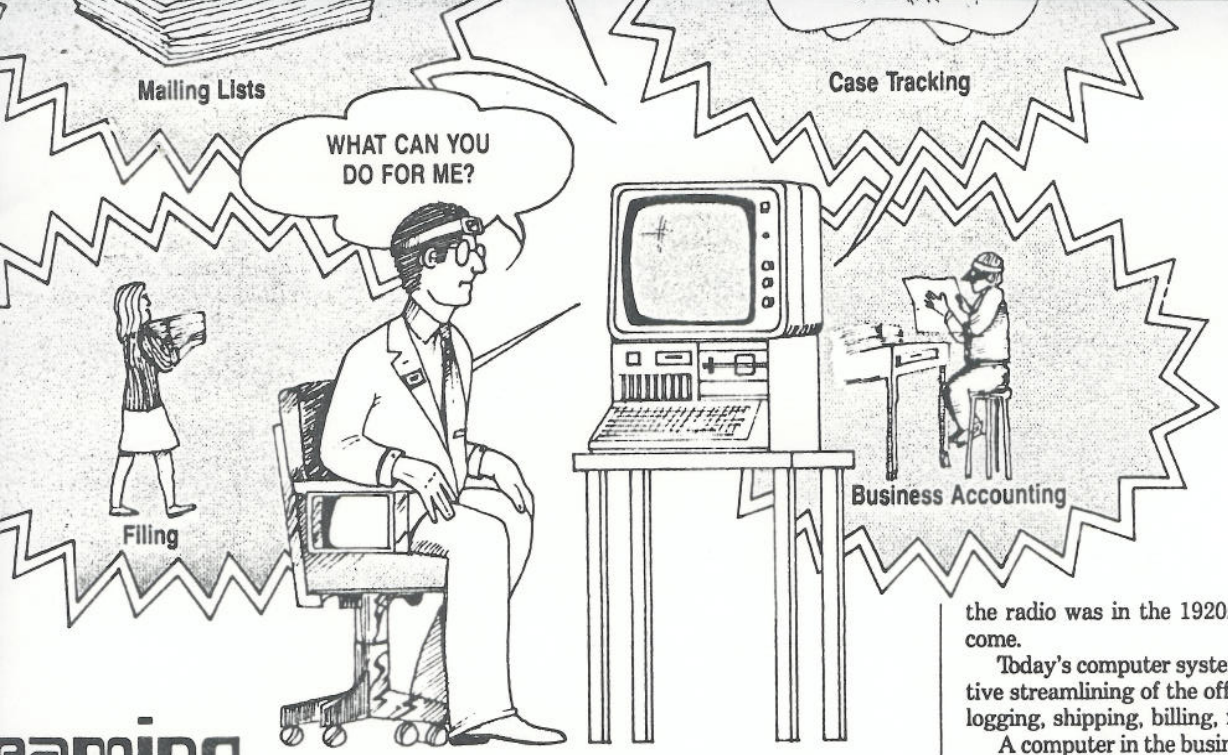

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By Brenda Spears Tacker
Managing Editor

OK, the word "computer" carries the equivalent nastiness of a string of obscenities in the hearts and minds of some people. Yet, there are those who wonder how the Earth managed to orbit the sun before computers blessed us with their presence.

Others have embraced the new high-technology with open arms only to find themselves firmly in the grip of a paper monster bigger than anything functioning under a manual system.

Yes, the computer age is here. It has been here for a while actually, when you consider the first computer was an abacus. Consider also that personal computing today is probably on the same level as the radio was in the 1920s, so changes are sure to come.

Today's computer system can translate into effective streamlining of the office through computerized logging, shipping, billing, filing and mass mailings.

A computer in the business, at the least, gives the impression of an upscale, modern business, whether or not a customer is interested in any of the latest technologies. Often, the customer finds comfort in believing that the business provides options and is professionally managed.

At this time dental laboratory computer systems are best suited for managerial chores: invoicing, tracking, marketing mailings, inventory control and business reports (where the company stands financially last week, today, tomorrow, next year). The growing number of software companies offering wares to the industry attests to the interest in computerizing dental laboratories.

In the future, computers will play a much larger role in the dental laboratory, particularly in manufacturing the end product. Please note that the future may be closer than you think. ■

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computer to do means more than walking into a computer store, telling the salesperson you want a computer to solve all your problems and taking whatever is handed to you. Disasterous results are sure to follow such a plan of inaction.

Buying a computer should not be a spur of the moment decision. Spend time learning about computers. That means more than buying a magazine on computers and never reading it. This also means talking with people other than your neighbor who "knows someone who's good with computers."

Read magazines and books

See **Shopping,** pg 18.

Stepping into the future with CAD/CAM

Dr. Francois Duret, a French oral surgeon and researcher, has studied, during the past 15 years, the possibilities of uniting dentistry with computer aided design/computer aided manufacturing (CAD/CAM) technology. He is now appearing at dental technology shows to present his findings.

More specifically, he is presenting the forerunner of a dental CAD/CAM system based on his research. The system involves an optical probe that gathers specifications for a prosthesis, software to interpret the data and a machine to mill the prosthesis from the data.

Dr. Duret began his research with the hypothesis that a patient could be completely treated in one visit and that the process could be enhanced by computer technology. During his first presentation of the system at the International Congress of the French Dental Association in Paris 1985, a crown was produced in one hour.

The system was scheduled to be available in the North American market in 1987, but it will probably be 1988—at the earliest—before the systems arrive on these shores.

Hennson International of Vienne, France, the manufacturer, plans to market 800 systems in France during 1987. Early cost estimates range between $30,000 and $90,000 depending on the configuration purchased. However, the cost could be much higher after refinements, and by the time it is available in the United States and Canada. The company said negotiations are continuing for a marketing/distributor for North America.

Dr. Duret explained the basic theory and operation of the system during two sessions at the International Education Congress of Dental Technology in New York. Using slides and videotapes, he showed how the optic probe is used, how the prosthesis is selected, how the color is selected and how the prosthe-

See **Keeping,** pg 18.

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Computing 500"

vised pricing schedules? Does it flag past-due accounts before you take new orders? Can the one-man dental laboratory/ computer wizard could find the time and means to use a com-

by determining current costs for such items, usually based on

See **Office**, pg 19.

Keeping an eye on the future

continued from page 17

sis is manufactured.

Technology such as this eliminates the need for impressions, molds and the time necessary to accomplish those procedures and return the finished product to the dentist and patient.

As might be expected, the presentation was well attended and drew numerous spontaneous questions. Many questions carried an almost defensive tone: "But it can't do bridges, right?" One man, who was watching the presentation with interest, noted that he could relax about the possibilities since he was near retirement; however, the defensive ones were younger dental technicians who were concerned that the new technology might make them obsolete.

Several questions dealt with margin fit and radiographs. Dr. Duret said no radiographs have been used with CAD/CAM produced and placed crowns. He added that he prefers the accuracy of testing extracted teeth.

Fear of the unknown, particularly of what the consequences might be for dental technicians, is to be anticipated. It could mean the loss of jobs or the closing of dental laboratories. On the other hand it could create jobs in the industry but with redefined responsibilities.

Dr. Duret's goal at the meeting was to discuss the technology, not the manufacturing or price details.

Dr. Gerald McLaughlin, who assisted Dr. Duret at the New York presentation, said that the system's impact on the dental laboratory industry is impossible to predict. "Undoubtably, some dentists will have the entire system. Others will have only the optical probe system," he said.

Dental laboratories with the computer aided manufacturing system will be able to receive the necessary computer aided design information over the telephone with a modem hookup. The result will save time on pickup, labor at the bench and delivery.

Currently, the CAD/CAM system is used primarily to produce crowns; however, Dr. Duret said the system will produce bridges and dentures. The limitation on bridges and dentures is primarily because of the materials currently used to make the prostheses and esthetics, he said. The system can form the metal bridgework to be completed by a dental laboratory.

The Duret-Hennson system consists of an optical probe, software, a computer aided design microprocessor, a digital controller and a micro-milling machine.

The optical probe is designed to measure teeth in three dimensions and has less than a 20 micrometer margin of error in determining a point in the position of a tooth.

The optical probe is connected to the image processor and makes a digital record of the measurements, which is transmitted through a charge coupled device (CCD). The CCD, a matrix microcaptor, scans at three to six megahertz and provides images on a flat surface at a rate of several times per second.

Relevant data from the image processor is used to calculate the dimensions of the prepared tooth. The information is fed into the software which plans the interior and exterior design of the prosthesis to adhere properly in the patient's mouth. The design phase is said to consider fluid flow, reduction, retention and contact areas. The resulting design may be used as is or modified depending on the needs of the patient.

> ***"Undoubtably, some dentists will have the entire system. Others will have only the optical probe system."***
>
> ***—Dr. Gerald McLaughlin***

In the next step, a digital controller unites direct, link and written material. This information guides a micro-milling machine in producing a prosthesis. Basically, the information tells the machine which tools to pick and how to shape the material.

Dr. Duret said the machine automatically recalibrates each time a tool is used to allow for wear on the tool head. The recalibration prevents the prosthesis from being made out of specifications.

Dr. Duret said he is using already ceramed Dicor for the crowns, but other materials, primarily metals, may be substituted. The final product is shaded and polished by hand.

After finishing, the product is ready to be placed in the patient's mouth.

To begin the process on a patient, Dr. Duret said the patient's oral area would be prepared as if taking an impression in the traditional manner. The optical probe is used after preparation to record a series of video-monitored images.

Video monitoring allows the dentist to ensure accurate and precise renditions of all areas of the mouth. The image taking, or imprint, process can be completed in less than 3 minutes if the dentist is accustomed to working with the probe.

Processing the image and integrating the information from the optical probe also takes about 3 minutes. The information is then verified on the CAD software. Verification indicates that the tooth form is acceptable. This step can occur in the dentist's office or the dental laboratory, depending on where the equipment is located. Verification is done by someone trained in the manufacturer's education program on the system's software.

In the verification process, the software can indicate where adjustments could be made on the tooth. Verification usually takes about 2 minutes to 10 minutes, according to the company.

If modification is necessary, the CAD worker or dentist will use interactive functions to modify angles, close or separate contact areas, modify a fissure or cervical curvature and position the centers or points. Hennson said the modification terms/language will use dental terms to make it easier to learn.

The software also examines occlusal movements in accordance with several theories. The pattern chosen will determine the occlusal form for the patient.

After veritification and modifications, the next step is the micro-milling machine producing the prosthesis. The material to be machined is inserted and automatically held in place. The information from the CAD guides the CAM system in production.

A single switch engages the unit and the cycle takes about 20 minutes per element. Hennson said the time can be less-

See **CAD/CAM**, pg 19.

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man-hours and material costs.

Be sure to include the cost of the software, equipment and accessories plus new forms or stationery which may be required. (Computer printers may require continuous feed stationery and forms instead of single sheets.)

A tax adviser may be necessary to tell you about the latest investment tax credits and depreciation, or whether or not the system will be eligible for such write-offs under the new tax laws.

As with the software, ask questions about the hardware and do not stop until the answers are satisfactory. For example, if the hardware is extremely sensitive and requires a special, controlled environment, is it really suitable for the dental laboratory? Review written terms on warranty, maintenance and support services. If the seller is local, are repairs done locally? Or is the machine shipped to the manufacturer? If so, what do you do in the meantime?

Find out if the equipment has sufficient capacity to run the chosen software and what type of accessories are included. A printer may be included in a package but usually is considered optional. If so, review the

When buying a computer, an important rule to remember is: do not expect

CAD/CAM

ened if the interior design is milled at the same time as the exterior.

The prosthesis is finished according to the material used. The prosthesis is verified by an optical probe reading and compared to the original images. In this way, the prosthesis is verified before it is placed in the patient's mouth.

If all portions of the system are in the dentist's office, the procedure may be completed in one hour and the patient treated in one visit. An optical probe may be installed in each operatory, if so desired.

In another configuration, the dentist may own the optical probe and CAD software while working with a dental laboratory which owns the CAM equipment. The dentist's office would transmit the data via a modem to the dental laboratory after the image taking, verification and a portion of the image processing. The dental laboratory would oversee the manufacturing process, finish the prosthesis and deliver it to the dentist's office after verification.

Video monitoring allows the dentist to ensure accurate and precise renditions of all areas of the mouth.

Dr. Duret said research is continuing on software to analyze and select the correct stain. He demonstrated the color selection process at the seminar using an optical probe and video screen. The optical probe took a reading of the tooth in three areas while a color spectrum analysis appeared on the screen. The software selected a product name and shade that would be used to closely match the patient's natural tooth color.

Hennson expects the system to be fully capable of large scale bridges, pin crowns and attachments by mid-1987. The company also expects the system to be adapted to orthodontics, paradontology, splints and brackets during the coming year. ■