workplace. They check room temperature, light and noise levels, ventilation efficiency, dust hazards, and exposure to hazardous chemicals.

Base line

The BEE establishes a base line, or normal level, for most of the elements during the initial survey. Afterwards, BEE conducts annual surveys to compare the baseline with current levels. BEEs check equipment performance and document employee compliance with procedures. They also check PPE use and provide employee education. If any deficiencies are noted, BEE will reinspect in six months. This allows time to correct problems like equipment repair or replacement, development of operating instructions, and so on.

Surveys on request

BEE conducts unscheduled surveys upon request. Anyone concerned with the operation of a dental laboratory or the health of the technician can make this request. Reasons for the request include the use of new materials and equipment or potential unsafe practice/procedures.

Accurate survey

For the BEE to perform an accurate survey, you must provide the procedures involved, materials used, specific hazards, safety procedure used, and the effectiveness of the safety procedures. Another important aspect is to test the appropriate areas and people. Occasionally, an inexperienced engineer may try to monitor a suspected hazard in a section where the hazard does not exist. For example, if you suspect exposure to gold dust, a technician finishing gold crowns should be monitored. The engineer and supervisory laboratory personnel must work together when conducting surveys.

High temperatures

The two hottest areas you will encounter in a laboratory are the removable partial denture burnout section and the boil-out section. The burnout section of an area dental laboratory (ADL) is usually isolated from the rest of the laboratory. Therefore, the ADL's heat problem usually affects only a few technicians. The boil-out section of a base laboratory is open to the entire base dental laboratory (BDL). The heat from the boil-out tanks affects all of the technicians in the laboratory. In both cases, heat affects the people and materials exposed to it.

Heat stress

These hot spots often exceed 90 degrees Fahrenheit (°F), and you may have to work in one for several hours. If the laboratory has its own thermostat, you may receive some relief in under an hour. However, the heat is still excessive, so watch for heat-stress symptoms in yourself and others. Irritability is the first and most common symptom. As the mercury rises, tempers shorten. You'll be uncomfortable and sweaty, and you'll not feel like working. Serious symptoms include cramps, nausea, dizziness, or high body temperature. If you experience any of these symptoms, tell someone and leave the area with an escort. You may need medical attention if symptoms continue.

Increased comfort

Whether the heat is dry or humid, there are a few things you can do to increase your comfort. First, ensure the exhaust ventilation is working properly. Place burnout ovens directly under the exhaust hood. Use the oven timer, if available, so you may perform the majority of the burnout at night. This

decreases the daytime temperature. Boil-out tanks should have an exhaust intake on the back wall, plus a canopy. The back-wall exhaust pulls steam away from you, rather than around you.

Circulate the air

While you wait for the laboratory's cooling system to lower the room temperature, use fans to help circulate the air. Open as many doors as possible to increase air circulation. Wear the shirt of your utility uniform outside your pants. This allows air to enter at the bottom of the shirt to cool your torso. Remove your shirt, if possible. Use the buddy system if you are going to be in the hot spot an extended amount of time. This allows you to take breaks without leaving the equipment unattended. Partners can also observe each other for signs of heat stress.

Ergonomics

Ergonomics is the science of fitting a job to an employee. Forcing an employee to fit the job can result in muscle strain and fatigue, weak lower back muscles, and permanently deformed spines. Incorrect work posture also decreases the volume of air inhaled and interferes with digestion and circulation. Avoid these problems by making your work area fit you.

Laboratory chairs

Your chair should be comfortable and supportive. Adjust the chair's seat height so your thighs are parallel to the floor. The edge of the seat should not exert pressure on the back of your knees or thighs. If it does, your feet and lower legs will lose circulation. Both feet should rest flat on the floor. If your feet do not rest on the floor and you cannot lower the chair, place your feet on a box or wedge so your thighs are parallel with the floor. The back of the chair should support your lower back. You should be able to sit up straight and feel the chair back resisting your weight. Do not put the chair back any higher than necessary to complete your work.

Laboratory benches

The bench should be high enough to get your knees under it and allow you to perform your duties. The bench top should be approximately 18 inches from your eyes when sitting comfortably—this prevents hunching over when you work. The depth of the work area should be 24 inches. This depth allows for adequate workspace and permits most people to reach the center of the bench. Width is a matter of preference and compromise with your neighbors. If possible, ensure the table has rounded edges to support your arms. Resting your arms on a sharp edge exerts pressure on the ulnar nerve and becomes painful with repetition. Padding the edge may help as long as it is not a safety hazard. On the other hand, you can clamp angled armrests to the bench for support. The stand-up bench is about 36 to 40 inches in height. This elevation is preferable for most people because it allows them to stand erect when working—reducing lower back strain.

Work surface

A bench's work surface should be nonreflective. A reflective surface causes eyestrain because it transmits light back into the technician's eyes. In addition, the bench should be uncluttered—remove any equipment not in use. The same is true of instruments—to prevent damage to the instruments or injury to the technician, don't leave them scattered on the bench top. A magnetic bar mounted at the back of the bench will hold most dental instruments and burs.

Everything you need should be in easy reach

When working, focus all your attention on the appliance. Everything you need should be in easy reach. You can complete the task quicker and easier if you don't have to strain to reach an instrument or leave your bench. Using a handpiece is one example. Keep your foot on the pedal when pausing while grinding. This eliminates feeling for the pedal when you need it again. Also, place your foot on the pedal so the hinge is close to your heel. This reduces the muscle strain of holding your foot at an angle.

The bench and chair should be adjustable

Ideally, the bench and chair is adjustable to match your individual needs. Fitting the work area to your body reduces the risk of musculoskeletal problems at work and later in life. Exercising off-duty and frequent stretching at work to maintain muscle tone also helps prevent problems. How well your body works is up to you.

004. Personal protective equipment

There are many ways you can protect yourself in the laboratory using PPE. This lesson presents information about the limitations of PPE, personal health, safety equipment, and safety-related administrative requirements.

Limitations

Physical, physiological, and psychological limitations determine the type of personal protection you use. For specific information on the use of PPE, see Air Force Manual (AFMAN) 91–203, *Air Force Occupational Safety, Fire, and Health Standards*. Physical limitations include vision, depth perception, hearing, dexterity, reflexes, height, weight, and reach. Safety equipment protects you without hindering performance.

Personal Protective Limitations		
Type	**Description**	
Physiological limitations	Physiological limitations involve all body systems and how they rely on each other to operate effectively. Toxic substances entering a system tend to disturb this biochemical balance.	
	O_2	Toxins may displace O_2, which may reduce your effectiveness in the laboratory.
	Alcohol	Alcohol and the damage it causes is a more common problem. A hangover is the body's way of saying it is out of balance chemically.
	Fatigue	Fatigue is another problem caused by overwork, illness, or medications. When the body is tired, efficiency and judgment decreases, errors increase, and error perception is less acute.
Psychological limitation	The psychological limitation is the most crucial to your personal protection.	
	Emotion	Your emotional stability is a factor in any psychological limitations. You must control your emotions in potentially hazardous areas to prevent accidents.
	Motivation	Another psychological factor is motivation—you must desire to work safely. Look for dangerous conditions and communicate them clearly. Also, evaluate your safety practices and never take unnecessary chances.

Personal health

You can protect your personal health by following safety procedures and recognizing the symptoms of occupational diseases. If you are injured or exposed to a disease while working in the laboratory, report it to a supervisor immediately and seek immediate medical attention. The emergency room will alleviate the problem and document it for future reference. Part of the medical treatment may include medications. Remember, some medicines can cause drowsiness or dehydration—two conditions potentially harmful in the laboratory. Inform the supervisor of any medication side effects to prevent personal harm.

Pregnancy does *not* exclude a technician from all tasks and duties; however, there are some health concerns for pregnant technicians. Some duty restrictions may be necessary to decrease exposure to

hazardous conditions. In the laboratory, these conditions are infectious diseases, heavy metals, ionizing radiation, chemicals, and medications.

Considerations for Pregnancy	
Factors	**Effects**
Responsibility	Although a variety of agencies and people are involved—obstetric (OB) clinic, military public health (MPH), and the supervisor—protecting the health of the mother and her fetus is primarily the mother's responsibility.
Job risks and duty restrictions	After a technician has a positive pregnancy result, the OB will refer her to MPH. MPH determines her duty-related risks and recommends duty restrictions based on those risks. It's the supervisor's responsibility to inform the environmental health section of all hazardous duty conditions and to follow all safety recommendations concerning pregnant personnel.
Recommended exposure limits	MPH provides recommended exposure limits to specific hazards. These limits usually restrict contact or exposure with MMA and particulates from certain metals. Additional restrictions may exist. Ensure strict adherence to safety practices when handling heavy metals throughout the term of pregnancy, and longer if breast-feeding. If toxic chemicals, like MMA, frequently exceed safe limits, consider removing the mother from the area until delivery, and longer if breast-feeding. Also, limit exposure to radiation.
Consequences of blatant disregard	The consequences of blatant disregard of personal safety include fetal deformities, miscarriage, maternal death, fetal brain damage, cancer, disease, or reduced fertility. The fetus is most susceptible to damage during the first trimester (3 months) of pregnancy. Remember, early identification is critical to protect the health and welfare of the mother and her child.

Safety equipment

No dental laboratory is complete without a well-stocked arsenal of safety equipment. Eye protection, respirators, hearing protection, and other protective equipment are essential in the laboratory environment.

Eye protection

Several types of eye protection are available. The first type combines face and eye protection. The *face shield* is effective in guarding against flying particles and liquids. Its wide area prevents ingestion and respiration of harmful airborne material. A face shield worn with spectacles provides excellent protection from acid splashes and may be an authorized alternative for goggles during most grinding and polishing operations. A heavily tinted face shield is available for casting operations.

Goggles

Goggles come in two varieties—cover and spectacle:

Cover goggles enclose the eyes and part of the face. They are especially useful for procedures requiring complete coverage. Welding goggles protect against sparks, metal splashes, and intense light. Technicians must wear welding goggles when casting with a gas-oxygen torch. The heavy tinting of these goggles protects the eyes from intense ultraviolet light. Wearing sunglasses or looking to one side while melting alloy does *not* prevent burning of the retina and the resulting blind spot.

Spectacle goggles are like normal eyeglasses with side shields added and offer general-purpose protection from flying particles. Wear them during any procedure exposing your eyes to chips, dusts, liquids, or intense light. They are impact-resistant and may be tinted. The hospital eye clinic issues spectacles, or safety glasses. The lenses are treated plastic and can be prescription. Spectacles give less protection than cover goggles as they do *not* offer complete protection.

Eyewash stations

An eyewash station is mandatory in every laboratory in case the eye protection equipment fails. The station must be easily accessible and located near eye hazard areas.

Respirators

Use respirators with normal and exhaust ventilation. Remember, we cannot use exhaust ventilation when performing precious metal finishing. Other times, the dust stays within your breathing zone even with adequate ventilation. Handling gypsum materials also takes place away from exhaust ventilation and requires the use of a dust respirator. Either laboratory personnel use a disposable dust respirator or a mechanical respirator, with a third type (cartridge) available if needed.

Types of Dust Respirators	
Type	**Description**
Disposable	Dust respirators have a 99.9 percent filtration efficiency against 1.0 µm particulates. Personnel must wear a suitable dust respirator to protect against normal dust concentrations. Even if dust levels are not high enough to be harmful, they are still a nuisance. When using a disposable respirator, remember to discard it after use.
Mechanical	A mechanical respirator uses a replaceable filter designed to remove dust particles from the air. Replace filters when breathing becomes difficult.
Cartridge	A third type of respirator is the cartridge respirator. This respirator has separate cartridges for different hazards, like acid fumes or chemical vapors.

BEEs evaluate specific laboratory hazards and recommend an appropriate respirator. Prior to a laboratory technician using a particular respirator, the technician must receive proper training. The BEEs identify what respirators the laboratory technicians need training on and may allow the flight safety representative to provide the training. One example is the training required for the N95 respirator.

Hearing protection

The dental laboratory has many noise hazards. Handpieces, steam cleaners, ultrasonic cleaners, casting machines, and air hoses are just a few examples. Use of an insert-type earplug or standard earmuff protects an operator's hearing. Premolded earplugs, fitted by Public Health, offer the most effective type of hearing protection. An improperly fitted plug will not protect an operator's hearing. Technicians must dispose of the hand-molded foam earplugs after each use. Earmuffs provide less protection than properly fitted ear plugs and are *not* the ideal choice for reducing noise.

Sound absorbent material

If the noise hazard is severe, consider installing sound absorbent material in the laboratory.

Reducing vibration

Placing a rubber mat under stand-up and bench-top equipment helps prevent the amplification of vibration to the work surface and prevents the equipment from moving during operation. Another method is to perform as much of the task in wax to reduce exposure time with finishing equipment. In addition, making a sound-absorbing container will isolate the task. The container can be made by cutting two armholes in a plastic bucket, replacing the top with Plexiglas, and performing all tasks requiring a pneumatic chisel or air hose inside it.

Gloves

Wear gloves when performing hazardous tasks. Welders' gloves are heavy leather and suitable for casting and boil-out procedures. You may substitute welders' gloves with firefighters' heat-resistance gloves, but they transmit heat quicker than welders' gloves. Wear synthetic rubber gloves when using MMA or other irritating chemicals. The synthetic material resists chemical breakdown better than natural rubber. The technician may wear electrical workers' gloves when working with acids and in the sand and shell blasting chambers. Inspect gloves for wear before use and store them in a safe place.

Shoes

Wear shoes with nonslip soles. Placing rubber mats near water-producing equipment will provide extra protection. Although not a requirement, laboratory personnel may wear safety shoes. Often, a technician will have to move heavy supplies and equipment for house cleaning. These heavy objects could fracture your foot if dropped.

Acid gear

When working with acids (caustic materials) in your laboratory, you must have the proper safety equipment. This includes safety glasses or goggles, a face shield, a rubber apron, and elbow-length rubber gloves. Work in a ventilated acid-proof fume box near a sink and eyewash station. Take any additional steps needed to protect yourself from an accident. Remember, even hydrofluoric acid substitutes can cause serious injury, so treat them like hydrofluoric acid. Heated pickling solutions can also be very irritating to the skin and sinuses, so handle with care. When using caustic materials, never eat or drink because ingestion of caustic fumes is always a risk. Wash and neutralize any container appearing to have any residue on the outside.

Equipment safety

Continually inspect all laboratory equipment and the surrounding area for possible hazards. Consider all hazards, however unlikely, before operating equipment. Begin with a thorough inspection at the start of the day and supplement it with quick checks before each use. Cleanup is a perfect time to do a thorough safety check. Check parts and electrical cords for wear and damage. One of the most important parts is the guards placed on the equipment.

Equipment guards

Equipment guards should contain the hazard without creating another one. The guard should *not* interfere with the operation of the machine. Most importantly, never bypass equipment guards. Do *not* use the stand-up lathe without the plastic shield in the down position. High-speed lathes must have the belt guards in place when running. There are other examples in the laboratory too numerous to mention, but these simple guidelines should allow safe equipment operation.

Material safety

Caustic materials must be stored away from flammable laboratory materials. Place large quantities of these materials in a room with an automatic fire suppression system. You may keep small quantities (working amounts) of these hazardous materials in the laboratory for daily use if you follow proper safety procedures.

Storage

Whether the amount is small or large, storage is the same. For containers larger than a quart, use acid bottle carriers. Store flammables in an Air Force Occupational Safety and Health (AFOSH) agency approved flammables cabinet, if available. Use safety cans for quantities of one gallon or more. If a flammables cabinet is not available, store small quantities of *working amounts* (especially bulky items) at least six inches back on open shelves in a well-ventilated area. Do not use in a closed area, like an indoor closet or refrigerator, where fumes can accumulate. Do not store flammables in direct sunlight or in areas subject to high temperatures—boiler rooms, metal lockers in sunny areas, and so forth.

Compressed gas cylinders

Compressed gas cylinders present fire, explosion, and missile hazards. With full O_2 cylinders pressurized to about 2,000 pounds per square inch (psi), accidently breaking the valve causes an uncontrolled release of O_2 and turns the cylinder into a dangerous projectile. For this reason, and others, follow these procedures:

1. Transport cylinders with hand trucks or dollies. Once in the laboratory, separately secure cylinders in a vertical position.
2. Don’t store extra, full, or empty, cylinders in the laboratory.

3. Don’t drop cylinders or handle them roughly. Don’t drag or roll cylinders.
4. Shut off all cylinders valves when not in use.
5. Keep oil and grease away from O_2 cylinders. Oiling an O_2 regulator will cause an explosion.

Proper fittings

Make sure the proper fittings are used for the specific type of gas. The valve of the O_2 cylinder has a right-hand thread to prevent confusing it with other types of cylinders. Fittings must be clean and attached with nonsparking wrenches. Always be alert for leaks.

Follow procedures

Follow local procedures when using hazardous materials. These procedures should be a combination of manufacturers’ directions and AFOSH guidelines. After using excess and contaminated materials, dispose of them according to the current guidance and directives. If you are unsure of how to dispose of a material, or a large amount must be disposed of, contact the BEE office.

Administrative requirements

All Air Force programs require the appropriate documentation to ensure compliance with existing regulatory guidance.

Air Force Occupational Safety and Health Standards for Air Force Specialty Code 4Y0X2

The steps of personal protection is to know what to protect yourself from, how to protect yourself, and what can happen if you don’t. The Air Force has Air Force Occupational Safety and Health standards (AFOSH STD) that ensure technicians are protected from hazardous materials in the laboratory.

Comply with standards

Every manufacturer and supplier must comply with this standard. Their responsibility is to supply a safety data sheet (SDS) with every product they sell containing hazardous material. The manufacturer must label all hazardous products as “Hazardous Materials.” The SDS must contain the following:

- Name and address of the manufacturer.
- Specific components of the material.
- Physical characteristics of the chemicals (flash and boiling points, appearance, odor, etc.).
- Fire and explosion data.
- Reaction with other chemicals.
- How the material is absorbed into the body.
- Safe handling, storage, and spill-control procedures.

Documentation

The dental laboratory must have documentation describing its compliance to the standard. It should cover how to label materials, the SDS maintenance, the training program, and a list of the hazardous materials in the laboratory. Start an SDS file and ensure it is easily accessible to all laboratory personnel. If an SDS does not come with the product, the laboratory must get it from the manufacturer.

Training

All personnel receive hazardous material training upon initial assignment and when new material is introduced into the laboratory. Dental laboratory materials may contain the potentially hazardous chemicals of acetone, acrylic, acid, aluminum dust, aluminum chloride, asbestos, beryllium, carbolic acid, carbon tetrachloride, chromite ore, chromic acid, cobalt dust, copper, glass dust, liquefied natural gas, MMA, muriatic acid, nitric acid, nitrogen mustard, platinum, rouge, rubber solvent, silicon, silver, sulfuric acid, vinyl acetate, soldering fumes, and zinc oxide.

Hazardous chemicals

A major part of training is alerting personnel to hazardous chemicals in dental materials. To ensure hazard communication is effective, don't accept materials from supply with missing labels. In addition, do not maintain materials with illegible labels. Post warnings in areas where hazardous materials are frequently used. These warnings should indicate the hazard and appropriate safety measures.

Established criteria

While an effective safety program requires education in all safety areas, the hazard communication standard has established criteria. Technicians must know the requirements of the standard, such as the SDS file and the hazard evaluation program. Supervisors must brief all personnel on those operations involving hazardous materials. In addition, supervisors must inform all personnel the location of the SDS file, the different SDS formats, and its availability for all. Technicians must have safety equipment available; know when and how to use it.

Detecting the presence or release of hazardous materials

Another aspect of training is detecting the presence or release of hazardous materials. This includes everything from reading and interpreting material labels to using the five senses to detect hazardous materials. Supervisors must inform personnel about the physical and health hazards of the hazardous materials and, in case safety measures prove inadequate, provide first aid.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

001. Laboratory safety

1. What is the first step in safely performing laboratory tasks?

2. When a fire occurs, you extinguish the fire by removing one of the three elements. What are the three elements of a fire?

3. At a minimum, how wide should you arrange a walkway from furniture and equipment?

4. What are some examples of potential hazards in the laboratory?

002. Occupational hazards

1. What are the types of burns you may encounter in the dental laboratory?

2. What is the first indication of a foreign substance in the eye?

3. What are the five major body systems affected by dental materials?

4. What size particles are emitted from dispersed smoke, aerosol, and fumes?

5. How long do the symptoms of MFF last?

6. What are the types of dermatitis?

7. What are the symptoms of MMA overexposure?

8. How are the majority of pathogens transmitted?

9. What are the types of stress?

10. What is the body's physical reaction to stress?

003. Dental laboratory environment

1. What kinds of laboratory equipment commonly produce noise above 85 dB?

2. What are the types of laboratory ventilation?

3. How high is the seat of your laboratory chair adjusted to provide maximum comfort and support?

4. Why should a bench-top work surface be nonreflective?

004. Personal protective equipment

1. When using PPE, what physical limitations must the user consider?

2. When is a developing fetus most susceptible to environmental hazards?

3. What type of ear protection provides less protection than properly fitted ear plugs?

4. What are the proper steps to take when transporting compressed gas cylinders?

5. When should personnel receive hazardous material training?

1–2. Infection Control

The spread of infection has been a significant health risk for centuries. Even within medical treatment facilities (MTF), patients and staff members contract infections. Your capability to limit this spread of infection depends on your knowledge and application of infection control procedures. This section presents information about infection control and protecting the dental team.

005. Infection process

Infection control begins with the assumption that every case entering the laboratory is contaminated. Based on this very realistic possibility, all cases are disinfected using current infection control protocol. Using established protocol breaks the chain of infection and reduces the spread of an infectious agent. In this lesson, you will learn about infectious agents and the chain of infection.

Infectious agents

Pathogens are microorganisms that cause disease. Disease-causing agents you may encounter as a laboratory technician are bacteria, fungi, protozoa, and viruses.

Infectious Agents		
Agent	**Description**	
Bacteria	Bacteria are primitive, one-celled organisms known to reproduce rapidly. Some are pathogens, and others are essential for life. Average bacteria can divide every 0.50 to 2.00 hours—this rate creates several million new bacteria in a few days.	
	Ability to adapt	Bacterial cells have the ability to adapt in some extremely unfavorable conditions. Some cells become dormant until more favorable conditions exist. Others adapt by forming capsules or spores. A capsule is a slimy layer forming on the cell's outer wall. A spore is thick-walled structure formed within the cell. A spore withstands extreme conditions and lasts for an indefinite period. Spores resume their cellular growth once conditions become favorable.
	Aerobic or anaerobic	Bacteria can be either (1) *aerobic*, which requires O_2, or (2) *anaerobic*, which can live without O_2. In either case, bacteria also require nutrition to thrive. Parasites are bacteria, inhabiting our bodies, designed to obtain their nutrients from living sources.
Fungi	Two categories of fungi are yeasts and molds. They range in size from microscopic single celled organisms to mushroom-shaped organisms seen without the aid of a microscope. Fungi's primary food source is dead and decaying matter. Fungi thrive in warm, moist, dark environments and, like bacteria, can survive some extreme environmental changes. Fungi can be either pathogenic or nonpathogenic. Fungi can cause superficial (external) and systemic (internal) infections. An example of external fungi is athlete's foot. An example of internal fungi is oral thrush.	
Protozoa	Protozoa are single-celled structures resembling animal cells, usually found in fluid environments—surrounded by cell membranes rather than cell walls. The ones we are concerned with live as pathogenic parasites in the fluids of human blood or tissue. Protozoa	

Infectious Agents	
Agent	**Description**
	react to unfavorable conditions by secreting a protective cyst-like covering. This encystment allows the protozoa to withstand environmental changes and survive transfer from one host to another. When protozoa return to a fluid environment, they resume their activities.
Viruses	Viruses are intracellular parasites and the smallest known microorganism. They lack both a cell wall and a distinct nucleus. Each virus consists of a strand of nucleic acid surrounded by a protein-based membrane. They survive by entering a host cell and altering its reproductive structures—so additional viruses produce instead of the host cell structure. These new viral structures then release to invade other cells. The original cell breaks down through a process called *lysis*, or continues to grow and duplicate. Viral cells are specific to certain body parts. For example, the measles virus affects skin cells, rabies affects the brain and spinal cord, and yellow fever affects the liver. Viruses are responsible for a multitude of diseases including acquired immunodeficiency syndrome (AIDS) or human T-lymphocyte virus (HTLV) III.

Chain of infection

The chain of infection is comprised of six interrelated links. They are a (1) portal of entry, (2) susceptible host, (3) infectious agent, (4) reservoir, (5) portal of exit, and (6) mode of transmission. As figure 1–1 shows, this cyclic chain of events must remain unbroken to spread disease. Breaking this sequence prevents the spread of disease.

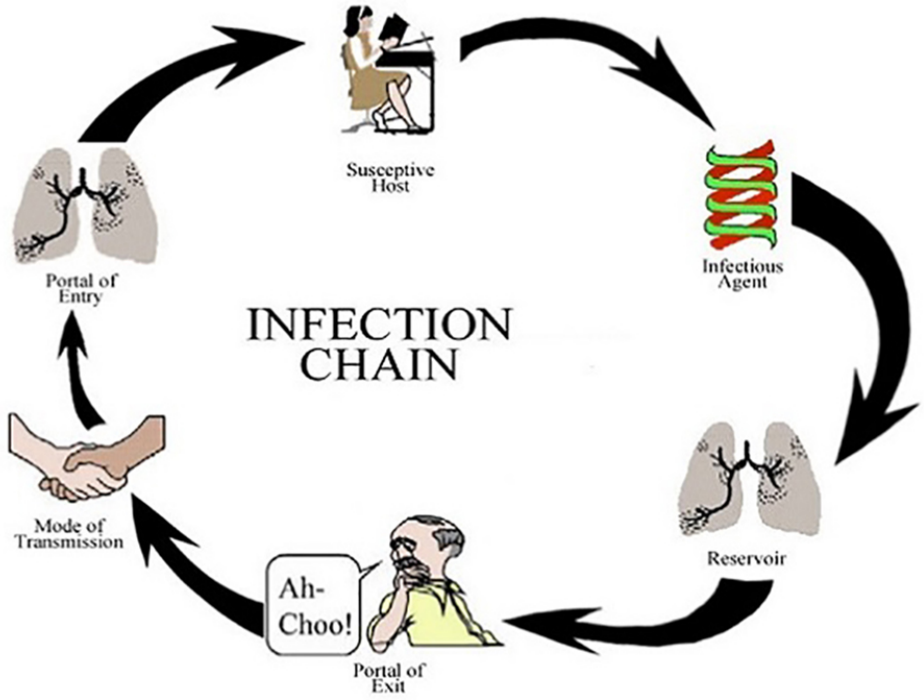


Figure 1–1. Cycle of infection.

Chain of Infection	
Link	**Description**
Portal of entry	The portal of entry is the way an infectious agent enters the body. The most common portals of entry for laboratory personnel are the mouth, nose, eyes, and breaks in the skin. A portal of entry is only a link for infection if it provides the infectious agent (microorganism) with a favorable environment for reproduction.

<table>
<tr><th colspan="3">Chain of Infection</th></tr>
<tr><th>Link</th><th colspan="2">Description</th></tr>
<tr><td>Susceptible host</td><td colspan="2">Susceptible, in this context, indicates a condition allowing a microorganism to penetrate a person's natural defenses. A host is a person/body penetrated by an infectious agent and a disease has developed because his or her defense mechanisms could not stop the spread of the infection.</td></tr>
<tr><td>Infectious agent</td><td colspan="2">As you know, infectious agents are pathogens and, in this case, are microorganisms known to cause disease. Disease-causing agents you may encounter as a laboratory technician are bacteria, fungi, protozoa, and viruses.</td></tr>
<tr><td>Reservoir</td><td colspan="2">Each infectious agent has a requirement for O_2, proper temperature, moisture, light, proper pH, and a nutrition source. An environment (reservoir) that is favorable to one microorganism may be unfavorable to another.

When an infectious agent is placed in an unfavorable environment, it either dies or changes to a dormant stage—cyst or spore. When this happens, the microorganism is dormant and noninfectious. It may reactivate if introduced to a favorable reservoir. In many cases, these reservoirs are located within human and/or animal hosts.

A host can be permanent or intermediate. In either case, the host acts as a carrier to transmit the pathogenic organism to another reservoir—person or animal.</td></tr>
<tr><td>Portal of exit</td><td colspan="2">The portal of exit is usually some form of waste elimination product. These products include urine, feces, oral-nasal secretions, and genital fluids—all of which transmit through casual contact (shaking hands or handling an impression or appliance).</td></tr>
<tr><td>Mode of transmission</td><td colspan="2">There are five major modes of transmission. The first four are the most common forms of infectious transmission within the clinical setting.</td></tr>
<tr><td></td><td>
<table>
<tr><th>Mode</th><th>Definition</th></tr>
<tr><td>Contact</td><td>Direct: direct contact with source of infectious agent—usually occurs in the dentist's treatment room; however, can be transmitted by a vehicle.
Indirect: touching a contaminated object—prosthesis or impression.</td></tr>
<tr><td>Droplet</td><td>Expelled through coughing or sneezing—immediate range not usually more than 5 feet from source.</td></tr>
<tr><td>Vehicle</td><td>Intravenous (IV) methods transfer microorganisms by food, beverages, or blood products.</td></tr>
<tr><td>Airborne</td><td>Occurs when infectious agents become suspended in air—dust particles, aerosols, and sprays. An example is preparing denture surface for reline or repair.</td></tr>
<tr><td>Vectors</td><td>Usually insects or rodents can act as intermediate host until the pathogen finds a favorable environment.</td></tr>
</table>
</td></tr>
</table>

Break the chain

The most likely place to break this chain is between the portal of exit of the infected host and portal of entry of the uninfected host. The spread of infection occurs when an infectious agent finds an uninfected host.

Acquired immunodeficiency syndrome

The one disease we must discuss and of utmost concern to all health care providers is AIDS. When infected, all body fluids contain the AIDS virus.

Transmitted

As of this writing, blood, vaginal fluids, and semen are the only known ways to transmit AIDS. The numbers of virus particles in saliva are too few to transmit AIDS. A break in the skin—usually caused

by an accidental stick with a contaminated needle is the main cause of contracting AIDS in health care providers.

Infection control

Transmitted the same way as Hepatitis B, if medical personnel treat an AIDS case the same as the Hepatitis case, there should not be any problems. The biggest problem in handling a case is not knowing if it is contaminated or not. Your best defense is to use proper infection control procedures on every case.

006. Infection control methods

Infection control is an ongoing program affecting everyone in a hospital—both patients and staff. There is a chance a small percentage of patients will develop nosocomial infections. *Nosocomial infections* are infections patients acquire because of treatment in an MTF. Although figures are not readily available, a significant number of hospital personnel will also develop infections. This problem is so serious, the Centers for Disease Control and Prevention (CDC) recommends all medical facilities establish an ongoing infection control program to deal with the problem of nosocomial infections. The joint commission has endorsed and expanded the establishment of ongoing infection control programs. The joint commission also made infection control programs one of the basic criteria for hospital accreditation. In this lesson, you will study nosocomial infections, how various infection control procedures break the chain of infection and halt the infectious process. The techniques we cover here include hand-hygiene and isolation precautions.

Preventive measures for nosocomial infections

As you know, there is a possibility patients may develop nosocomial infections during treatment. In terms of time, supplies, and equipment, the monetary damage of such infections cost billions of dollars. In terms of patient suffering, the figure is incalculable. Part of your responsibility is to provide the best possible care for your patients. You must do everything you can to prevent nosocomial infections. To do this, you must learn what causes these infections, what the contributing factors are, and what measures prevent them.

Causative factors

We divide causative factors into the categories of actual infectious agents (microorganisms) causing disease and patient condition or method of care contributing to the infections.

Actual infectious agents

Gram-negative aerobic bacilli cause most nosocomial infections. These include Klebsiella, Enterobacter, Pseudomonas, Serratia, Proteus, and Escherichia coli. Other infectious agents include gram-positive bacteria (Staphylococcus aureus), viruses (rotavirus), fungi (candida) or protozoa (pneumocystis). These infectious agents are not normally pathogenic; they are commensal or part of the patient's normal flora becoming opportunistic and invasive when the patient's condition weakens. The factors contributing to nosocomial infections are patient condition, type of treatment/therapy, exposure, and employee carelessness.

Contributing Factors to Nosocomial Infections	
Factors	**Risks**
Patient conditions	Any illness causes some deterioration of the body's defense mechanisms and makes the patient more susceptible to infections. Illnesses or injuries directly affecting the immune system are especially hazardous. For example, patients with AIDS are highly susceptible. Patients who have burns or other injuries damaging the skin also have increased susceptibility. Sometimes age is a factor in susceptibility. Elderly patients are highly susceptible because their systems are deteriorating. At the same time, infants and young children are more susceptible because their systems are immature.

Contributing Factors to Nosocomial Infections	
Factors	**Risks**
Treatment and therapy	Many of the new diagnostic techniques involve some sort of invasive procedure. Contaminated equipment or IV fluids and blood are also sources of infection. Certain types of therapy actually suppress the immune system. For example, cancer patients frequently receive chemotherapy and/or radiation therapy. Either form of therapy depresses the immune system. The patient's normal flora is able to survive and frequently cause opportunistic infections. When this type of a patient needs dental care, the possibility of spreading an infection is increased.
Exposure	A hospital is one of the least healthful places in the world. It's where sick people go. Their lower resistance, in combination with the microorganisms in the MTF environment, increases opportunities for cross-contamination. Patients in intensive care or special care units have an increased chance of exposure because they are sicker and closer together.
Carelessness	Carelessness may be one of the major contributing factors for nosocomial infections. Staff members, who accidentally contaminate equipment or supplies, then use those (equipment or supplies) on a patient, risk causing nosocomial infection. Have you ever seen a fellow staff member provide patient care and then not wash his or her hands?

Preventive measures

The most basic and important preventive measure is handwashing. We cover this later, but wash your hands before and after you provide any patient care. The type of handwashing (routine versus antiseptic versus surgical scrub) is in accordance with the procedure you perform. Other preventive measures include isolation techniques, strict aseptic technique for invasive therapy, close surveillance to identify potential infections and prevent contamination, and monitoring staff aseptic practices.

The infection chain

This topic actually relates to the whole concept of infection control. The result of proper infection control practice ensures we stop the infectious process. Look at figure 1–2, and you will see each link in the infection chain separated from the next link by certain activities. Begin with the infectious agent and you can see we use handwashing, antibiotic therapy, and cleaning and disinfecting techniques to stop agents from reaching their reservoir. If they cannot reach their reservoir, they will not be able to grow and multiply.

Isolation techniques

In the next link, we deal with microorganisms who establish themselves in a reservoir. If the reservoir is a human host, use isolation techniques to prevent its spread. Depending where the microorganisms are, use antibiotics, chemicals, or other means to destroy the organism and prevent it from leaving the reservoir.

Prevent transmission

If the microorganism does leave, handwashing and proper treatment of waste products will help prevent its transmission. At the other end of the transmission, you can again use handwashing, as well as gloves and other sterile techniques, to prevent it from reaching a portal of entry in a new host.

Best defense

The best defenses against infection are good health, proper personal hygiene, and natural barriers. Even if a microorganism does manage to enter your body, you have an excellent chance of resisting it if your natural defenses are working. You will also be able to prevent microorganisms from establishing a reservoir in your body if you limit your exposure to infectious agents. Logically, if you hang around with a room full of sick people, you will probably become sick. Of course, in your occupation, you may not have a choice, but you can still take precautions. Keep your immunizations current; the Air Force will remind you when to go to the immunization clinic to get your shots. Again, maintaining good health habits is the best way to decrease your susceptibility to infection.

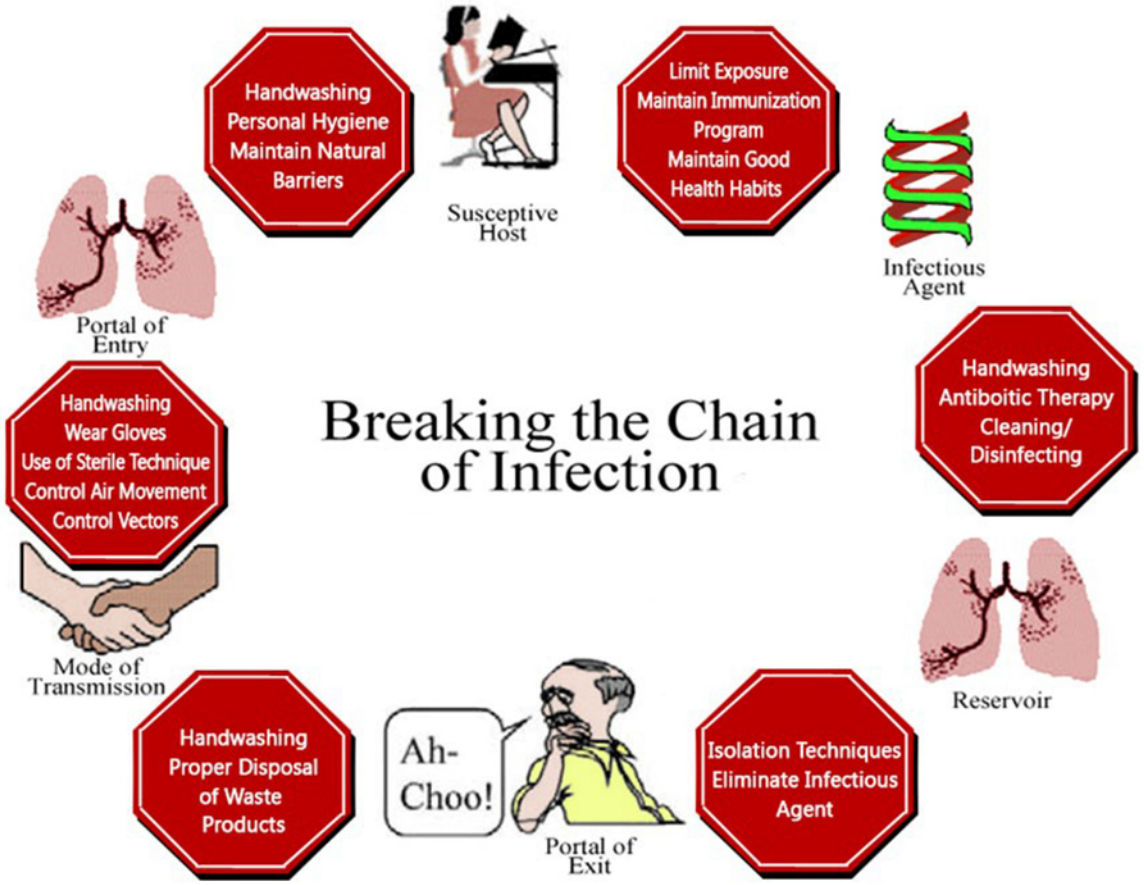


Figure 1–2. Breaking the infection chain.

Asepsis

Sepsis is a term meaning infection. *Asepsis* means the absence of infection. As a health care worker, strive to reduce or eliminate all possible sources known to spread infections. Reducing, destroying, or eliminating pathogens are some of the ways in which you can strive for asepsis.

Destroy the microorganisms

We can achieve asepsis on inanimate objects, but not on people. Even though most microorganisms require a specific environment, many microorganisms are capable of developing into forms (i.e., spores, cysts, etc.) known to survive environmental changes. The human body, on the other hand, is relatively fragile. It is not possible to kill the microorganisms on our bodies without damaging ourselves in the process. However, it is possible to destroy all the microorganisms on an inanimate object.

Stop the spread of microorganisms

As you know, limiting the spread of microorganisms breaks the infection chain and results in the eventual destruction of the organism. It is not necessary to kill all the microorganisms to stop an infection. If you can stop the spread of the microorganisms, you will break the infection chain and halt the infectious process. We can destroy the microorganism if we can confine the infectious agents to their original host. Once confined, we can destroy the microorganism with a combination of medical care and the host's defensive mechanisms, or when the host dies and the source of nutrition is gone.

Know the terminology

You must be familiar with aseptic technique terminology. The following table gives some of the more common terms along with their definitions. With this background knowledge of asepsis, you'll know

the levels of asepsis you will study in the rest of the lesson. Your knowledge and understanding of each level is important for both your patients and your safety.

Levels of Asepsis	
Term	**Definition**
Contamination	This is exposure of a sterile item to a microorganism, or a clean item to an infectious agent.
Cleaning	This requires the physical removal of organic material or soil. This is usually accomplished using water with or without detergents to either surgical or medical asepsis.
Disinfection	Asepsis measures between cleaning and sterilization. These measures destroy pathogenic organisms, but they usually do not affect spores. Disinfectants are substances used to carry out disinfection and generally are used on inanimate objects.
Antiseptics	A substance designed to reduce the number of microorganisms on living tissue. Antiseptics are associated with medical asepsis.
Sterilization	Designed to destroy or remove all forms of microbial life. Sterilization applies to surgical asepsis only.

Handwashing

Medical authorities consider handwashing to be the most effective means of preventing nosocomial infection. Hands are the most useful tools used in medical care. Unfortunately, hands are also one of the most frequent sources of contamination. We can link most contamination to poor handwashing techniques. In spite of the dangers associated with infections such as the human immunodeficiency virus (HIV) or hepatitis, many medical personnel either do not wash their hands at all or do not wash them properly. In this lesson, you will learn about types of microorganisms found on your hands. You will also receive some recommendations for handwashing frequency and cleansing agents, as well as specific hand-hygiene methods.

Skin flora

The microorganisms inhabiting your skin are either resident or transient flora. Resident flora are relatively stable. They can survive for extended periods and usually identified whenever the skin is cultured. Resident flora are located primarily on the superficial layers of the skin but can also be found in the deeper layers. They tend to cling to the skin, and even the superficial types are difficult to remove. Soap, water, and mechanical activity such as handwashing will sometimes remove superficial resident flora. Handwashing does not normally remove deep flora but can sometimes be killed or inhibited with antiseptics. Fortunately, resident flora generally are low in virulence and cause infections only in patients who are undergoing invasive procedures or who are immunocompromised.

Transient flora

Transient flora are those microorganisms picked up through casual contact and usually survive less than 24 hours. Thankfully, frequent handwashing easily removes transient flora. Transient flora vary from nonpathogenic to highly virulent. In many cases, people pick up transient flora from infected patients and are involved in outbreaks of nosocomial infection.

Resident flora

If transient flora remain on the skin for extended periods or in large numbers, they can adjust to their environment and become resident flora. If such flora also happens to be pathogenic, then the individual becomes a carrier for the disease. Thorough and frequent handwashing is the only way to prevent transient flora and reduce the possibility of contamination.

Handwashing recommendations

There is no question we should wash our hands, but there is some dispute about how often to wash them and what agents to use. Actual handwashing requirements depend on the type, intensity, and duration of patient contact.

Contaminated hands

Those who work in high-risk units frequently encounter circumstances requiring handwashing. Their patients are often either infected or colonized, carrying a disease with a virulent or resistant form of microorganism. These patients usually are highly susceptible to infection because of their wounds, invasive procedures, or diminished immune function. High-risk unit personnel should wash their hands between patient contacts and anytime their hands become contaminated with secretions or excretions during individual patient care. Always wash contaminated hands before proceeding with a patient's care.

Techniques and agents

Recommendations for hand-hygiene methods and agents depend on the purpose for washing. There is not a specific handwashing time for all situations. Washing for 15 seconds is effective in removing most transient contaminants. In situations where hands are visibly contaminated, more time may be required. For routine situations, we recommend a vigorous, brief washing with soap under a stream of water.

Mechanical removal of contaminates

Wash hands with plain soap, detergents, or antiseptic (antimicrobial) solutions. Although detergents work a little better in cold water, handwashing with either plain soaps or detergents suspends microorganisms and rinses them off (often referred to as "mechanical removal of microorganisms"). Handwashing with an antiseptic or antimicrobial product kills or inhibits the growth of the microorganisms (often referred to as "chemical removal of microorganisms").

Wearing gloves

In addition to handwashing, wearing gloves gives an extra margin of protection from contaminates. As with handwashing, we do not know the absolute indications for wearing gloves. There is general agreement the wear of sterile gloves is necessary when performing certain invasive procedures or when open wounds are touched. Wear nonsterile gloves when dealing with potentially infectious material, such as blood, body fluids, or secretions. Since we do not always know which patient's blood, body fluids, or secretions contain pathogenic organisms, wearing nonsterile gloves in any of these situations is now part of our *standard precautions*. Furthermore, wear gloves to prevent gross microbial contamination of hands, such as when handling objects soiled with feces. In addition, since perforated gloves are always possible, and bacteria multiply rapidly on glued hands, we recommend handwashing even when wearing.

Frequent and appropriate hand hygiene

You must wash your hands both before and after going to lunch, taking a break, or using the bathroom. You must also wash your hands at the beginning and end of each duty day as well as immediately after the removal of PPE. As you can see, hand hygiene is one of the most important ways to prevent the transfer of microorganisms from one person to another.

Placing sinks, handwashing products, and paper towels in convenient locations encourages frequent and appropriate handwashing. Sinks with faucets turned on by means other than the hands and sinks minimizing a splash can help personnel avoid immediate recontamination of washed hands.

Hand-hygiene methods

We need to reemphasize this is the hand-hygiene method for routine, and antiseptic handwashing in the dental laboratory. Surgical antisepsis is the term used for handwashing for surgical procedures and is much more extensive. In simple terms, routine and antiseptic handwashing decontaminates the hands without contaminating the rest of the body.

The basic steps of handwashing begin with the rinsing of hands and wrists under cool running water. Then dispense the handwashing agent (soap) to cover hands and wrists. You should rub the agent into all areas with particular emphasis around nails and between fingers, before rinsing with cool water. You must dry hands completely with disposable towels before donning gloves. Use the towel to turn off the faucet if automatic controls are not available. Remember, the minimum duration is 15 seconds. Indicators for routine handwash and antiseptic handwash are:

1. When visibly soiled.
2. After barehanded touching of inanimate objects, likely containing blood or saliva contaminates.
3. Before or after treating each patient.
4. Before leaving patient-care, laboratory, or instrument-processing areas.
5. Before regloving after removing gloves that are torn, cut, or punctured.

Isolation precautions

We design isolation precautions to prevent the spread of microorganisms among patients, personnel, and visitors. Isolation precautions break the chain of infection by placing transmission barriers between susceptible individuals and sources of contamination. In most cases, the patient is the source of contamination, and we use barriers to protect everyone else.

Physical barriers

The physical barriers of isolation fundamentals include the unit itself, masks, gloves, eye protection/face shields, and equipment. Let's look at each one.

Patient unit

The most effective type of isolation unit is a private treatment room. Here, we physically separate the patient from other patients; personnel are more apt to remember to wash their hands before going on to other patients. A private room is not a requirement but normally used for patients affected by highly infectious or virulent disorders. Also, use a private treatment room for patients who have poor hygiene habits, will contaminate the environment, or share contaminated items (e.g., pediatric or confused patients). In addition, we should place those patients with clinically significant microorganisms (resistant bacteria) or infectious blood disorders in a private room.

Ventilation

Ventilation creates a pressure difference between the room and the outside so we draw the air into the room rather than expel it when someone opens the door. This system should provide at least six air changes per hour and discharged outdoors.

Masks

We use masks to prevent transmission of airborne infectious agents. They protect the wearer from inhaling large particle aerosols (droplets) transmitted by close contact and generally travel only short distances (3 feet) and small particle aerosols (droplet nuclei) remaining suspended in air and travel longer distances. Masks may also prevent transmission of some infections spread by direct contact with mucous membranes because they may discourage personnel from touching the mucous membranes of their eyes, nose, and mouth. The high-efficiency disposable masks are more effective than cotton gauze or paper-tissue masks. If large-particle aerosols transmit the infection, wear a mask when working close to the patient. If the infection is transmitted over longer distances, wear a mask when you enter the room for any reason. Before leaving, take the contaminated mask off and drop it in the trash because you cannot take it out of the room.

Gloves

We wear gloves for the following reasons:

1. They provide a protective barrier and prevent gross contamination of the hands exposed to blood, body fluids, secretions, excretions, mucous membranes, and nonintact skin.

2. They reduce the likelihood of transferring the microorganisms present on personnel during invasive or other patient care procedures involving touching a patient's mucous membranes and nonintact skin.
3. Reduce the likelihood personnel contaminated with microorganisms from a patient or fomites can transmit these organisms to another patient.

A *fomite* is an infectious object. Gloves are either sterile or nonsterile for isolation, depending on the type of isolation or the procedure performed. If you are doing a sterile procedure or working with an immunosuppressed patient, for example, wear sterile gloves. For routine care, you can wear nonsterile gloves. Gloves, however, do not eliminate the need for handwashing! You will still accumulate microorganisms beneath the gloves, and there is always a possibility the gloves could be torn or punctured. Take care to touch the outside of one glove with the outside of the other when you take the gloves off. Your bare hand should only touch the inside of either glove. Take your gloves off before you leave the area and drop them in the trash. If your gloves become heavily contaminated, change them before continuing.

Eye protection and face shields

The Occupational Safety and Health Administration (OSHA) mandates the wear of goggles or face shields in certain circumstances to prevent the transmission of bloodborne pathogens. The purpose of wearing such protective equipment is to protect your eyes and the mucous membranes of your mouth when splattering or splashing of blood or body fluids is possible.

Equipment

If disposable equipment becomes contaminated, bag, label, and dispose of the equipment in accordance with local policy. When nondisposable equipment becomes contaminated, clean, bag, and send the equipment for sterilization. Take special care with needles, syringes, scalpel blades, and other items possibly contaminated with the patient's blood. Place such items in an appropriate biohazard storage device. When full, bag, label, and dispose of the device according to infection control and Environmental Protection Agency (EPA) guidelines.

Isolation systems

As you know, isolation precautions prevent the spread of disease by blocking transmission of the infectious agent. Since each infectious agent has its own particular mode of transmission, we tailor the isolation precautions to the agent. The CDC has recommended a two-system tier of precautions to be used within hospitals—standard precautions and transmission-based precautions. Standard precautions are the primary strategy in the prevention of nosocomial infections. Transmission-based precautions prevent the spread of infectious agents by interfering with the organisms' known method of transmission.

Standard precautions

Standard precautions are the minimum infection prevention practices applied to all patient care regardless of suspected or confirmed infection status of a patient. Standard precautions include hand hygiene, use of PPE, respiratory hygiene/cough etiquette, sharps safety, safe injection practices, sterile instruments and devices, and clean and disinfected environmental surfaces. Standard precautions integrate and expand the elements of universal precautions into a standard of care designed to protect healthcare personnel and patients from pathogens that can be spread by blood or any other body fluids, excretion, or secretion. Standard precautions apply to contact with blood; all body fluids, secretions, and excretions (except sweat), regardless of whether they contain blood; nonintact skin; and mucous membranes. Saliva classifies as a potentially infectious material in dental infection control; thus, no operational difference exists in clinical dental practice between universal precautions and standard precautions.

The following precautions are standard for most circumstances:

1. Wear gloves when touching blood, body fluids, body substances, or mucous membranes.

2. Wear gloves when there are cuts, breaks, or openings in the skin.
3. Wear masks, goggles, or face shields when splattering or splashing of blood or body fluids is possible.
4. Wear gowns or aprons when splashing, splattering, smearing, or soiling from blood or body fluids is possible.
5. Wash hands and other body parts immediately if contaminated with blood or body fluids.
6. Wash hands immediately after removing gloves.
7. Wash hands after contact with the patient.
8. Handle razor blades and other sharp objects carefully to avoid injuring the patient or yourself.
9. When using mouth-to-mouth resuscitation, use resuscitation devices.
10. Avoid patient contact when you have open skin wounds or lesions. Discuss the situation with your supervisor.

Universal precaution is an old term we no longer use, but you can still find in OSHA documents. It is a concept where we treat all potentially contaminated blood and body fluids as infectious because patients with bloodborne infections can be asymptomatic or unaware they are infected. In 1996, the CDC expanded the concept and changed the term to standard precautions.

Transmission-based precautions

Use transmission-based precautions in addition to standard precautions when treating a patient infected with highly transmissible pathogens (e.g., active tuberculosis [TB]). The three types of transmission-based precautions are airborne, droplet, and contact transmission. These precautions contain and/or prevent transfer of microorganisms from a source (patient and/or environment) to a susceptible host (patent or health care provider). For example, transmission-based precautions for an active TB patient may require you to wear gloves, an airtight facemask, and a disposable gown.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

005. Infection process

1. As a dental laboratory technician, what are the common infectious agents you may encounter?

2. What are the two categories of fungi?

3. List the six interrelated links of the chain of infection.

4. While reviewing the chain of infection, what are the transmission modes for pathogens?

5. Where is the most likely place you can break the chain of infection?

6. When treating a patient with AIDS, what is the best defense for preventing transmission of the disease?

006. Infection control methods

1. What are the factors contributing to nosocomial infections?

2. What is the single, most effective personal hygiene practice in stopping disease transmission?

3. What are the physical barriers of isolation fundamentals?

4. What are the three types of transmission-based precautions?

Answers to Self-Test Questions

001

1. Planning.
2. Fuel, O_2, and heat.
3. 36 inches.
4. Frayed wiring, loose connections, and improper grounding of electrical equipment.

002

1. Thermal and chemical.
2. Pain and irritation of the conjunctiva and eyelids.
3. Integumentary, respiratory, nervous, digestive, and urinary.
4. 0.1 µm to 0.0001 µm.
5. 12 to 24 hours.
6. Contact and allergic.
7. Headache, dizziness, nausea, depression, drowsiness, low blood pressure, loss of coordination, and, in serious cases, unconsciousness.
8. Through blood and saliva.
9. Situational and developmental.
10. A heightened nervous system, increased muscle tension, and a release of adrenaline.

003

1. Air hoses, pneumatic chisels, high-speed lathes, steam cleaners, and handpieces.
2. General and exhaust.
3. Chair height should be set to allow thighs to be parallel to the floor.
4. To reduce light reflection into eyes, which can cause eyestrain.

004

1. Vision, depth perception, hearing, dexterity, reflexes, weight, and reach.
2. First trimester.

3. Earmuffs.
4. (1) Transport cylinders with hand trucks or dollies. Once in the laboratory, separately secure cylinders in a vertical position.
   (2) Don't store extra, full or empty, cylinders in the laboratory.
   (3) Don't drop cylinders or handle them roughly. Don't drag or roll cylinders.
   (4) Make sure all cylinder valves are shut off when not in use.
   (5) Keep oil and grease away from O_2 cylinders. Oiling an O_2 regulator will cause an explosion.
5. Upon initial assignment and whenever a new material is introduced to the laboratory.

005

1. Bacteria, fungi, protozoa, and viruses.
2. Yeasts and molds.
3. (1) Portal of entry.
   (2) Susceptible host.
   (3) Infectious agent.
   (4) Reservoir.
   (5) Portal of exit.
   (6) Mode of transmission.
4. Contact, droplet, vehicle, airborne, and vectors.
5. Between the portal of exit of an infected host and the portal of entry of an uninfected host.
6. The biggest problem of handling a case is not knowing if it's contaminated or not. Your best defense is to use proper infection control procedures on every case.

006

1. Patient condition, type of treatment and therapy, exposure, and employee carelessness.
2. Handwashing.
3. The unit, masks, gloves, eye protection, and equipment.
4. Airborne, droplet, and contact transmission.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter.

1. (001) What is the *first* step in performing a task safely?
   a. Safety.
   b. Planning.
   c. Knowledge.
   d. Attentiveness.

2. (001) When using a knife, you should
   a. cut *towards* yourself.
   b. wear gloves and a mask.
   c. cut *away* from yourself.
   d. avoid using sharp blades.

3. (002) When using acids, you should work near a sink and eyewash station and have what neutralizer easily available?
   a. Baking soda.
   b. Baking powder.
   c. Sodium chloride.
   d. Sodium hypochlorite.

4. (002) Pain and irritation in which area of the eye *usually* indicates the presence of a foreign substance?
   a. Rods.
   b. Cones.
   c. Retina.
   d. Conjunctiva.

5. (002) Which organ has a tendency to collect toxic materials over a long period of time?
   a. Kidney.
   b. Stomach.
   c. Large intestine.
   d. Small intestine.

6. (002) Extremely small dust particles can remain airborne
   a. up to 10 hours.
   b. up to 14 hours.
   c. no more than 12 hours.
   d. no more than 16 hours.

7. (002) Which material is known to have a large percentage of silica and can cause silicosis?
   a. Alloys containing beryllium.
   b. High nickel-containing alloys.
   c. High heat-resistant investments.
   d. Red rouge polishing compounds.

8. (002) Overexposure to methyl methacrylate (MMA) is indicated by the presence of what chemical in a urine sample?
   a. Acetone.
   b. Methanol.
   c. Ammonia.
   d. Hydroxide.

9. (002) Which two alloys are known carcinogens?
   a. Copper and zinc.
   b. Tin and aluminum.
   c. Nickel and chromium.
   d. Manganese and selenium.

10. (003) Dust from keying casts can travel at what speed?
   a. 100 to 200 feet per minute.
   b. 200 to 300 feet per minute.
   c. 300 to 400 feet per minute.
   d. 400 to 500 feet per minute.

11. (003) How should your upper legs (thighs) be positioned in relation to the floor when you are seated in an ergonomically adjusted chair?
   a. Parallel.
   b. Perpendicular.
   c. At a 45-degree angle.
   d. At a 135-degree angle.

12. (003) The work area of a laboratory bench top should be how many inches deep?
   a. 12.
   b. 18.
   c. 24.
   d. 30.

13. (004) When treating a patient who is pregnant, the fetus is *most* susceptible to harm from environmental conditions during the
   a. first trimester.
   b. second trimester.
   c. third trimester.
   d. pre-embryonic period.

14. (005) When studying infectious agents, on average, bacteria can divide every how many hours?
   a. 0.5 to 2.0.
   b. 2.00 to 3.5.
   c. 3.5 to 5.00.
   d. 5.00 to 6.5.

15. (005) What mode of transmission transfers microorganisms using food, beverage, or blood products?
   a. Contact.
   b. Droplet.
   c. Vehicle.
   d. Airborne.

16. (005) When treating a patient with acquired immunodeficiency syndrome (AIDS), what is the *best* way to prevent transmission of the disease?
   a. Perform good handwashing.
   b. Use the proper barrier system.
   c. Wear gloves, a facemask, and disposable gown.
   d. Use proper infection control procedures on every patient.

17. (006) What type of infections do patients acquire as a result of treatment in a medical facility?
    a. Latent.
    b. Agonal.
    c. Germinal.
    d. Nosocomial.

18. (006) What level of asepsis is designed to destroy pathogenic organisms but does *not* usually affect spores?
    a. Cleaning.
    b. Antiseptic.
    c. Disinfection.
    d. Sterilization.

Please read the unit menu for unit 2 and continue ➔

Unit 2. Management and Administration

2–1. Management 2–1
007. Artificial tooth inventory 2–1
008. Fabrication standards 2–2
2–2. Administration 2–6
009. Precious metals and alloys 2–6
010. Shipping and receiving cases 2–14

FABRICATING A CLINICALLY ACCEPTABLE PROSTHESIS requires each person (of the treatment team) to have the necessary materials to complete his or her task. Managing these resources and the laboratory workload are important to meeting the dentist and patient's expectations. This unit presents information about laboratory management and administration.

2–1. Management

Management is the act and art of conducting or supervising your actions and the actions of others to complete a specific task or project. Good managers have the knowledge and capacity to do the right things. This means they focus on what is important to meeting their mission. This requires the manager to understand his or her internal (within the laboratory) and external (outside of the laboratory) support systems. This section presents information to improve your knowledge about the management of the artificial tooth inventory and laboratory fabrication standards.

007. Artificial tooth inventory

Management of the dental lab's artificial tooth supply involves inventory, ordering, adjusting stock levels and exchanges of tooth cards with the manufacturer. It's important you know how often to conduct inventories as well how to replenish your stock level. In addition to knowing how to prepare requests for new tooth cards, you should also be able to exchange broken tooth cards or sets no longer needed. To provide you with this knowledge, we begin with procurement responsibility of the artificial teeth inventory.

Procurement responsibilities

The squadron commander is responsible for the brands of artificial teeth selected to fulfill local requirements. The squadron commander usually delegates this task (but not the responsibility) to a tooth file custodian who performs all inventories, ordering, and other functions. In the continental United States (CONUS), we procure artificial teeth under a blanket purchase agreement (BPA) with a dealer or manufacturer. Overseas bases, without an available dealer, order direct from the manufacturer.

Requisition

The custodian requests artificial teeth on the manufacturer's order blank. Medical supply uses this order form, in addition to its own forms, when ordering teeth. Local requirements determine the number of order form copies needed by supply. As long as the orders are going to the same source, you can process several orders in one medical supply request. When the orders go to different sources, supply must process different requests for each source.

To prepare the order form, inventory the teeth on hand and compare it to your established stock levels. You may record the inventory in pencil and then compare it with the orders due in; ordered, but not delivered; and backorder listings for teeth previously ordered. Enter the final decision on what to order in ink. Also, count broken sets and use them for an even exchange with the manufacturer.

Stock handling

The custodian is delegated the responsibility of maintaining adequate stock levels. To maintain an adequate stock, the file should contain the stock level of each type of artificial tooth, orders due in, and orders received. This lets the custodian compare what is on hand with the established level.

Effective stock maintenance

The most cost-effective method of stock maintenance is for the custodian to order small amounts frequently. This eliminates waste by keeping a minimum stock level on-hand and ensuring an adequate supply of each type of artificial teeth remains on-hand. This method also documents the usage rate of each type of artificial teeth, making adjustments of stock levels easier. Eliminate artificial teeth not used from the file.

Stock level

Determine the artificial teeth stock level by usage and ordering frequency. Adjust, eliminate, or initiate stock levels whenever the usage rate varies. As a minimum, the custodian must review the stock levels semiannually. Document the review date in the file.

Exchange

So, how do you get rid of these teeth? You exchange the unused artificial teeth for artificial teeth regularly used with the company. Manufacturers also accept broken sets of *unaltered* teeth attached to their original cards. Exchanges keep scrap teeth to a minimum, reducing the amount of money the Air Force has tied up in dead stock. Exchange teeth independent of medical supply or as part of an order.

008. Fabrication standards

The ability to fabricate a prosthesis is an art or skill. Fabricating a prosthesis to a preconceived level requires an established standard. We base the standard on what is clinically acceptable for a type of prosthesis; consequently, a standard determines what level of skill the technicians must achieve and maintain. Training to this skill requires each laboratory to establish fabrication standards for every type of prosthesis it fabricates. This lesson presents information about how to establish these standards.

Establishing standards

Fabrication standards can vary from laboratory to laboratory; therefore, clearly state locally developed standards so your trainers can use this information to conduct their training.

Key elements

For example, key elements for developing laboratory prosthetic standards should consider sanitation, function, form, and esthetics.

Principle elements

These principle elements are the basis for establishing specific and measurable objectives. An objective is an outcome or result—something measurable. For example, removable prostheses have three primary objectives: (1) achieve maximum function, (2) avoid speech disruption, and (3) restore natural appearance.

Objectives

You may measure each of these objectives in the laboratory by the technician or chairside by the dentist. For example, if a prescription from the dentist stipulates you must fabricate a denture for a patient with cross-bite occlusion, your laboratory fabrication standards are determined as follows:

Determining Laboratory Standards for Fabrication	
Item	**Description**
1	Were the casts accurately mounted—as prescribed by the dentist?
2	Was the correct artificial tooth shade and mold selected as prescribed by the dentist?

Determining Laboratory Standards for Fabrication	
Item	**Description**
3	Were the maxillary and mandibular anterior teeth arranged for optimum function and esthetics?
4	Is the alignment of the midline correct?
5	Is the central sulcus of mandibular posterior teeth over the crest of the lower ridge?
6	Are the maxillary posterior teeth positioned for maximum intercuspation?
7	Is there sufficient negative horizontal overlap to prevent cheek biting?
8	Is the compensating curve appropriate for the patient's maxillary and mandibular relationship?

Criteria

These sample eight criteria are specific and measurable and address the first removable prosthesis objective—achieving maximum function. The other two objectives—avoiding speech disruption and restoring natural appearance—are primarily dependent on the dimensions, contour, and thickness of the denture base. Again, each of these areas has measurable results compared to an established standard.

Training

Fortunately, qualification training packages (QTP) exist for many laboratory tasks. A QTP is an instructional package designed for use at the unit to qualify, or aid qualification in a duty position or program, on a piece of equipment, or on a performance item identified for competency verification within the career field education and training plan (CFETP). QTPs establish performance standards and standardize skills verification and validation of task competency. QTPs support performance-based training in the dental laboratory. Currently, we divide our QTPs into four volumes:

Current Dental Laboratory QTPs	
Volume	**Title**
1	General Dental Laboratory Experience
2	Fixed Prosthodontics
3	Treatment and Orthodontic Appliances, Complete and Removable Dental Prostheses
4	Dental Laboratory Administration

Each volume contains procedural guidelines and performance checklists (fabrication standards) based on commonly performed laboratory tasks. QTPs help you and your trainers establish fabrication standards within your laboratory; however, they may not meet all of your needs. There may be times when you'll need to establish written fabrication standards or establish interim criteria. Interim criteria are intermediate steps to completing the final product.

The QTP provides a training environment designed to maintain consistency for the trainee. The main point to remember is the trainer will need to use the QTP when the specialty training standard (STS) is a core task. The QTP provides guidance for the respective task. QTPs provide the foundation for the task certifier to conduct and evaluate the trainee.

Quality control program

This program is directly involved with the dental laboratory's quality assurance and risk management committee (headed by the squadron commander). The committee monitors all aspects of dental health care from dentist's credentials to the laboratories' quality control (QC) programs. Remember, QC starts with you—the technician.

Incoming cases

Inspect incoming cases prior to fabricating the prosthesis. Each laboratory has a QC program in place and the steps below serve as a guide:

- Disinfect each properly.

- Inspect impressions for accuracy/distortion.
- Inspect incoming casts for acceptability for what the dentist prescribed.
- Ensure bite registrations are accurate and provided if needed.
- Ensure accuracy of mounted casts (if case comes in mounted).
- Ensure Department of Defense (DD) Form 2322, Dental Laboratory Work Authorization (fig. 2–1), has been filled out correctly and completely.
- Log the case into the local case-tracking database.

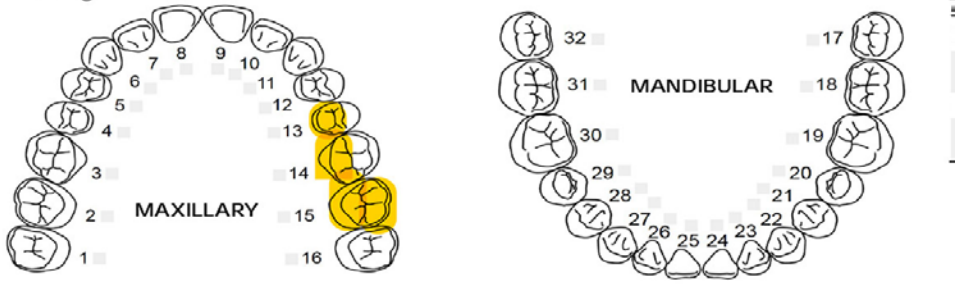
10-02	59 DSS/SGDL 2133 Pepperell St JBSA-Lackland TX 78236 DSN 554-7792	
1. Local Case No.	2. Name of Treatment Facility, Mailing Address & DSN	3. ADL Case No.

4. Patient's Name *(Last, First, Middle Initial)*	5. Grade	6. DOB (dd-mmm-yyyy)	7. Age	8. Date Initiated
Doe, John E.	E-8	06-Aug-1981	38	1-Oct-18

9. Beneficiary Type	10. Organization, Duty and Home Telephone Nos.	11. Date Forwarded
12 - Air Force	344 TRS, 421-0988, 621-008-1125	1-Oct-18

12. Type of Prosthesis or Restoration	13. Shade and Mold by Guide	14. Date Delivered
Metal ceramic FDP #13-15	A3	

15. Prosthesis Design



Request(s) *(Check appropriate box(es))* 16. ☐ Framework Only 17. ☐ Set-up

18. ☐ Process 19. ☒ Fully Fabricate 20. ☐ Bisque Bake 21. ☐ Consultation

22. ☒ Diagnostic Casts 23. ☐ Jaw Relation Record 24. ☐ Radiographs 25. ☐ Other *(See remarks)*

26. Dental Officer's Remarks/Instructions

Mount casts on articulator. Max/Man casts are included along with a centric relation bite. Please fabricate metal ceramic FDP #13-15 with Vita Shade A3. Full metal on #15, PD-4 on #13-14. Any question please contact me at DSN 554-2135.

27. Name and Grade of Dental Officer	29. Signature
ANGEL ALVAREZ, Lt Col	*Angel Alvarez*
28. Dental Officer's Email angel.alvarez.mil@mail.mil	

DD Form 2322, DEC 2017 Dental Laboratory Work Authorization

Figure 2–1. Sample, DD Form 2322 (front).

Completed cases

With the laboratory technician completing the case, the laboratory noncommissioned officer in charge (NCOIC) must verify the accuracy of the case. If the NCOIC identifies an issue, the NCOIC returns the case back to the laboratory technician who fabricated the prosthesis. The steps below serve as a guide for completed case QC:

- Ensure we met all the requirements on the DD Form 2322.
- Ensure quality of work meets or exceeds clinically accepted standards.
- Ensure the case was disinfected.
- Log the case out of local case tracking database.

Quality control documentation

Any effective QC plan will include a method to identify and track trends. We can only identify trends from a collection of historical data. In other words, your laboratory will need to maintain your QC forms (or the data from them) for a specific period. How long is up to the NCOIC, but remember, the QC forms also show an inspector your laboratory has an effective QC program.

Responsibility

The laboratory flight commander has the primary responsibility for laboratory QC. Their duties include checking the acceptability of incoming and outgoing cases and verify the laboratory meets QC standards. Laboratory flight commanders work closely with their laboratory flight chief/NCOIC to establish QC standards based on *minimum* clinical standards.

Your laboratory should have predetermined standards clearly communicated to all technicians as well as the providers using the laboratory's services. It is best to have these standards written. Include submission requirements such as adequate casts, adequate centric or orientation records, and properly completed DD Form 2322.

Documentation

Document QC checks on the DD Form 2322. Documenting QC checks can be anything from a BDL superintendent/NCOIC initials to an extensive chain of inspectors at an ADL. When satisfied with the quality of the appliance, the laboratory flight commander signs the back of DD Form 2322. You may also document QC on a locally developed QC form. For either form, the inserting dentist must review the form. The dentist can use this form to record information about the case. This information could include insertion time, number of adjustments, shade match, and fit. This feedback is returned to the responsible laboratory for final review.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

007. Artificial tooth inventory

1. Who is responsible for selecting the brands of artificial teeth?

2. At a minimum, how often should the custodian review the artificial teeth stock levels?

008. Fabrication standards

1. What are the key elements to developing laboratory prosthetic standards?

2. What is an objective?

3. Who is primarily responsible for laboratory QC?

2–2. Administration

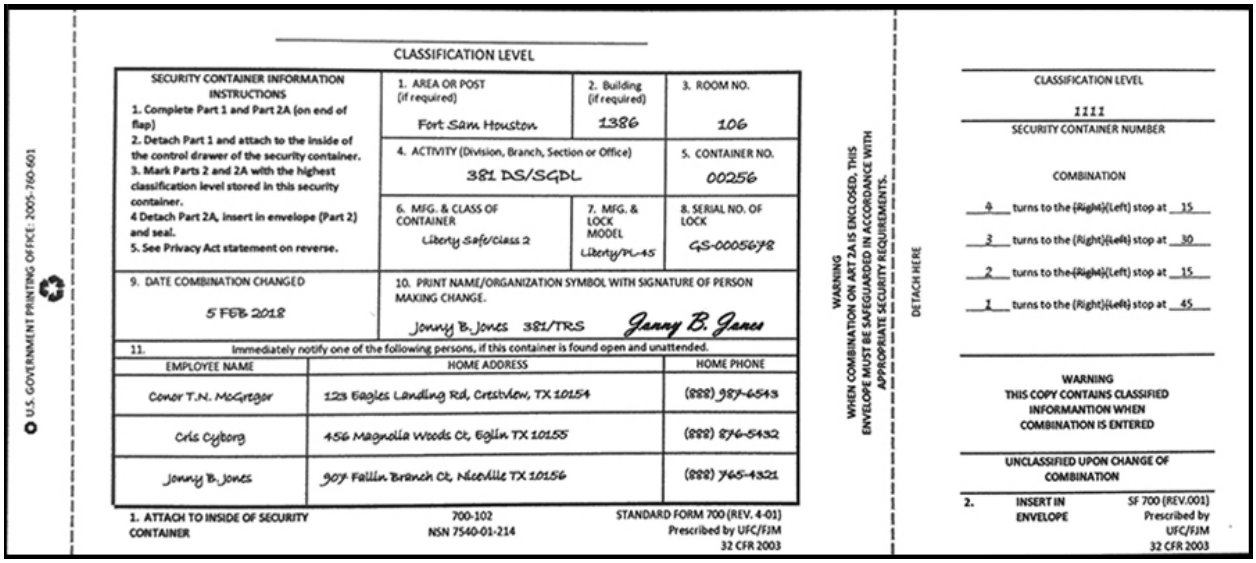
Dental laboratory administration is relatively simple compared to other career fields. Due to this simplicity, many technicians do not understand the importance of the administrative tasks they perform. From documenting simple math calculations to following proper shipping protocols, the administrative actions performed by the laboratory technician determines the accuracy of records, delivery case information and many other areas affecting the laboratory. This section starts by presenting you with information concerning dental precious metals and alloys then finishes with protocols for shipping and receiving case.

009. Precious metals and alloys

The precious metals incorporated into dental alloys are a pilferable item; consequently, we must closely monitor the purchase, use, and storage of all precious metals and alloys. In this lesson, you'll learn custodial responsibilities and associated documentation for handling precious metals in the laboratory.

Secure precious metals and alloys

Each medical facility is required to implement a protection program based on an assessment of its particular needs and resources, mission requirements, and local threats. If assigned responsibility for the register of precious metals and alloys, you must have a good understanding of the associated security requirements. The safekeeping of precious metals and alloys requires a burglar-resistant safe (kept in a lockable room) and proper monitoring procedures. Forms used to monitor the safekeeping of these items include the Standard Form (SF) 700, Security Container Information (fig. 2–2), SF 701, Activity Security Checklist (fig. 2–3), and SF 702, Security Container Check Sheet (fig. 2–4). Although designed to ensure the security of classified material, local procedures may dictate the use of SF 701 to document end-of-day security checks.



CLASSIFICATION LEVEL

SECURITY CONTAINER INFORMATION INSTRUCTIONS
1. Complete Part 1 and Part 2A (on end of flap)
2. Detach Part 1 and attach to the inside of the control drawer of the security container.
3. Mark Parts 2 and 2A with the highest classification level stored in this security container.
4 Detach Part 2A, insert in envelope (Part 2) and seal.
5. See Privacy Act statement on reverse.

1. AREA OR POST (if required)	2. Building (if required)	3. ROOM NO.
Fort Sam Houston	1386	106
4. ACTIVITY (Division, Branch, Section or Office)		5. CONTAINER NO.
381 DS/SGDL		00256
6. MFG. & CLASS OF CONTAINER	7. MFG. & LOCK MODEL	8. SERIAL NO. OF LOCK
Liberty Safe/Class 2	Liberty/PL-45	GS-0005678
9. DATE COMBINATION CHANGED	10. PRINT NAME/ORGANIZATION SYMBOL WITH SIGNATURE OF PERSON MAKING CHANGE.	
5 FEB 2018	Jonny B. Jones 381/TRS	Jonny B. Jones

11. Immediately notify one of the following persons, if this container is found open and unattended.

EMPLOYEE NAME	HOME ADDRESS	HOME PHONE
Conor T.N. McGregor	123 Eagles Landing Rd, Crestview, TX 10154	(888) 987-6543
Cris Cyborg	456 Magnolia Woods Ct, Eglin TX 10155	(888) 876-5432
Jonny B. Jones	909 Fallin Branch Ct, Niceville TX 10156	(888) 765-4321

1. ATTACH TO INSIDE OF SECURITY CONTAINER | 700-102 NSN 7540-01-214 | STANDARD FORM 700 (REV. 4-01) Prescribed by UFC/FJM 32 CFR 2003

U.S. GOVERNMENT PRINTING OFFICE: 2005-760-601

WARNING
WHEN COMBINATION ON ART 2A IS ENCLOSED, THIS ENVELOPE MUST BE SAFEGUARDED IN ACCORDANCE WITH APPROPRIATE SECURITY REQUIREMENTS.

DETACH HERE

CLASSIFICATION LEVEL
IIII
SECURITY CONTAINER NUMBER

COMBINATION
4 turns to the ~~(Right)~~(Left) stop at 15
3 turns to the (Right)~~(Left)~~ stop at 30
2 turns to the ~~(Right)~~(Left) stop at 15
1 turns to the (Right)~~(Left)~~ stop at 45

WARNING
THIS COPY CONTAINS CLASSIFIED INFORMANTION WHEN COMBINATION IS ENTERED

UNCLASSIFIED UPON CHANGE OF COMBINATION

2. INSERT IN ENVELOPE | SF 700 (REV.001) Prescribed by UFC/FJM 32 CFR 2003

Figure 2–2. Sample, SF 700.

ACTIVITY SECURITY CHECKLIST	DIVISION/BRANCH/OFFICE: 381 DS/SGDL	ROOM NUMBER: 106	MONTH AND YEAR: July 2018
Irregularities discovered will be promptly reported to the designated Security Office for corrective action.	**Statement** I have conducted a security inspection of this work area and checked all the items listed below.		
TO *(If required)*	FROM *(If required)*	THROUGH *(If required)*	

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1. Security containers have been locked and checked.		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓
2. Desks, wastebaskets and other surfaces and receptacles are free of classified material. N/A																															
3. Windows and doors have been locked (where appropriate).		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓
4. Typewriter ribbons and ADP devices (e.g.,disks, tapes) containing classified material have been removed and properly stored. N/A																															
5. Security alarm(s) and equipment have been activated (where appropriate). N/A																															
INITIAL FOR DAILY REPORT		KAC	KAC	KAC	KAC	KAC			KAC	KAC	KAC	KAC	KAC			KAC	KAC	KAC	KAC	KAC			KAC	KAC	KAC	KAC	KAC			KAC	KAC
TIME		1645	1630	1630	1645	1700			1700	1645	1630	1645	1700			1630	1700	1645	1645	1630			1630	1700	1700	1630	1645			1645	1630

701-101
NSN 7540-01-213-7899

STANDARD FORM 701 (8-85)
Prescribed by UFC/FJM
32 CFR 2003

Figure 2–3. Sample, SF 701.

SECURITY CONTAINER CHECK SHEET

TO (if required) | THRU (if required)

CERTIFICATION

I CERTIFY, BY MY INITIALS BELOW, THAT I HAVE OPENED, CLOSED OR CHECKED THIS SECURITY CONTAINER IN ACCORDANCE WITH PERTINENT AGENCY REGULATIONS AND OPERATING INSTRUCTIONS.

MONTH/YEAR: NOV 2012

DATE	OPENED BY		CLOSED BY		CHECKED BY		GUARD CHECK (if required)	
	INITIALS	TIME	INITIALS	TIME	INITIALS	TIME	INITIALS	TIME
1	JY	0615	JY	1530	JDD	1535		
2	JY	0630	JY	1545	JDD	1550		
5	JY	0615	JY	1530	JDD	1535		
6	JY	0630	JY	1545	JDD	1550		
7	JY	0625	JY	1535	JDD	1536		
8	JY	0630	JY	1545	JDD	1550		
9	JY	0615	JY	1530	JDD	1535		
12	JY	0615	JY	1530	JDD	1535		
13	JY	0630	JY	1545	JDD	1550		
14	JY	0625	JY	1535	JDD	1536		
15	JY	0615	JY	1530	JDD	1535		
16	JY	0630	JY	1545	JDD	1550		
19	JY	0615	JY	1530	JDD	1535		
20	JY	0625	JY	1535	JDD	1536		
21	JY	0630	JY	1545	JDD	1550		
22	JY	0625	JY	1535	JDD	1536		
23	JY	0615	JY	1530	JDD	1535		
26	JY	0630	JY	1545	JDD	1550		
27	JY	0615	JY	1530	JDD	1535		
28	JY	0615	JY	1530	JDD	1535		
29	JY	0630	JY	1545	JDD	1550		
30	JY	0625	JY	1535	JDD	1536		

SECURITY CONTAINER CHECK SHEET

FROM | ROOM NO. 106 | BUILDING 1386 | CONTAINER NO. 00256

CERTIFICATION

I CERTIFY, BY MY INITIALS BELOW, THAT I HAVE OPENED, CLOSED OR CHECKED THIS SECURITY CONTAINER IN ACCORDANCE WITH PERTINENT AGENCY REGULATIONS AND OPERATING INSTRUCTIONS.

MONTH/YEAR: DEC 2012

DATE	OPENED BY		CLOSED BY		CHECKED BY		GUARD CHECK (if required)	
	INITIALS	TIME	INITIALS	TIME	INITIALS	TIME	INITIALS	TIME
3	JY	0630	JY	1545	JDD	1550		
4	JY	0625	JY	1535	JDD	1536		
5	JY	0615	JY	1530	JDD	1535		
6	JY	0630	JY	1545	JDD	1550		
7	JY	0615	JY	1530	JDD	1535		
10	JY	0625	JY	1535	JDD	1536		
11	JY	0615	JY	1530	JDD	1535		
12	JY	0615	JY	1530	JDD	1535		
13	JY	0625	JY	1535	JDD	1536		

STANDARD FORM 702 (11-2010)
Prescribed by UFC/FJM
32 CFR PART 2001 EO 13526

Figure 2–4. Sample, SF 702.

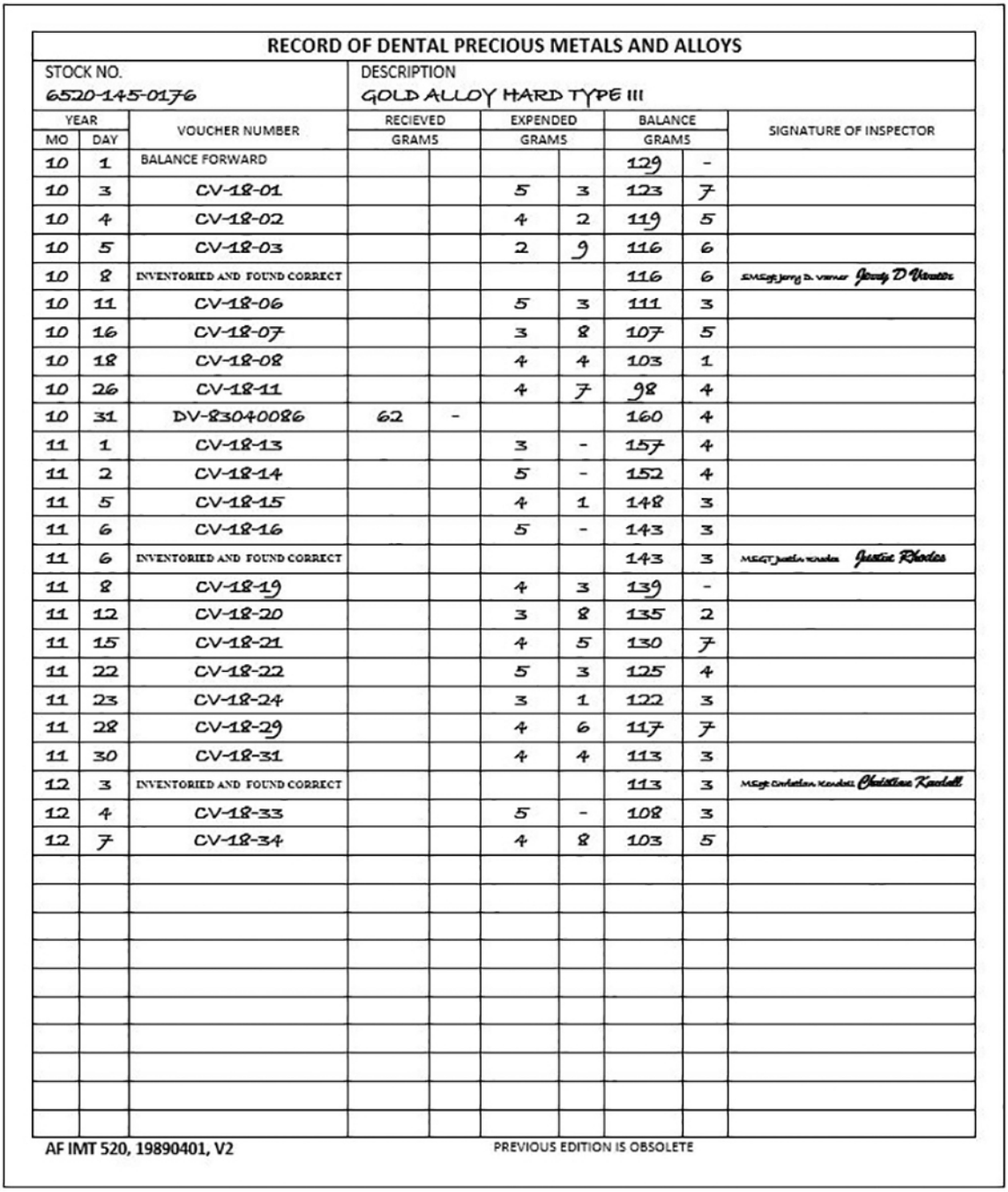
Manage the dental register of precious metals and alloys

The squadron commander is responsible for safekeeping, maintaining records, and authorizing expenditures of dental precious metals and alloys. This task may be delegated (in writing) to primary and alternate custodians. The custodian may be any officer, enlisted member, or civilian trained to manage the register of precious metals and alloys. The custodian's major duty is to keep accurate, up-to-date records of precious metal receipts and expenditures. The person receiving the metal must sign all receipts in ink. The custodian receiving the precious metals from a supply representative signs a form acknowledging responsibility for the metal. Keep a copy of the form in the register. Record the precious metals expended on a case and have the dentist and the laboratory flight commander sign the DD Form 2322.

Documents

Keep all documents noting the receipt, issue, expenditure, balance, and verification of dental precious metals and alloys in a file designated as the register of precious metals and alloys. All dental laboratories using precious metals and alloys must have this register. Maintain the following forms in the register:

Register of Precious Metals and Alloys Documents	
Documents	**Descriptions**
Air Force (AF) Information Management Tool (IMT) 520	AF IMT 520, Record of Dental Precious Metals and Alloys, records all receipts and expenditures of precious metals and alloys (fig. 2–5). A separate AF IMT 520 is kept for each type of precious metal or alloy used (except amalgam); dust and grindings; and scrap precious metals and alloys. Each entry on AF IMT 520 must be supported by a debit voucher (DV) or credit voucher (CV).
DD Form 2322	DD Form 2322, Dental Laboratory Work Authorization, serves as a DV or CV for several types of transactions. Use the back of the form for the entries (fig. 2–6). As a DV, DD Form 2322 documents the amount of unusable scrap and grindings recovered in the laboratory and entered on AF IMT 520. As a CV, it shows expenditures of precious metals and alloys for dental cases. You may use the DD Form 2322 as a CV when submitting scrap or grindings to medical supply. You may also use a DD Form 1348–6, Single Line Item Requisition System Document (Manual - Long Form), for turn-in. Consult with medical supply personnel for their preference. Remember: *Always get a receipt each time precious metals and alloys change hands.*
DD Form 1348–6	When receiving precious metal from medical supply, a DD Form 1348–6 (or hard copy computer printout issue list), serves as a CV or DV. Enter the quantity of precious metals and alloys obtained from Medical Supply on an AF IMT 520 with the hard copy printout or DD Form 1348–6 as the DV. We use the DD Form 1348–6 as a CV when we turn-in excess or salvaged precious metals and alloys to medical supply.
DD Form 200	DD Form 200, Financial Liability Investigation of Property Loss, records the financial liability investigation for shortages of precious metals and alloys. If repayment is necessary, the custodian is usually the one to make it. Have a more experienced technician double check your entries in the register. Entering the wrong digit, for example, can cause a 10-gram (gm) discrepancy in the recorded balance. Inspectors may have to initiate a DD Form 200 if they find errors not corrected.



RECORD OF DENTAL PRECIOUS METALS AND ALLOYS

STOCK NO. 6520-145-0176

DESCRIPTION: GOLD ALLOY HARD TYPE III

YEAR MO	YEAR DAY	VOUCHER NUMBER	RECIEVED GRAMS		EXPENDED GRAMS		BALANCE GRAMS		SIGNATURE OF INSPECTOR
10	1	BALANCE FORWARD					129	-	
10	3	CV-18-01			5	3	123	7	
10	4	CV-18-02			4	2	119	5	
10	5	CV-18-03			2	9	116	6	
10	8	INVENTORIED AND FOUND CORRECT					116	6	SMSgt Jerry D. Vranter Jerry D Vranter
10	11	CV-18-06			5	3	111	3	
10	16	CV-18-07			3	8	107	5	
10	18	CV-18-08			4	4	103	1	
10	26	CV-18-11			4	7	98	4	
10	31	DV-83040086	62	-			160	4	
11	1	CV-18-13			3	-	157	4	
11	2	CV-18-14			5	-	152	4	
11	5	CV-18-15			4	1	148	3	
11	6	CV-18-16			5	-	143	3	
11	6	INVENTORIED AND FOUND CORRECT					143	3	MSGT Justin Rhodes Justin Rhodes
11	8	CV-18-19			4	3	139	-	
11	12	CV-18-20			3	8	135	2	
11	15	CV-18-21			4	5	130	7	
11	22	CV-18-22			5	3	125	4	
11	23	CV-18-24			3	1	122	3	
11	28	CV-18-29			4	6	117	7	
11	30	CV-18-31			4	4	113	3	
12	3	INVENTORIED AND FOUND CORRECT					113	3	MSgt Christian Kendall Christian Kendall
12	4	CV-18-33			5	-	108	3	
12	7	CV-18-34			4	8	103	5	

AF IMT 520, 19890401, V2

PREVIOUS EDITION IS OBSOLETE

Figure 2–5. Sample, AF IMT 520.

LABORATORY DATA

1. Name of Dental Laboratory: JBSA Lackland

2. Date Received	3. Date Completed	4. Teeth Facings or Pontics				
		Location	Tooth Nos.	Shade	Guide	Mold
8-Nov-18	14-Nov-18	Max Ant				
		Max Post				
		Man Ant				
		Man Post				

5. Articulator Number:

Settings:

6. Metals Voucher No: CV18-19

Metals Used	Out		In		Used	
Type	~~DWT~~ grams	~~GR~~	~~DWT~~ grams	~~GR~~	~~DWT~~ grams	~~GR~~
0176	12	3	8	0	4	3
1733	23	5	10	3	13	2

7. CAD/CAM Materials:

8. Implant Components:

Lot Number:

9. Laboratory Remarks, Instructions, or Consultation Report

0176
12.3
- 8.0
used 4.3

1733
23.5
-10.3
used 13.2

10. Typed Name and Grade of Laboratory Officer: CHARLES DEFREEST, Col

11. Laboratory Officer's Email: charles.defreest.mil@mail.mil

12. Signature: Charles DeFreest

DD Form 2322 Reverse, DEC 2017

Figure 2–6. Sample, DD Form 2322 (reverse).

Voucher number

Assign DV or CV numbers to all documents entering items into (debit) or removing items from (credit) the register. The custodian may keep both vouchers in the same section of the file or separate if there is a large quantity of vouchers.

Credit vouchers

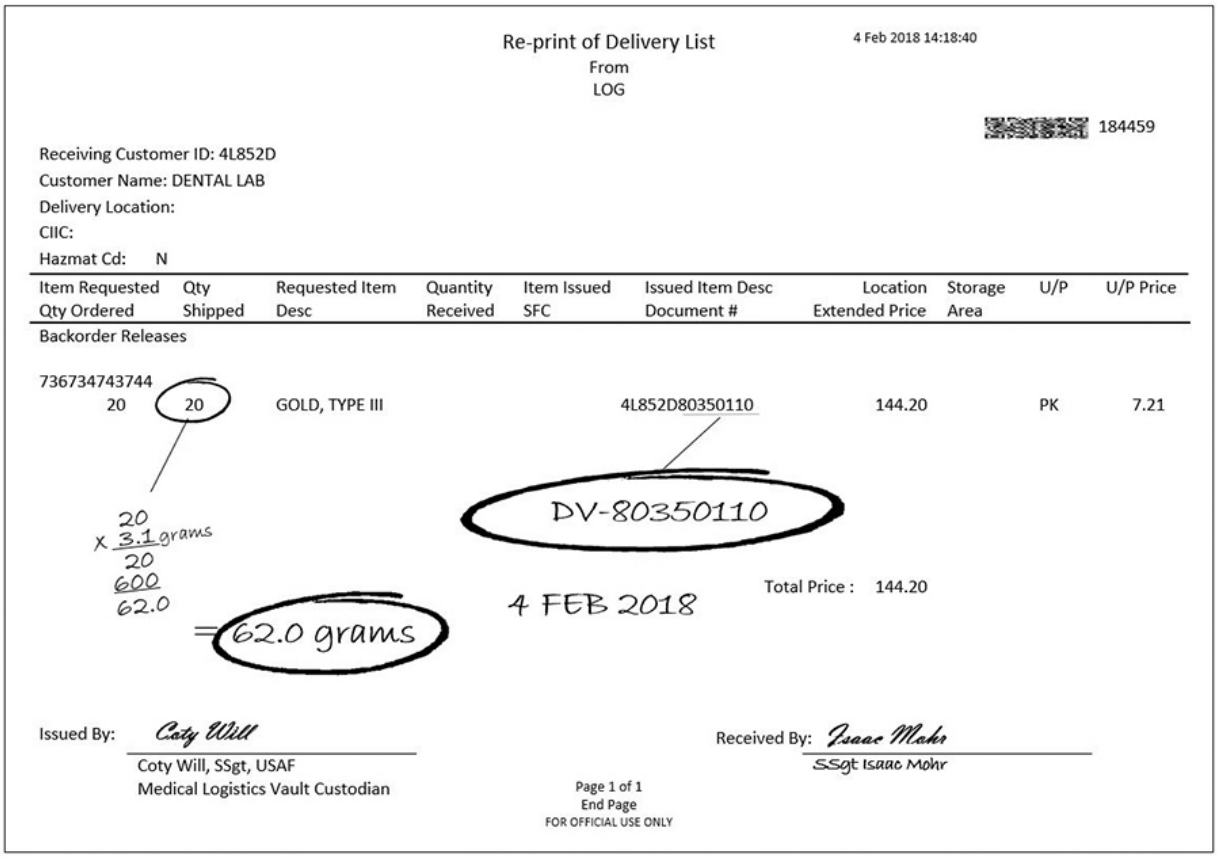
CV numbers will always begin with the abbreviated letters "CV." In figure 2–6 (block VI), look at the entry for CV18–19, we already know this is CV but what do those other numbers mean? The number "18" is the last two digits of the fiscal year (FY) when creating the voucher. The last digit of the sequence, "19", is the order number when creating the voucher. CV numbers are assigned consecutively by FY to each DD Form 2322 showing local expenditures of precious metals and alloys (e.g., CV18–1, 18–2, 18–3, etc.).

NOTE: The FY begins on 1 October and is designated by the calendar year in which it ends; for example, FY 2018 begins on October 1, 2017 and ends on September 30, 2018.

Debit vouchers

DV numbers will also begin with its abbreviated letters, "DV." When a DD Form 2322 is used as a DV, it will too be numbered consecutively by FY (e.g., DV18–1, 18–2, 18–3, etc.). You may have DVs with the same numerical digits as CVs (e.g., CV18–2, DV18–2), but they are tracked separately.

The numbering of DVs is different when receiving precious metals from medical logistics. The voucher number will be the date and document number assigned by medical logistics. You may see an example of these computer-generated numbers on the Delivery List (fig. 2–7).



Re-print of Delivery List
From
LOG

4 Feb 2018 14:18:40

184459

Receiving Customer ID: 4L852D
Customer Name: DENTAL LAB
Delivery Location:
CIIC:
Hazmat Cd: N

Item Requested Qty Ordered	Qty Shipped	Requested Item Desc	Quantity Received	Item Issued SFC	Issued Item Desc Document #	Location Extended Price	Storage Area	U/P	U/P Price
Backorder Releases									
736734743744									
20	20	GOLD, TYPE III			4L852D80350110	144.20		PK	7.21

20
X 3.1 grams
20
600
62.0
= 62.0 grams

DV-80350110

4 FEB 2018

Total Price : 144.20

Issued By: Coty Will
Coty Will, SSgt, USAF
Medical Logistics Vault Custodian

Received By: Isaac Mohr
SSgt Isaac Mohr

Page 1 of 1
End Page
FOR OFFICIAL USE ONLY

Figure 2–7. Sample, Delivery List.

Maintenance

Keep the register in a file folder with all vouchers attached to one inside cover, and AF IMTs 520 for each type of precious metals and alloys attached to the other inside cover. Registers close out at the end of each FY (30 September) and new registers are established on 1 October of each succeeding FY. Obtain an inventory by a disinterested party when closing out the old register and dispose of its contents according to Air Force Instruction (AFI) 33–364, *Records Disposition – Procedures and Responsibilities.*

Audit the register monthly. The commander may direct audits more frequently when necessary. A disinterested officer or senior noncommissioned officer (SNCO) performs all audits. A disinterested person is someone who is not a member of the dental clinic. The inspector compares the recorded balances on the AF IMTs 520 with the actual balances, and checks the entries on AF IMTs 520 with the issue/turn-in documents. The inspector certifies correct entries on the respective AF IMT 520. The inspector forwards any administrative discrepancies, either overages or shortages, to the local commander. If shortages exist, the unit must conduct a *report of survey*, and the survey officer must initiate a DD Form 200 to recover the loss.

Consistency

Inspectors look for consistency—does the issue document number match the debit number as well as the amount received from supply? As you look at all the changes in the entries carefully, if you change an entry, line through the entry without obliterating it. Make the correction, date, and initial it. Make sure all entries are legible and in ink.

Briefing

Often, the inspector is unfamiliar with troy weight or the metric system. To ensure a successful audit, tactfully ask if the inspector is familiar with performing a dental laboratory audit. If not, offer to give a quick briefing on audit procedures.

AF IMT 520 entries

Record each transaction on the appropriate AF IMT 520 as it occurs. Remember, precious metals or alloys expended must include a CV and those received must include a DV. These entries ensure a clear trail of items received, used for fabrication and documents those items turned in to medical logistics. Figure 2–5 shows some examples of recorded entries.

Metric versus troy weight

To simplify the register, manage precious metals and alloys using the metric system rather than troy weight. Since manufacturers still use troy weight, you need to know both systems of measurement. For troy weight, remember 24 grains (gr) = 1 pennyweight (dwt), and 20 dwt = 1 ounce (oz). Most alloys are issued in 2 dwt ingots; there are 10 ingots to a package. Conversions of troy to metric are one troy oz = 31.1 gms, one dwt = 1.5 gms, and two dwt = 3.1 gms. These three conversions should be enough for most situations. On some occasions, you may have to convert odd amounts of precious metals from one system to another. The simplest and most accurate conversion method is to weigh the alloy with the weights of the system to you are converting.

Calculating balances

Most of the math performed for the register involves calculating balances. Figure 2–5 shows 4.3 gms issued against CV18–19 on November 8th. The amount was subtracted from the register resulting in a new balance of 139.0 gms. See the calculation formula below.

Current balance:	143.3
Minus credit amount:	– 4.3
New balance:	139.0 gms

Entry on AF IMT 520

Record all weights to the nearest tenth and document on the appropriate AF IMT 520.

Recover precious metals and alloys

Each dental facility should have a dental operating instruction (DOI) stating how the precious grindings and scrap are managed as well as how serviceable scrap is handled. Unusable precious metals should be turned in to medical logistics on a periodic basis or when a certain amount is collected.

Unusable scrap and grindings

The dental facility must account for and safeguard the byproduct of gold processing procedures. The DOI should clearly state the procedures for completing this task. After collection, all scrap, slag (the residue remaining in the crucible after casting, also known as flash), and dust must be secured in the safe. Weigh and record the material on the appropriate AF IMT 520. Scrap includes various foils as well as large pieces of precious metal left from the finishing process.

Finishing and polishing produce dust. To collect the dust, the Department of Defense (DOD) provides a small portable vacuum cleaner. Vacuum the work area, your clothing, and even your shoes after completing an appliance containing precious alloys. Along with the dust, the vacuum attachments pick up large objects perforating the collection bag. You can avoid this by affixing a piece of window screen at the end of the attachment. This screen allows the dust to flow into the vacuum cleaner while excluding broken discs and other finishing items. When the collection bag is full, weigh the bag. You will have to subtract the weight of an empty bag to get the correct weight of the bag contents. Document the remaining weight on the turn-in document and turn it in to medical supply.

Serviceable material

Serviceable implies we can reuse the material. Most materials falling in this category are new castings returned by the dentist due to poor fit. Use another DD Form 2322 for the patient as a DV, and enter the reason for the return in the “Remarks” section. Enter this usable scrap on the original AF IMT 520 as a debit. The dentist begins the case over again with a new set of DD Forms 2322. This process ensures the correct register and procedure accounting records are correct.

Patient’s restorations

The dentist must offer the patient all of the precious metal restorations removed from their mouth. If the patient refuses to accept the previous restoration prosthesis, complete precious metals disposition turn-in procedures and record the results in the patient’s dental record. This rule does not apply to temporarily cemented precious alloy restorations. The patient should be aware of this before inserting the temporary. If the patient refuses the restoration, the dentist must complete a DD Form 2322 and the restoration will be entered into the register with a debit number. The dental facility may consider restorations as serviceable if there is a need for items like cast posts and cores.

Precious metals recovery

Collect and turn in all unusable precious metal scraps to medical logistics. Safeguard the material until turn-in, and follow any local procedures. Handle precious metal dust and grindings separately from scrap. The *Dental Management Guide* directs the accumulation, safeguarding, and turn-in of precious metal-bearing scrap. Contact medical supply or the base precious metal recovery officer for help with any problem you cannot resolve through your unit’s precious material recovery representative.

010. Shipping and receiving cases

By now, you understand how much work goes into the production of a quality set of casts and how these models are the foundation for a quality prosthesis. The time and effort put into packaging a case is also an investment in the quality of the final prosthesis. Ensure you pack all cases sent to ADLs or other base laboratories properly. We lose time, effort, and money if we damage or misroute cases due to inadequate packing or shipping procedures.

Preparing for packing

Most dental laboratories have a designated shipping and receiving area. Be sure you have adequate space to work while packing and wrapping. QC plays a role in virtually every aspect of your job. As you prepare to pack a case for shipping, remember what goes in this box says a lot about the standards of your laboratory. Use this opportunity to double-check the quality of the materials and to verify all items are present. Ensure all items have been disinfected and allowed to dry.

The completed DD Form 2322

Once the case arrives at the ADL, the DD Form 2322 becomes the sole source of information for the prosthodontist and laboratory technicians. It must be complete and thoroughly describe the contents and fabrication requirements of the prosthesis. Complete blocks 1 and 2. This information is critical in the event the servicing laboratory needs to contact the base laboratory. Block 25, Clinician's Remarks/Instructions, should contain detailed instructions from the prescribing dentist. Ensure the dentist signs the form in block 27.

Inventory and identification

Make sure you have the correct number of DD Forms 2322 to be sent with the case at this time.

Number of DD Form 2322 Copies to Send the ADL	
Cases *not* requiring precious metals	3 (original and 2 copies)
Cases requiring precious metals	4 (original and 3 copies)
Always keep a copy for the base lab	

The DD Form 2322 should list all items to be included in the shipment. Use this to make sure nothing is missing. Verify each cast contains the patient's name on the heel using waterproof ink.

The base laboratory case number must be identified on items accompanying the case (i.e., stone straps, impressions, bite registrations, and bottles containing crown and bridge dies). The ADL shipping and receiving clerk will very much appreciate your efforts, and it ensures the items are available during the fabrication process.

Packing the shipping box

Use shipping boxes designed for mailing dental cases to protect the fragile casts and dies. These boxes include custom foam inserts and do a terrific job when used correctly. Before inserting items into the foam compartments, place the casts and additional items in plastic bags (i.e., headrest covers). This helps to keep the foam inserts clean. Position the casts in the foam inserts with bases facing the center, heels down, and teeth facing the end of the box. Pack individual dies in small containers (pill bottles) and adequately cushion the dies with cotton or gauze. Pack no more than one cast, impression, or pill bottle per slot in the shipping box.

Use additional shipping boxes for extra items such as diagnostic casts, stone straps, or jaw relation records. Place the DD Form 2322 (without the carbons) on the inside of the lid.

Wrapping

When shipping through official government agencies, wrap the box with brown Kraft paper and tape securely with shipping tape. Complete the address labels and affix them to the wrapped box. Do not apply tape or address labels directly to an unwrapped shipping box.

Multiple box shipments

It's common to need more than one box per case. Resist the temptation to crowd too many items in one box (this most often results in broken teeth). Follow these guidelines when shipping a case in more than one box.

- Include a DD Form 2322 in each box.
- Indicate the box number on the top of DD Form 2322 (e.g., 1 of 2, 2 of 2, etc.).

- Wrap multiple boxes together as a single package.

Receiving cases

Unwrap and unpack newly received cases carefully. Check to ensure the prosthesis matches the DD Form 2322 and all items are present. As you remove items from the box, ensure it contains a completed (and sometimes delicate) prosthesis. Disinfect the entire contents according to local protocol.

Documentation

Track all shipping and receiving cases using a shipping and receiving log. Local procedures will dictate its exact contents, but most contain information such as patient's name, dentist's name, type of prosthesis, date of shipment, and date of receipt. Document this information for each case passing through the shipping and receiving area.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

009. Precious metals and alloys

1. What is the major duty of a precious metals custodian?

2. On what form do you record all receipts and expenditures of precious metals and alloys?

3. If we must offer the patient all the precious metal restorations that were removed from their mouth, where must we document the patient's refusal in accepting the previous restoration prosthesis?

4. Where do you turn in unusable precious metals?

010. Shipping and receiving cases

1. How do we identify each cast prior to shipping?

2. What items are frequently sent with a case and identified with the base laboratory case number?

3. How do you position casts in the shipping box?

4. Where do you place the DD Form 2322 in the shipping box?

Answers to Self-Test Questions

007

1. Squadron commander.
2. At least semiannually.

008

1. Sanitation, function, form, and esthetics.
2. An outcome or result—something measurable.
3. Laboratory flight commander.

009

1. Keep accurate and up-to-date records of precious metal receipts and expenditures.
2. AF IMT 520.
3. In the patient's dental record.
4. Medical logistics

010

1. Place the patient's name on the heel of the cast in waterproof ink.
2. Stone straps, impressions, bite registrations, and small bottles containing dies.
3. Bases of casts face the center with heels down and teeth facing the end of the box.
4. On the inside of the lid.

Complete the unit review exercises.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter.

19. (007) Who is responsible for selecting the artificial teeth available at a dental facility?
    a. Superintendent.
    b. Flight commander.
    c. Property custodian.
    d. Squadron commander.

20. (007) What determines the stock level of artificial teeth?
    a. Base population.
    b. Usage and ordering frequency.
    c. Dental laboratory annual budget.
    d. Amount of dental laboratory technicians.

21. (008) What *best* describes the purpose of a qualification training package (QTP)?
    a. Evaluate the trainers.
    b. Establish safety standards.
    c. Document career field progression.
    d. Standardize skills verification and validation of task competencies.

22. (008) At what level does quality control (QC) begin?
    a. Noncommissioned officer in charge (NCOIC).
    b. Technician.
    c. Flight commander.
    d. Squadron commander.

23. (008) The *primary* responsibility for laboratory quality control (QC) rests with the
    a. trainer.
    b. flight commander.
    c. section supervisor.
    d. squadron commander.

24. (008) Which one is *not* information the dentist would record on a locally developed quality control (QC) form?
    a. Shade match.
    b. Location of caries.
    c. Number of adjustments.
    d. Appliance insertion time.

25. (009) Who is responsible for safekeeping, maintaining records, and authorizing expenditures of dental precious metals and alloys?
    a. Laboratory noncommissioned officer in charge (NCOIC).
    b. Squadron superintendent.
    c. Laboratory officer.
    d. Squadron commander.

26. (009) What form is used to record precious metal expenditures and must be signed by the dentist and laboratory flight commander?
    a. Air Force (AF) Form 520.
    b. Department of Defense (DD) Form 200.
    c. DD Form 1348–6.
    d. DD Form 2322.

27. (009) What form do you use to record the financial liability investigation for shortages of precious metals and alloys?
    a. Air Force (AF) Form 520.
    b. Department of Defense (DD) Form 200.
    c. DD Form 1348–6.
    d. DD Form 2322.

28. (009) Who initiates the financial liability investigation for shortages of precious metals and alloys?
    a. Inspector.
    b. Flight chief.
    c. Commander.
    d. Precious metals custodian.

29. (009) How are credit voucher (CV) numbers assigned?
    a. Consecutively by fiscal year (FY).
    b. Consecutively by calendar year.
    c. They match laboratory case number.
    d. They start with "CV" followed by patient's identification number.

30. (009) The dental register of precious metals and alloys closes out every year on
    a. 1 January.
    b. 1 July.
    c. 30 September.
    d. 31 December.

31. (009) How often is the register of precious metals audited?
    a. Weekly.
    b. Monthly.
    c. Quarterly.
    d. Semiannually.

32. (009) Who conducts the precious metals and alloy audits?
    a. Dental commander.
    b. Any medical logistics noncommissioned officer (NCO).
    c. The dental laboratory noncommissioned officer in charge (NCOIC).
    d. A disinterested officer or senior noncommissioned officer (SNCO).

33. (010) Which section of the Department of Defense (DD) Form 2322 includes detailed instructions from the prescribing dentist?
    a. Requests.
    b. Prosthesis design.
    c. Laboratory remarks.
    d. Clinician's remarks.

34. (010) How do you position the casts in the shipping box?
    a. Bases of casts facing the center with heels up and teeth facing the end of the box.
    b. Teeth facing the center with heels up and bases of casts facing the end of the box.
    c. Bases of casts facing the center with heels down and teeth facing the end of the box.
    d. Teeth facing the center with heels down and bases of casts facing the end of the box.

35. (010) In the shipping box, the Department of Defense (DD) Form 2322 is placed against the
    a. top of the inside of the lid.
    b. top of the outside of the lid.
    c. side, inside the foam insert.
    d. side, outside the foam insert.

Glossary of Terms, Abbreviations, and Acronyms

Terms

berylliosis—Respiratory disease caused by inhaling beryllium.

carcinogenic—Cancer-causing substance.

conjunctiva—Mucous membrane lining the eyelids and eye.

conjunctivitis—Irritation of the eye.

cyanoacrylate—Fast acting adhesive.

dermatitis—Skin inflammation.

disinfect—To destroy pathogenic microorganisms.

embolism—Blockage of a vessel.

fomite—An object able to harbor pathogenic organisms.

handpiece—A rotary dental instrument.

invasive—Tending to enter the body and/or spread throughout the tissues.

maxillary—Upper jaw.

methyl methacrylate—Acrylic resin used in denture fabrication; also referred to as monomer.

musculoskeletal—System composed of the bones, muscles, and connective tissue.

pathogen—A disease-producing microorganism.

pharynx—Pathway for food and air, common to the nose, mouth, and esophagus.

pneumoconiosis—Respiratory condition caused by inhaling dust particles.

prosthesis—Artificial replacement for a part of the body.

prosthodontics—Science of replacing natural teeth and related tissue with oral prostheses.

prosthodontist—Dentist specializing in prosthodontics.

sensitizer—A substance creating an allergic reaction to itself in an individual.

siderosis—Pneumoconiosis caused by inhaling iron particles.

silicosis—Respiratory disease caused by inhaling silica particles.

Staphylococcus—A pathogenic bacteria.

Abbreviations and Acronyms

°F	degree Fahrenheit
µm	micron
ADL	area dental laboratory
AF	Air Force
AFI	Air Force instruction
AFMAN	Air Force manual
AFOSH	Air Force Occupational Safety and Health
AFOSH STD	Air Force Occupational Safety and Health standard
AIDS	acquired immunodeficiency syndrome
BDL	base dental laboratory
BEE	bioenvironmental engineer
BPA	blanket purchase agreement
CDC	Centers for Disease Control and Prevention
CFETP	career field education and training plan
CO_2	carbon dioxide
CONUS	continental United States
CV	credit voucher
dB	decibel
DD	Department of Defense
DOD	Department of Defense
DOI	dental operating instruction
DV	debit voucher
dwt	pennyweight
EPA	Environmental Protection Agency
FY	fiscal year
gm	gram
gr	grain
HIV	human immunodeficiency virus
HTLV	human T-lymphocyte virus
HVES	high-velocity evacuation system

IMT	information management tool
IV	intravenous
MFF	metal fume fever
mm	millimeter
MMA	methyl methacrylate
MPH	military public health
MTF	medical treatment facility
NCOIC	noncommissioned officer in charge
O_2	oxygen
OB	obstetric
OSHA	Occupational Safety and Health Administration
oz	ounce
PPE	personal protective equipment
psi	pounds per square inch
QC	quality control
QTP	qualification training package
SDS	safety data sheet
SF	standard form
SNCO	senior noncommissioned officer
STS	specialty training standard
TB	tuberculosis

Student Notes

Student Notes

AFSC 4Y052
4Y052 01 1908
Edit Code 06