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# Medical, Dental, and Ophthalmic Laboratory Technicians

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(O\*NET 51-9081.00, 51-9082.00, 51-9083.00)

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## Significant Points

- Around 55 percent of salaried jobs were in medical equipment and supply manufacturing laboratories, which usually are small, privately owned businesses with fewer than 5 employees.
- Most technicians learn their craft on the job, but many employers prefer to hire those with formal training.
- Slower-than-average employment growth is expected for dental and ophthalmic laboratory technicians, while average employment growth is expected for medical appliance technicians.
- Job opportunities should be favorable because few people seek these positions.

## Nature of the Work

When patients require a medical device to help them see clearly, chew and speak well, or walk, their health care providers send requests to medical, dental, and ophthalmic laboratory technicians. These technicians produce a variety of implements to help patients.

*Medical appliance technicians* construct, fit, maintain, and repair braces, artificial limbs, joints, arch supports, and other surgical and medical appliances. They follow prescriptions or detailed instructions from podiatrists or orthotists, who request braces, supports, corrective shoes, or other devices; prosthetists, who order prostheses—replacement limbs, such as an arm, leg, hand, or foot—for patients who need them due to a birth defect, accident, or amputation; or other health care professionals. Medical appliance technicians who work with these types of devices are called orthotic and prosthetic technicians. Other medical appliance technicians work with appliances that help correct other medical problems, such as hearing aids.

Creating medical devices takes several steps. To make arch supports, for example, technicians first make a wax or plastic impression of the patient's foot. Then they bend and form a material so that it conforms to prescribed contours required to fabricate structural components. If a support is mainly required to correct the balance of a patient with legs of different lengths, a rigid material is used. If the support is primarily intended to protect those with arthritic or diabetic feet, a soft material is used. Supports and braces are polished with grinding and buffing wheels. Technicians may cover arch supports with felt to make them more comfortable.

For prostheses, technicians construct or receive a plaster cast of the patient's limb to use as a pattern. Then, they lay out parts and use precision measuring instruments to measure them. Technicians may use wood, plastic, metal, or other material for the parts of the artificial limb. Next, they carve, cut, or grind the material using hand or power tools. Then, they drill holes for rivets and glue, rivet, or weld the parts together. They are able to do very precise work using common tools. Next, technicians use grinding and buffing wheels to smooth and polish artificial

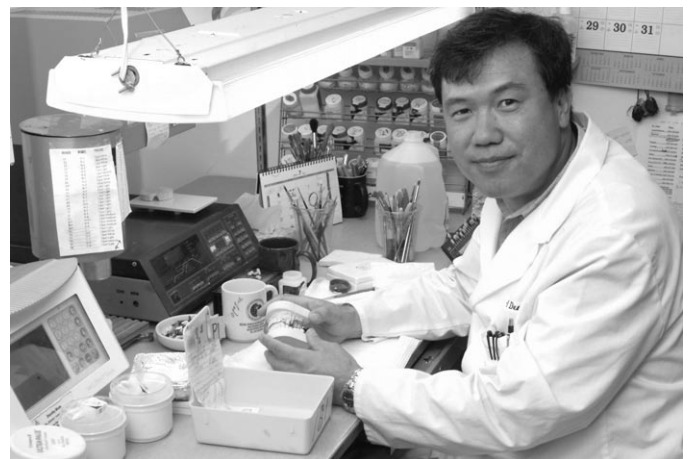
limbs. Lastly, they may cover or pad the limbs with rubber, leather, felt, plastic, or another material. Also, technicians may mix pigments according to formulas to match the patient's skin color and apply the mixture to the artificial limb.

After fabrication, medical appliance technicians test devices for proper alignment, movement, and biomechanical stability using meters and alignment fixtures. They also may fit the appliance on the patient and adjust them as necessary. Over time the appliance will wear down, so technicians must repair and maintain the device. They also may service and repair the machinery used for the fabrication of orthotic and prosthetic devices.

*Dental laboratory technicians* fill prescriptions from dentists for crowns, bridges, dentures, and other dental prosthetics. First, dentists send a specification of the item to be manufactured, along with an impression or mold of the patient's mouth or teeth. With new technology, a technician may receive a digital impression rather than a physical mold. Then dental laboratory technicians, also called dental technicians, create a model of the patient's mouth by pouring plaster into the impression and allowing it to set. They place the model on an apparatus that mimics the bite and movement of the patient's jaw. The model serves as the basis of the prosthetic device. Technicians examine the model, noting the size and shape of the adjacent teeth, as well as gaps within the gumline. Based upon these observations and the dentist's specifications, technicians build and shape a wax tooth or teeth model, using small hand instruments called wax spatulas and wax carvers. The wax model is used to cast the metal framework for the prosthetic device.

After the wax tooth has been formed, dental technicians pour the cast and form the metal and, using small hand-held tools, prepare the surface to allow the metal and porcelain to bond. They then apply porcelain in layers, to arrive at the precise shape and color of a tooth. Technicians place the tooth in a porcelain furnace to bake the porcelain onto the metal framework, and then adjust the shape and color, with subsequent grinding and addition of porcelain to achieve a sealed finish. The final product is a nearly exact replica of the lost tooth or teeth.

In some laboratories, technicians perform all stages of the work, whereas in other labs, each technician does only a few. Dental laboratory technicians can specialize in 1 of 5 areas: orthodontic appliances, crowns and bridges, complete dentures, partial dentures, or ceramics. Job titles can reflect specializa-



*Dental laboratory technicians create models of a patient's mouth, and use those models to create dental prosthetics such as dentures.*

tion in these areas. For example, technicians who make porcelain and acrylic restorations are called *dental ceramists*.

*Ophthalmic laboratory technicians*—also known as manufacturing opticians, optical mechanics, or optical goods workers—make prescription eyeglass or contact lenses. Prescription lenses are curved in such a way that light is correctly focused onto the retina of the patient’s eye, improving his or her vision. Some ophthalmic laboratory technicians manufacture lenses for other optical instruments, such as telescopes and binoculars. Ophthalmic laboratory technicians cut, grind, edge, and finish lenses according to specifications provided by dispensing opticians, optometrists, or ophthalmologists and may insert lenses into frames to produce finished glasses. Although some lenses still are produced by hand, technicians are increasingly using automated equipment to make lenses.

Ophthalmic laboratory technicians should not be confused with workers in other vision care occupations. Ophthalmologists and optometrists are “eye doctors” who examine eyes, diagnose and treat vision problems, and prescribe corrective lenses. Ophthalmologists are physicians who also perform eye surgery. Dispensing opticians, who also may do the work of ophthalmic laboratory technicians, help patients select frames and lenses, and adjust finished eyeglasses. (See the statement on physicians and surgeons, which includes ophthalmologists, as well as the statement on optometrists and opticians, dispensing, elsewhere in the *Handbook*.)

Ophthalmic laboratory technicians read prescription specifications, select standard glass or plastic lens blanks, and then mark them to indicate where the curves specified on the prescription should be ground. They place the lens in the lens grinder, set the dials for the prescribed curvature, and start the machine. After a minute or so, the lens is ready to be “finished” by a machine that rotates it against a fine abrasive, to grind it and smooth out rough edges. The lens is then placed in a polishing machine with an even finer abrasive, to polish it to a smooth, bright finish.

Next, the technician examines the lens through a lensometer, an instrument similar in shape to a microscope, to make sure that the degree and placement of the curve are correct. The technician then cuts the lenses and bevels the edges to fit the frame, dips each lens into dye if the prescription calls for tinted or coated lenses, polishes the edges, and assembles the lenses and frame parts into a finished pair of glasses.

In small laboratories, technicians usually handle every phase of the operation. In large ones, in which virtually every phase of the operation is automated, technicians may be responsible for operating computerized equipment. Technicians also inspect the final product for quality and accuracy.

**Work environment.** Medical, dental, and ophthalmic laboratory technicians generally work in clean, well-lighted, and well-ventilated laboratories. They have limited contact with the public. Salaried laboratory technicians usually work 40 hours a week, but some work part time. At times, technicians wear goggles to protect their eyes, gloves to handle hot objects, or masks to avoid inhaling dust. They may spend a great deal of time standing.

Dental technicians usually have their own workbenches, which can be equipped with Bunsen burners, grinding and pol-

ishing equipment, and hand instruments, such as wax spatulas and wax carvers. Some dental technicians have computer-aided milling equipment to assist them with creating artificial teeth.

### **Training, Other Qualifications, and Advancement**

Most medical, dental, and ophthalmic laboratory technicians learn their craft on the job; however, many employers prefer to hire those with formal training.

**Education and training.** High school students interested in becoming medical appliance technicians should take mathematics, metal and wood shop, and drafting. Medical appliance technicians usually begin as helpers and gradually learn new skills as they gain experience.

Formal training is also available. In 2006, there were four orthotic and prosthetic technician programs accredited by the National Commission on Orthotic and Prosthetic Education (NCOPE). These programs offer either an associate degree or a 1-year certificate for orthotic or prosthetic technicians. The programs instruct students on human anatomy and physiology, orthotic and prosthetic equipment and materials, and applied biomechanical principles to customize orthotics or prostheses. The programs also include clinical rotations to provide hands-on experience.

Dental laboratory technicians begin by learning simple tasks, such as pouring plaster into an impression, and progress to more complex procedures, such as making porcelain crowns and bridges. Becoming a fully trained technician requires an average of 3 to 4 years, depending upon the individual’s aptitude and ambition, but it may take a few years more to become an accomplished technician. High school students interested in becoming dental laboratory technicians should take courses in art, metal and wood shop, drafting, and sciences. Courses in management and business may help those wishing to operate their own laboratories.

Training in dental laboratory technology also is available through community and junior colleges, vocational-technical institutes, and the Armed Forces. Formal training programs vary greatly both in length and in the level of skill they impart. In 2006, 20 programs in dental laboratory technology were accredited by the Commission on Dental Accreditation in conjunction with the American Dental Association. These programs provide classroom instruction in dental materials science, oral anatomy, fabrication procedures, ethics, and related subjects. In addition, each student is given supervised practical experience in a school or an associated dental laboratory. Accredited programs normally take 2 years to complete and lead to an associate degree. A few programs take about 4 years to complete and offer a bachelor’s degree in dental technology. Graduates of 2-year training programs need additional hands-on experience to become fully qualified.

Each dental laboratory owner operates in a different way, and classroom instruction does not necessarily expose students to techniques and procedures favored by individual laboratory owners. Students who have taken enough courses to learn the basics of the craft usually are considered good candidates for training, regardless of whether they have completed a formal program. Many employers will train someone without any classroom experience.

**Projections data from the National Employment Matrix**

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Medical, dental, and ophthalmic laboratory technicians .....	51-9080	95,000	100,000	5,000	5
Dental laboratory technicians .....	51-9081	53,000	55,000	2,000	4
Medical appliance technicians .....	51-9082	12,000	13,000	1,200	9
Ophthalmic laboratory technicians .....	51-9083	29,000	31,000	1,900	7

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

Ophthalmic laboratory technicians start on simple tasks if they are training to produce lenses by hand. They may begin with marking or blocking lenses for grinding; then, they progress to grinding, cutting, edging, and beveling lenses; finally, they are trained in assembling the eyeglasses. Depending on individual aptitude, it may take up to 6 months to become proficient in all phases of the work.

Employers filling trainee jobs prefer applicants who are high school graduates. Courses in science, mathematics, and computers are valuable; manual dexterity and the ability to do precision work are essential. Technicians using automated systems will find computer skills valuable.

A few ophthalmic laboratory technicians learn their trade in the Armed Forces or in the few programs in optical technology offered by vocational-technical institutes or trade schools. These programs have classes in optical theory, surfacing and lens finishing, and the reading and applying of prescriptions. Programs vary in length from 6 months to 1 year and award certificates or diplomas.

**Other qualifications.** A high degree of manual dexterity, good vision, and the ability to recognize very fine color shadings and variations in shape also are necessary for dental technicians. An artistic aptitude for detailed and precise work also is important.

**Certification and advancement.** Voluntary certification for orthotic and prosthetic technicians is available through the American Board for Certification in Orthotics and Prosthetics (ABC). Applicants are eligible for an exam after completing a program accredited by NCOPE or obtaining 2 years of experience as a technician under the direct supervision of an ABC-certified practitioner. After successfully passing the appropriate exam, technicians receive the Registered Orthotic Technician, Registered Prosthetic Technician, or Registered Prosthetic-Orthotic Technician credential. Certification may help those orthotic and prosthetic technicians seeking to advance.

With additional formal education, medical appliance technicians who make orthotics and prostheses can advance to become orthotists or prosthetists, technicians who work with patients who need braces, artificial limbs, or related devices and help to determine the specifications for those devices.

In large dental laboratories, dental technicians may become supervisors or managers. Experienced technicians may teach or take jobs with dental suppliers in such areas as product development, marketing, and sales. Opening one's own laboratory is another, and more common, way to advance and earn more.

The National Board for Certification, an independent board established by the National Association of Dental Laboratories, offers certification in dental laboratory technology. Certifica-

tion, which is voluntary except in three states, can be obtained in five specialty areas: crowns and bridges, ceramics, partial dentures, complete dentures, and orthodontic appliances. Certification may increase chances of advancement.

Ophthalmic laboratory technicians can become supervisors and managers. Some become dispensing opticians, although further education or training generally is required in that occupation.

**Employment**

Medical, dental, and ophthalmic laboratory technicians held about 95,000 jobs in 2006. About 55 percent of salaried jobs were in medical equipment and supply manufacturing laboratories, which usually are small, privately owned businesses with fewer than 5 employees. However, some laboratories are large; a few employ more than 1,000 workers. The following tabulation shows employment by detailed occupation:

Dental laboratory technicians .....	53,000
Ophthalmic laboratory technicians .....	29,000
Medical appliance technicians .....	12,000

In addition to manufacturing laboratories, many medical appliance technicians worked in health and personal care stores, while others worked in public and private hospitals, professional and commercial equipment and supplies merchant wholesalers, or consumer goods rental centers. Some were self-employed.

In addition to manufacturing laboratories, many dental laboratory technicians worked in offices of dentists. Some dental laboratory technicians open their own offices.

Most ophthalmic laboratory technician jobs were in medical equipment and supplies manufacturing laboratories, about 29 percent. Another 29 percent of jobs were in health and personal care stores, such as optical goods stores that manufacture and sell prescription glasses and contact lenses. Some jobs were in offices of optometrists or ophthalmologists, while others worked at professional and commercial equipment and supplies merchant wholesalers. A few worked in commercial and service industry machine manufacturing firms that produce lenses for other optical instruments, such as telescopes and binoculars.

**Job Outlook**

Overall, slower-than-average growth is expected for employment of medical, dental, and ophthalmic laboratory technicians. However, job opportunities should be favorable because few people seek these positions.

**Employment change.** Overall employment for these occupations is expected to grow five percent from 2006 to 2016, slower than the average for all occupations.

Medical appliance technicians will grow at nine percent, about as fast as the average for all occupations, because of the increasing prevalence of the two leading causes of limb loss—diabetes and cardiovascular disease. In addition, advances in technology may spur demand for prostheses that allow for greater movement.

Employment of dental laboratory technicians is expected to grow more slowly than average, at four percent. During the last few years, demand has arisen from an aging public that is growing increasingly interested in cosmetic prostheses. For example, many dental laboratories are filling orders for composite fillings that are the same shade of white as natural teeth to replace older, less attractive fillings. However, job growth for dental laboratory technicians will be limited. The overall dental health of the population has improved because of fluoridation of drinking water and greater emphasis on preventive dental care, which has reduced the incidence of dental cavities. As a result, full dentures will be less common, as most people will need only a bridge or crown.

Ophthalmic laboratory technicians are expected to experience employment growth of seven percent, about as fast as the average for all occupations. Demographic trends make it likely that many more Americans will need vision care in the years ahead. Not only will the population grow, but also the proportion of middle-aged and older adults is projected to increase rapidly. Middle age is a time when many people use corrective lenses for the first time, and elderly persons usually require more vision care than others. However, the increasing use of automated machinery will temper job growth for ophthalmic laboratory technicians.

**Job prospects.** Job opportunities for medical, dental, and ophthalmic laboratory technicians should be favorable, despite expected slower-than-average growth. Few people seek these jobs, reflecting the relatively limited public awareness and low starting wages. In addition to openings from job growth, many job openings also will arise from the need to replace technicians who transfer to other occupations or who leave the labor force.

## Earnings

Median hourly earnings of wage-and-salary medical appliance technicians were \$14.99 in May 2006. The middle 50 percent earned between \$11.34 and \$19.65 an hour. The lowest 10 percent earned less than \$8.93, and the highest 10 percent earned more than \$27.00 an hour.

Median hourly earnings of wage-and-salary dental laboratory technicians were \$15.67 in May 2006. The middle 50 percent earned between \$11.61 and \$20.57 an hour. The lowest 10 percent earned less than \$9.16, and the highest 10 percent earned more than \$26.13 an hour. In the two industries that employed the most dental laboratory technicians, medical equipment and supplies manufacturing and offices of dentists, median hourly earnings were \$15.09 and \$17.74, respectively.

Median hourly earnings of wage-and-salary ophthalmic laboratory technicians were \$12.24 in May 2006. The middle 50 percent earned between \$9.86 and \$15.82 an hour. The lowest 10 percent earned less than \$8.38, and the highest 10 percent earned more than \$19.98 an hour. Median hourly earnings were \$11.63 in medical equipment and supplies manufacturing and \$11.49 in health and personal care stores, the two industries that employ the most ophthalmic laboratory technicians.

## Related Occupations

Medical, dental, and ophthalmic laboratory technicians manufacture and work with the same devices that are used by dispensing opticians and orthotists and prosthetists. Other occupations that work with or manufacture goods using similar tools and skills are precision instrument and equipment repairers and textile, apparel, and furnishings occupations.

## Sources of Additional Information

For information on careers in orthotics and prosthetics, contact:

► American Academy of Orthotists and Prosthetists, 526 King St., Suite 201, Alexandria, VA 22314.

Internet: <http://www.opcareers.org>

For a list of accredited programs for orthotic and prosthetic technicians, contact:

► National Commission on Orthotic and Prosthetic Education, 330 John Carlyle St., Suite 200, Alexandria, VA 22314.

Internet: <http://www.ncope.org>

For information on requirements for certification of orthotic and prosthetic technicians, contact:

► American Board for Certification in Orthotics and Prosthetics, 330 John Carlyle St., Suite 210, Alexandria, VA 22314. Internet: <http://www.abcop.org>

For a list of accredited programs in dental laboratory technology, contact:

► Commission on Dental Accreditation, American Dental Association, 211 E. Chicago Ave., Chicago, IL 60611.

Internet: <http://www.ada.org>

For information on requirements for certification of dental laboratory technicians, contact:

► National Board for Certification in Dental Technology, 325 John Knox Rd., L103, Tallahassee, FL 32303.

Internet: <http://www.nbccert.org>

For information on career opportunities in commercial dental laboratories, contact:

► National Association of Dental Laboratories, 325 John Knox Rd., L103, Tallahassee, FL 32303.

Internet: <http://www.nadl.org>

For information on an accredited program in ophthalmic laboratory technology, contact:

► Commission on Opticianry Accreditation, P.O. Box 4342, Chapel Hill, NC 27515.

General information on grants and scholarships is available from individual schools. State employment service offices can provide information about job openings for medical, dental, and ophthalmic laboratory technicians.