THE CUTTING EDGE

(Editor's Note: This quarterly column is compiled by JCO Technology Editor Ronald Redmond. To help keep our readers on The Cutting Edge, Dr. Redmond will spotlight a particular area of orthodontic technology every three months. Your suggestions for future subjects or authors are welcome.)

This month's Cutting Edge column, by a frequent contributor, Dr. Robert Haeger, provides a step-by-step method for computerizing an orthodontic office. I can appreciate Dr. Haeger's formula better than most because I, too, have suffered the challenges of computerizing an office using the trial-and-error method. If you follow Dr. Haeger's well-thought-out approach to planning and implementation, I'm sure you will cut your time and effort by at least two-thirds.

I'd like to congratulate Dr. Haeger for being named a Contributing Editor of JCO. In my 35 years in orthodontics, the best description of a professional that I have heard is someone who shares his knowledge to help improve the profession.

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Establishing an All-Digital Office

Once you have made the decision to move into the digital world and fully computerize your office, many questions arise: Where do I start? How much will it cost? What can computers help me do? Will the new efficiencies be worth it? Can I fit these changes into the current layout of my office? Can I connect my satellite offices? Who has done this already, and what advice do they have? I will address these and many other questions in this article, as I take you through the complete process of computerizing your office and adding the necessary software.

I made the decision to take my office fully digital about five years ago because I wanted more time at home with my family. It took me two years to plan, six months to implement the new hardware, and another year to gradually integrate the software applications. My practice completed this transition nearly three years ago, and I could not be happier with the results. The changes allowed me to stay home every Friday; saved four to six hours of my time per week; enabled me to see more patients; and provided me with a more efficient office that includes electronic charting, digital x-rays, simple one-visit exam/consultation appointments, full Internet access, and a happy staff.[1,2] I hope that by reading this article, you can reduce your own planning time to six months and avoid many of the issues I had to struggle through.

Before Meeting with a Computer Consultant

The first thing to do before updating your

office computer system is to visit several practices that have already gone through the process. You will be surprised at what you can learn and how much time it will save you. Just observing other offices in action will open your eyes to the many possibilities of an all-digital office.

After doing this homework, start your project by considering two questions about basic software applications:

1. What orthodontic practice management software do you plan to use? Popular products include Kodak OrthoTrac,[3] Dolphin,[4] OAsys,[5] IMS,[6] OrthoExec,[7] and Ortho II.[8] If you are not happy with your current practice management software, this would be the time to upgrade or switch.
2. What photographic imaging and capture software do you plan on using? Dolphin, Kodak, OAsys, IMS, and GAC[9] are some popular brands. Many orthodontic management programs include integrated imaging systems, thus addressing both areas at once.

Because these two decisions will be the key to establishing your all-digital office, they should be considered as carefully as possible. Keep in mind that this article is not intended to compare the various products available, but rather to present a system for setting up a digital office. For ease of comprehension, the article is organized according to the computer locations and applications around the office. If you have at least a modest amount of computer knowledge, you should be able to fill out the initial questions before meeting with a computer consultant. That can make your first meeting significantly more productive. Otherwise, you may want to work through this section with your consultant.

Fig. 1 Consultation table with two monitors.

Initial Questions

Front Desk

- How many work stations do you want?
- Do you need a phone next to each computer work station?

Chairside Computers

- Will you be converting to electronic charting now or in the future?
- Do you want to use digital models?
- Do you want computer access to digital x-rays, models, and photographs at each chair?
- Where do you want the monitors placed in relation to each chair and your doctor position?

Exam/Consultation Room

- Do you want to enter your initial exam findings directly into the computer?
- Do you want to use a computer at the consultation table to display photographs, x-rays, and demonstration software?
- Do you have room for computer monitors within your existing space and cabinet configuration?
- Do you want to use a double monitor system at the consultation table (Fig. 1)?
- Will you have separate computers at the consultation table and treatment coordinator work station?
- Would you like a printer in this room?

Photography

- What type of digital camera will you be using?
- What software will you use to capture and crop the images on the computer?

• Where will the computer for image capture be located?

Radiography

• Will you use a direct digital x-ray machine or, considering the cost, will you use a phosphorus film machine?
• Will you use your current panoramic x-ray unit and scan the images into the computer?
• What software will you use to display the x-ray images on the computer?

Doctor's Desk

• Do you want private faxes to come directly to your computer?
• Will you need a larger monitor for digitizing your own x-rays?

Additional Work Stations

• Do you need a computer work station for ordering supplies?
• Do you need a work station for insurance processing?
• Do you need a work station for accessing credit reports on the Internet?
• Do you use HouseCalls[10] or a similar computer-generated program to confirm appointments?
• Do you want a computer work station in the main treatment bay, away from the chairs, to help monitor the schedule and patient flow and to pull up x-rays for patients on the phone?

Check-In Station

• Do you want a patient check-in computer in the reception room?
• Do you want a computer near the front desk for patients to enter their own e-mail addresses, or do you want a staff member to enter them?

Computer Server

• Where do you want to locate the server (the computer that stores all the data and images on the office network) for convenience of access and backup?

Printers

• Do you want a printer in each exam/consultation room?
• Do you need a separate color printer for photographs and x-rays?
• What are your printing needs around the office (letters, insurance forms, x-rays, photographs, next-appointment slips, envelopes, etc.)?

Orthodontic Consultants

• Will you need help converting all your paper charts to electronic charts? Consultants need months of lead time to set this in motion.
• Will you need a customized questionnaire to enter all the necessary information at the examination appointment, or are you experienced enough to format this on your own?
• Will you be updating your own website?

Internet Access

• Can you get a high-speed connection through a telephone line, TV cable, or T-1 line?

Local Computer Networking Specialists

• Do you have access to a local specialist with experience in networking orthodontic offices?
• Does this person bill by the hour or by the project?

After you have answered most of these questions, sketch a floor plan of your office showing each room and the proposed locations of your computer work stations, monitors, printers, x-ray machine, image capture station, consultation tables, and telephones. Now take an inventory of your existing computers, including the processor, RAM, hard-drive capacity, and operating system of each. Also make a list of your current printers.

At this point, it is time to sit down with your computer consultant and work out the details. If

you have some knowledge of computers, you should easily be able to follow the next checklist. If not, you may want to wait until after you have met with your consultant.

Consultant Checklist

Front Desk

• Record the number of work stations and any phone-line requirements.

• Decide where the monitors will be located and whether you need to run additional cables for future expansion.

Chairside Computers

• Determine how to place each monitor in the desired location and where each mouse will rest.
• Decide whether it would be easier to have two keyboards for each computer so that both the doctor and assistant can make entries. One option is to pole-mount the monitor and keyboard stands (Fig. 2).

• Determine whether you have room near each chair for a CPU, or whether any of the computers could use a dummy terminal, which is essentially a monitor and keyboard with a tiny CPU. Decide where you will position the CPUs or how to attach the dummy terminals to the monitors.

Exam/Consultation Room

• Plan out the monitor configurations and locations, and whether you will have a separate work station for the treatment coordinator away from the consultation table. If you want to use double monitors at the consultation table, the associated computer must have compatible video cards, mother board, and operating system.

• Determine whether any of the computers could use dummy terminals.

• Decide whether you need to make any cabinetry changes at the consultation table.

• Determine where to put a printer, if any.

Photography

• Calculate the storage space each image will use on the computer.
• Select a location in the office for the computer that transfers the images from the camera to the computer.
• Identify the interface or port needed for the camera or card reader to transfer images from the camera to the computer.
• Ask the imaging software company whether a phone connection to the capture computer is necessary for future technical support.

Radiography

• If you select a direct digital x-ray machine, obtain the electrical and computer connection specifications from the manufacturer. This will determine the power supply requirements and the conduit needed to connect the x-ray machine to the computer.
• Determine the computer storage requirements for the x-ray images and how many you will take each month.
• Identify an available computer to run the x-ray machine. If you need a new computer, determine the locations of the monitor, the CPU, and the mouse, and make sure it is not too close to water.
• Identify the computer that will connect to the scanner for integrating x-rays from other offices.
• Select a scanner, and make sure you have the appropriate port and mother board for it.

Doctor's Desk

• If you want to receive private faxes, determine the appropriate software and telephone connections.
• Discuss the need for a 17" monitor.

Additional Work Stations

• Itemize the number of additional computer work stations you need now or might need in the future. Determine the locations of work stations for supply ordering, insurance processing, credit

reports, computer-generated appointment reminders, patient flow and check-in, etc.
• Determine how many of these work stations will need phone lines (HouseCalls, for instance, needs a phone line connected to the computer).
• Decide whether to use a computer or a dummy terminal at each work station.

Computer Server

• Determine where the servers will be located and whether there is adequate ventilation for cooling.
• Decide how fast a machine you need. You will never regret purchasing the fastest machine possible to allow for future applications.
• Calculate the necessary hard-drive capacity by adding up the sizes of potential photographic images, digital x-rays and models, and software products, and projecting your usage over the next few years.
• Find out if your orthodontic practice management software uses the UNIX[11] or Windows[12] operating system, which may require separate servers. If you need two servers, decide whether you should use a keyboard/video/mouse (KVM) switch so you don't need a separate monitor for each server.
• If you will be using dummy terminals around the office, determine whether you need extra RAM and special software such as Citrix[13] or Client Services for Windows 2003 Small Business Server. Windows 2003 SBS has extra features for routing faxes to your e-mail inbox for remote access, setting up your own website with SharePoint,[12] and controlling internal e-mail messages with Exchange Server.
• Find out whether programs such as your practice management software, imaging software, Citrix, or UNIX need to be loaded or configured by the providers.
• Determine how many battery-powered uninterruptible power sources and electrical surge protectors are needed.
• Design a backup system using tapes or a USB-connected mirroring hard drive.
• Decide whether you want a DVD burner in the server or one of the other computers.
• Plan for virus protection at the server and throughout the office.
• Ensure that all applications have adequate privacy protection features for HIPAA.

Printers

• Determine the locations of all printers.
• Decide how you will accommodate plain paper, letterhead, envelopes, faxes, photographs, x-rays, appointment reminders, and insurance forms.
• Select printers to meet these needs, and decide whether you will connect them directly to the network or to individual computers.
• Check into combination printer-copier-scanner-fax machines.
• Record the cabling needs for each printer.

Internet Access

• Determine how you will connect to the Internet (cable, DSL, or T-1). Static IP addresses will be needed for remote access from home or satellite offices.
• Decide how you will connect multiple offices and whether the Internet will be the conduit (this will determine how fast an Internet connection is needed).
• Plan for a backup Internet connection if you will use one to connect multiple offices. A relatively new solution is to hook up your cell phone to a USB port on the back of your computer. This will be a slow connection, but it can at least act as a backup for transmitting data if the primary Internet access is interrupted.
• Plan for adequate firewall protection and HIPAA controls.

Cabling

• Map out the final locations of all computers, x-ray machines, printers, and switches.
• Determine whether you have space above the ceiling, below the floor, or under the baseboards to run the necessary cables.

• Select the fastest cables available for movement of large image files over the network.
• Identify any future cabling needs for potential computer or printer locations.
• Determine whether a wireless network is appropriate for any of the computers.
• Evaluate the need for additional phone lines next to each computer at the front desk, for fax machines, for HouseCalls, or for computers that might be used for software support in the future. Remember that all your data will be stored on the network, and the proximity of telephones to computers will make it easier to field calls.
• Identify a convenient location in the office for a switch or hub to reduce your cabling requirements. Decide whether adding one or two more switches would further reduce cabling needs.
• Determine the electrical requirements for each computer, and make sure there are outlets in the desired locations.

Local Computer Networking Specialists

• Find out whether your local computer consultant will provide all-inclusive service, or if you will need to find subcontractors for cabling, electrical work, and Internet access.
• Find out whether your local computer consultant has access to national specialists for advice to make your conversion run more smoothly. Contact national computer specialists who have already configured complex orthodontic offices.
• Record the specifications (hard drive, RAM, CD-DVD, tape backup, etc.) for each proposed computer in the office.

Basic Implementation

Draw up a budget with all your costs, including computers, x-ray machine, cameras, printers, and other equipment; software; cabinetry, plumbing, and carpeting; electrical work, cabling, and switches; and local and national computer consultants, as well as any consultants needed for the implementation of specific features. Schedule out how these costs will be incurred during the implementation process.

Now that you have addressed all the difficult issues and determined the physical layout of the computers in your state-of-the-art office, it is time to put the plan in motion. The implementation should proceed something like the following:
1. Order the digital x-ray machine and new cabinetry, because they usually need the longest lead time.
2. Order the digital camera.
3. Order the servers, computers, monitors, keyboards, mounting poles and arms, dummy terminals, scanner, printers, battery backups, surge protectors, firewall, backup equipment, and switches.
4. Order the high-speed Internet connection and router.
5. Have the electrician run dedicated circuits for the x-ray machine and for power to all computer locations.
6. Have the cabling company run lines for connecting all computers and printers to the switches, internal phone lines, and Internet connection.
7. If necessary, ship the new servers to the orthodontic practice management company for software installation, to the national computer consultant for configuration of Citrix or Client Services, and to the digital imaging company.
8. Have the carpenter install any new cabinetry and mounting poles needed for chairside monitors.
9. Have your local computer consultant set up your network, including double monitors for the consultation table, dummy terminals, antivirus software, backups, and Internet access. You may want to set up your Internet access sooner if you are using national computer consultants, who will then be able to access your network from their offices.
10. Transfer the data from your old server to your new one.
11. Train your assistants and treatment coordinators to operate the new camera.
12. Run your office with the new practice management software for one or two weeks to familiarize your team with the new terminals and basic computer functions.

13. Add the digital imaging software, and practice using the double monitors in the consultation room.
14. Add the digital x-ray machine after you are comfortable using the basic imaging and practice management software.

Advanced Uses of the All-Digital Office

Once everyone is familiar with the basic functions of the new camera, x-ray machine, and practice management software, you can really start to take advantage of your new system.[1,2] You might consider the following steps:
15. Install an Internet connection at home to access your schedule and images from your office computers.
16. Decide whether you need consultants to help implement electronic charting or patient information questionnaires. If so, schedule the consultants a few months in advance.
17. Convert your paper charts to electronic.
18. Create a questionnaire that will allow you to efficiently enter all the vital information from the initial exam appointment, design the treatment plan, and set up most of your correspondence with other dentists.
19. Develop an Excel[12] spreadsheet for presenting patients' financial options.
20. Brainstorm new Internet functions for your office.
21. Set up an office website including patient pictures and x-rays. Let your patients know how progressive you are.
22. Convert your inventory to a computerized program with e-mail ordering.
23. Pay your taxes through Internet websites.
24. Conduct credit checks on initial exam patients through the Internet.
25. Check insurance benefits at company websites.
26. Obtain a separate e-mail address for each staff member.
27. Assign separate log-ins to each computer so you can target messages throughout the office without getting up and walking around.
28. Decide whether you want to integrate a wireless network at the office and have patients enter their health histories directly into their electronic charts.
29. Decide whether you want to scan all documents, such as HIPAA forms, and totally eliminate paper forms.
30. The options are endless.

Computer Integration in My Office

This section will show how the all-digital integration progressed in my office. I started by meeting with two other orthodontists to see how they used electronic treatment charts and chairside terminals; they also helped me envision my exam questionnaire applications. I then called an orthodontist in New York who has been fully electronic for more than 10 years. These conversations gave me a better idea of where I wanted to go with my upgrade.

My existing practice management system, Kodak PracticeWorks OrthoTrac Classic,[3] offered all the features needed to upgrade to a fully electronic system. I had been using Dolphin Imaging[4] for several years and liked the product, so I gave up the efficiency of using the same company for both practice management and imaging software. Dolphin has since introduced an integrated practice management program.

Following the format of the above checklists, I answered the questions as follows:

Front Desk

• I wanted three work stations at my reception desk. One additional phone line was needed.

Chairside Computers

• I wanted to move immediately into electronic charts, with computer access to digital images, x-rays, and models at each chair.
• I sit in the 11:00 position and wanted the monitors in the 9:00 position, next to the patient's head. Therefore, I needed to mount a pole to the floor at each chair and attach the monitor and keyboard to the pole. On the Internet, we found

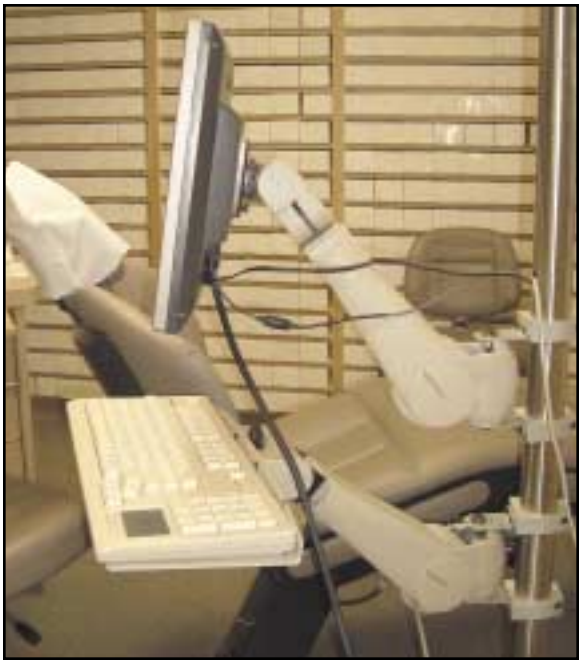

Fig. 2 Ergo arms used to attach monitor and keyboard to pole.

Ergo arms[14] for mounting the monitors and keyboards (Fig. 2). With an amplification box, the CPUs could be placed in another room. (Today, I use dummy terminals and attach the small boxes under the keyboards with straps.) We also found a keyboard with a touch pad (TouchBoard[15]) that eliminates the need for a mouse and makes sterilization simpler (Fig. 3).

Exam/Consultation Room

• I wanted the treatment coordinator's work station to be separate from the consultation table, but also to use a computer at the consultation table to display photographs, x-rays, and demonstration software. Because flat-screen monitors don't require much counter space, we had room for two at the end of the consultation table. This would make it much easier to move between patient images and proposed treatment photos. The treatment coordinator's work station could be a dummy terminal, but we needed a full computer at the consultation table to attach two monitors.

Fig. 3 Special keyboard from Cherry, Inc., with touch pad.

• By using a computer to enter our examination findings directly, we could avoid having to record the diagnostic information manually and then re-enter it later on a computer. Direct entry would also simplify incorporating the information in correspondence to patients and referring dentists.

• We also wanted a printer in the room so we could immediately generate photographs and letters for the patients and parents.

Photography

• The recommendation of Jim Clark at the University of Washington[16] was the Fuji S1[17] (subsequently replaced by the S2), which was available from Washington Scientific Camera[18] with the necessary flash unit and card readers. I exchanged the larger card that came with the camera for several smaller cards. The card reader plugs into a standard USB port on the back of the computer. We noted the image size requirements for computer storage.

• We decided to place the scanner and image capture station in our break room so we could have access to these functions without occupying the x-ray machine. Dolphin needed a phone line connection to the capture station for future technical support, although the company now uses our high-speed Internet connection.

Radiography

• I chose PlanMeca[19] because of its reputation for quality, its capability of interfacing with

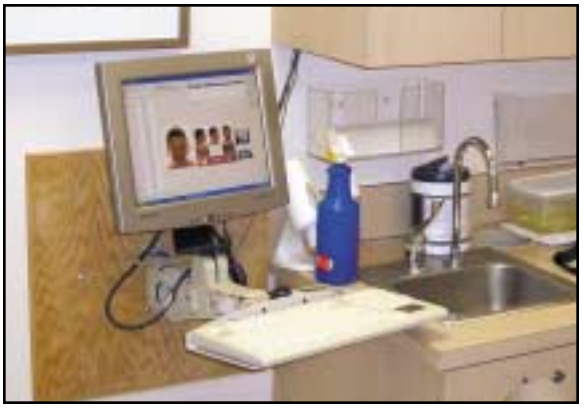

Fig. 4 Ergo arms used to attach monitor and keyboard to wall.

Dolphin for storage and management of the images, and its ease of use. A dedicated circuit was recommended for this unit, which required a conduit to the operating computer and a separate conduit to a control switch outside the room. We noted the cost and the image storage requirements.

• I needed a new computer to run the x-ray machine and obtained the specifications from PlanMeca. The only cabinet in our x-ray room has a sink in it, so I elected to place the CPU inside the cabinet and attach the monitor and keyboard to the wall with Ergo arms (Fig. 4). The scanner for converting x-rays from other offices would be located in the break room next to the image capture computer.

Doctor's Desk

• I wanted private faxes to come directly into my computer. I also wanted to digitize my own x-rays, so I chose a 17" high-resolution monitor.

Additional Work Stations

• We did not need separate work stations for ordering supplies, insurance processing, or accessing credit reports on the Internet; instead, we decided to place one multi-use work station in the break room (Fig. 5). Because HouseCalls cannot work on a dummy terminal, we elected to install its special hardware on the image capture computer.

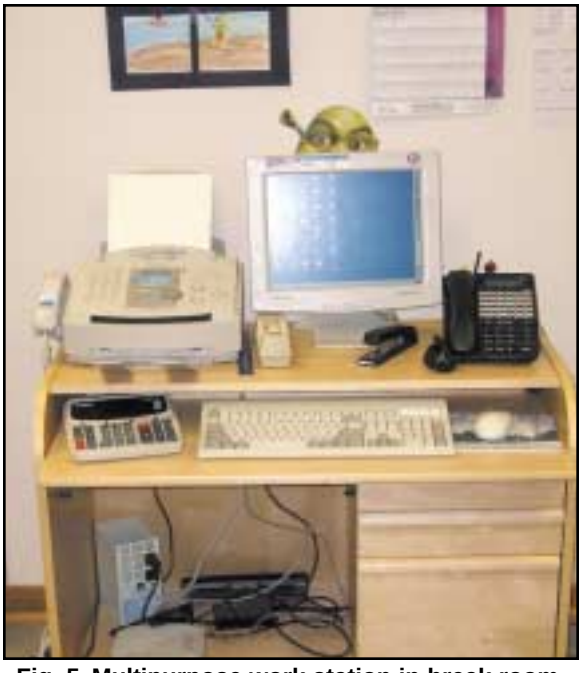

Fig. 5 Multipurpose work station in break room.

• I wanted a work station in the main treatment bay, away from the chairs, for scheduling, monitoring patient flow, and pulling up x-rays for patients on the phone. (It also works well for looking at patient images, x-rays, and treatment chart notes while conferring with GPs on the phone.)

• The work stations that could be dummy terminals were the treatment coordinator stations, break room multi-use computer, reception desk stations, chairside computers, and extra treatment bay computer. We had to use standard desktop computers for the consultation tables, x-ray unit operation, image capture station, and my personal office.

Check-In Station

• I did not want a check-in computer in the reception room, but decided to run a cable for possible future use. We needed space on the recep-

Fig. 6 Computer on front desk for patients to enter e-mail addresses.

Fig. 7 Two computer servers, battery backup, KVM switch, tape backup drives, modem for Kodak OrthoTrac Classic access, and Internet modem.

tion counter for a monitor and keyboard so that patients could enter their own e-mail addresses (Fig. 6). Cabling requirements were noted.

Computer Server

• We placed our servers next to the front desk due to space limitations, but would have preferred to locate them in the break room. I decided to have my computers custom-made locally with Intel[20] processors and purchased Wyse[21] units for the dummy terminals. We needed two servers, because Kodak OrthoTrac Classic runs on the UNIX operating system, and all other functions in my office ran on Windows. We chose to use a single monitor with a KVM switch to preserve counter space (Fig. 7).
• The machines we selected had 70GB hard drives, 1GB each of RAM, mirrored hard drives for data protection, and 20/40-speed backup tapes (40/80 is now available). We decided to back up our office computers on tape at 4 a.m. daily.
• We elected to replace our old Kodak OrthoTrac UNIX server and send the new servers to the company to configure the operating systems. We had to configure our Windows server for Citrix so we could use dummy terminals; today, I would consider Windows 2003 Small Business Server.
• Four uninterruptible power sources and three power surge protectors were needed.
• We chose Norton Corporate Edition[22] antivirus software, which can download an update over the Internet every night and scan the network for viruses.

Printers

• We have two consultation rooms, one of which is located next to our main office printer, so we only needed one additional printer for the second consultation room. We originally were going to print both x-rays and photographs on the same printer, but changed our minds when we found that the x-rays required different paper (a side benefit is the time saved by not having to wait for the images to print).
• Our situation is somewhat complicated because our basic management functions are run by Kodak OrthoTrac Classic on UNIX, but the Windows-based functions require different printer configurations. Therefore, our printer needs could be summarized as follows:

General Office Windows-Based Printer

• Kodak OrthoTrac Classic Connection Windows reports
• Exam questionnaire letters to patients

• Exam and consultation letters to referring dentists
• EMR Windows practice management reports
• HouseCalls reports
• General Internet and office printing needs
• Office checks

We needed two extra paper drawers (for a total of three) so we could simultaneously accommodate plain paper, letterhead, and second-page-quality paper. We also wanted an envelope feeder (Fig. 8).

Appointment Printer at Front Desk

• Appointment cards
• School excuses

Color X-Ray Printer in Break Room

• Glossy, photo-quality cardstock for better images of x-rays

Color Photographic Printer in Break Room

• Glossy, photo-quality paper for better images of photographs

Small HP[23] Printer in Exam Room

• Exam letters and other documents for patients
• Financial summaries

Medium-Size HP Printer Connected to Kodak OrthoTrac UNIX Server

• Initial welcome letters mailed to patients
• Insurance forms
• General Kodak OrthoTrac Classic reports
• Envelope feeder attachment

We needed to run a few extra cables to handle these requirements. The UNIX printers use a serial port on the computer or a Digiport connector sold by Kodak. We would now consider using the combination printer-copier-scanner-fax machines, but they were not available until after our office was set up.

Fig. 8 Large printer with drawers for letterhead, second-page stationery, and plain white paper.

Orthodontic Consultants

• I hired Sue Hanen of Kirkpatrick & Associates[24] to help us convert to electronic charting and set up the exam questionnaire.
• We decided to have Sesame Communications[25] (formerly Pt Interactive) set up our website for patient access to appointment information, financial ledger cards, and all photographic and x-ray images.

Internet Access

• Of the six phone lines into our office, only one was DSL-compatible. We did not have any satellite offices, but wanted to use Citrix software to connect my home to the office.
• We selected a combination firewall router for security and high-speed Internet connection.
• Cabling was needed for the Internet-access phone line at our server location.

Cabling

• We have a drop ceiling on the floor below us, so we were able to punch holes through the floor for simple lateral cabling. We chose 100-base T cables, but today would explore the new 1,000-base T to determine whether it made image transfer significantly faster.
• We found a manual switchboard that would allow incoming lines to be connected on an as-needed basis to various computers around the office for faxing, credit-card processing, HouseCalls, and Kodak modem access (Fig. 9). We have subsequently upgraded our phone system, so that the small manual switchboard is no longer needed.
• We decided to use two computer switches (hubs)—one in the back of the office and one under the receptionist's desk—to reduce our cabling needs. We also made a list of electrical outlet requirements and specifications for the x-ray machine.

Local Computer Networking Specialists

• I had already worked with a local computer networking specialist (RB Paulson Consulting[26]) for several years. I hired this company because I wanted someone who had configured general business offices and could bring fresh ideas for computer applications into our field. We set up an hourly scale with a cap for the project. I ended up being the general contractor, hiring the cabling specialist and electrician and calling the phone company to set up the high-speed Internet connection.
• We also used a specialist from California, One Merchant,[27] to set up our Citrix program and one from Kodak to set up our UNIX server. I found that these national specialists saved the local computer technician hours of time and made our network much easier to configure. The local consultant wrote out all the specifications for each proposed computer and dummy terminal.

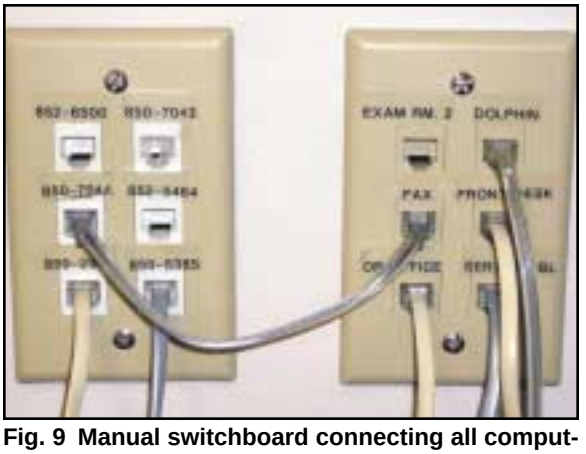

Fig. 9 Manual switchboard connecting all computers to outside phone lines for technical support.

Implementation in My Office

We made a budget of the computerization costs, projected over an 18-month period (Table 1). The implementation went as follows:
1. Ordered the PlanMeca ProlinePM 2002 CC x-ray machine, and had the company send specifications in advance.
2. Ordered the Fuji S1 photographic kit from Washington Scientific Camera.
3. Ordered two servers and three new computers from a local vendor. Ordered eight Wyse terminals from One Merchant. Ordered 14 flat-screen monitors, two color printers, and a Twain scanner online from Buy.com. Ordered five special keyboards with touch pads from Cherry. Ordered 12 Ergo arms from the local representative. Bought a large HP printer with auxiliary drawers at Office Depot. Had the local computer specialist pick up two tape backup drives, 12 tapes, four uninterruptible power sources, three power surge protectors, and two switches. I elected to purchase some equipment directly from stores because of price; buying them through the computer consultant would cost a bit more, but would ensure that the devices were properly configured and allow more expeditious service or returns in the future.
4. Called the phone company to set up our DSL connection and router.
5. Had the electrician run a dedicated circuit for the x-ray machine and power outlets for the new

TABLE 1
APPROXIMATE COSTS OF DIGITAL OFFICE CONVERSION

	Cost in 2001-2002	Optional Items	Current Cost
X-ray machine	$65,000		$48,000*
Plumbing	$1,300		**
Electrical	$5,494		**
Construction/cabinetry	$5,973		**
New carpeting	$12,049	$12,049	**
Painting	$2,300	$2,300	**
Cabling	$2,211		**
Camera	$4,656		$2,900
Computer equipment***	$68,393	$22,000†	$53,000
Computer consultants	$26,466	$12,000†	**
TOTAL	$193,842	$48,349	

*Estimated.
**Unknown.
***Includes terminals, printers, servers, and peripheral items.
†I upgraded three computers that I still could have used; I purchased a new laptop for accessing information at home, a new scanner, an extra-large printer, and Veritas[28] backup software; I replaced some monitors with flat screens; I hired consultants to assist with the conversion to electronic charts, implement our correspondence package, set up new schedule templates, and configure the new backup program.

chairside computers.
6. Had the cabling company run lines to connect all computers to the switches, internal phone lines, and Internet connection.
7. Shipped one new server to Kodak to configure the UNIX software and OrthoTrac Classic system. Shipped the other server to One Merchant to set up Citrix and the dummy terminals.
8. Had the carpenter mount poles next to the chairs for the monitors and a stabilization board on the wall for the x-ray machine (to meet earthquake standards).
9. Had the local computer consultant set up the office network, including double monitors for the consultation tables, dummy terminals, backup tapes, antivirus software, and Internet access.
10. Transferred the OrthoTrac Classic data to the new server by moving the tape drive from the old server temporarily to the new server, loading up all the data, and then disconnecting the old tape backup.
11. Invited Jim Clark to our office to train us on the new camera.
12. Did not need training on Kodak OrthoTrac Classic, which we were already using.
13. Did not need additional training on Dolphin Imaging or the double-monitor consultation.
14. Added and configured the PlanMeca x-ray machine.
15. Configured my home computers to access the office computers with Citrix software.
16. Set up appointments with Sue Hanen to implement electronic charting and our new exam/consultation questionnaires.
17. Converted all paper charts to electronic charts, four months after integrating the x-ray machine with our network.
18. With the help of Sue Hanen, designed a questionnaire for initial exams, treatment plans, recall visits, and debonding letters. We did this at the same time we were converting to electronic charts, but separate implementation would have been easier on the staff.
19. Sent staff members to Dolphin and OrthoTrac users' meetings to help them better utilize the software within the office system and as marketing tools.
20. Developed and added an Excel spreadsheet

for financial options, three months after converting to electronic charts.
21. Set up an office website with Sesame Communications for e-mailing patient reminders and allowing access to appointment and ledger cards; later added all patient images to the website.
22. Converted our inventory to a computer program (Office Inventory Ordering by FoxFales[29]) with e-mail ordering, four months after developing the financial spreadsheet.
23. Started paying taxes through Internet websites.
24. Began conducting all credit checks on initial exam patients through the Internet.
25. Began checking insurance benefits on company websites, where available.
26. Currently integrating a wireless network and tablet PCs into our office. This will allow patients in the waiting room to fill out their health histories directly on the computer and will enable us to send patient images and chart notes throughout the office.
27. Opted not to establish separate e-mail addresses for each staff member.
28. Opted to continue using the traditional call system and not to have separate log-ins for each computer. Adding a program such as V.Com[30] would streamline intra-office communication; for example, the scheduling coordinator could take phone calls and send messages directly to a targeted computer without having to get up. This program can also function as an indicator to the doctor and assistants when patients are ready for their services.
29. Anticipate scanning all documents and completely eliminating paper records.

Discussion

Now that I have been using computers around the office for more than 15 years and have had an all-digital practice for more than three years, I have a good idea of which systems, hardware, and software have had the greatest impact. The following is a list of these changes in order of importance:
1. Digital photography and IACT's CasePresenter[31] demonstration software have made patient communications much more effective. Dolphin software allows us to show patients their malocclusions quickly and help them better understand the need for braces. CasePresenter has been beneficial in demonstrating our proposed corrections. An extra benefit of digital cameras is the assistants' vastly accelerated learning curve in taking pictures and documenting procedures.
2. The addition of a digital x-ray machine, chairside computers, and exam questionnaires would rate a close second in importance. We still take a panoramic radiograph at every initial exam, but the x-rays take one minute compared to 10 with the old film-processing system. We have maintained the quality and thoroughness of our initial examinations while transitioning smoothly into one-step exam/consultation visits. I no longer have to dictate letters to patients and referring dentists. These efficiencies have increased our case acceptance rate, improved our information gathering at initial appointments, and saved me four to six hours of time per week
3. Electronic charts, HouseCalls, and remote access to all office information from home have provided the staff with more time and given me more freedom to stay home. Without the need to pull and refile charts and make confirmation calls, we have saved five to six hours of labor per day. I used to go into the office two or three Fridays a month for treatment planning, but since digitizing all my data, I have not had to spend one extra day in the office in more than two years. I take my kids to and from school every Friday, which is worth the upgrade in itself.
4. The addition of a practice website would be next in order of significance. Our website was designed to help our current patients, not to promote new business. In fact, we've found that our patients really appreciate the e-mail reminders, the access to appointment and billing information, and the ability to look back at their original malocclusions. Patients access this information between 75 and 125 times per month, which saves us countless hours in phone calls. In addition, e-mailing before-and-after images to our

patients has proven to be excellent internal marketing.

5. Online credit reports, financial spreadsheets, and web-based taxpaying would rank next in terms of saving time and money. Accessing online credit reports is fast and easy, and it allows us to better understand our credit risks and tailor financial arrangements for deserving patients. The Excel spreadsheet has saved us considerable time and eliminated miscalculations. Paying taxes on federal and state websites also gains some time each month.

6. Inventory control and e-mail ordering of supplies have not saved us much time, but have given us much better control over our purchasing decisions. Ordering online from Staples, Buy.com, Costco, and Office Depot has made stocking supplies much more expeditious.

7. The least productive electronic change has been accessing insurance information over the Internet. The insurance companies are slow to offer this information on their websites, and we still have to call many of the companies to check on patients' coverage.

Conclusion

Although computerizing my office represented a significant expense, I was able to recoup my costs in 10 months by increasing productivity, converting more new patients, scheduling more one-step exam/consultation appointments, controlling expenses, and avoiding the addition of more staff members as the practice grew. The time savings, although difficult to quantify, were another important benefit.

By following the checklists in this article, you may pick up new ideas for computer applications and shorten the time it takes to integrate your own new systems, making your progress toward an all-digital office more efficient and trouble-free.

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6. IMS Specialty Services, Inc., 43141 Business Center Parkway, Suite 108, Lancaster, CA 93534.
7. New Horizons Software, Inc., 301 N.E. 117th Ave., Vancouver, WA 98684.
8. Ortho II, 1107 Buckeye Ave., Ames, IA 50010.
9. GAC International, Inc., 355 Knickerbocker Ave., Bohemia, NY 11716.
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11. Registered trademark of The Open Group, San Francisco, CA.
12. Microsoft Corporation, Redmond, WA. Windows and SharePoint are registered trademarks.
13. Citrix Systems, Inc., 851 W. Cypress Creek Road, Fort Lauderdale, FL 33309.
14. Ergo In Demand, Inc., 4900 Industry Drive, Central Point, OR 97502.
15. Cherry Corporation, Electrical Products Division, 11200 88th Ave., Pleasant Prairie, WI 53158.
16. Clarkj@u.washington.edu.
17. Fuji Photo Film U.S.A., Inc., Valhalla, NY.
18. Washington Scientific Camera Company, Inc., 615 Wood Ave., Sumner, WA 98390.
19. PlanMeca USA, 100 N. Gary Ave., Suite A, Roselle, IL 60172.
20. Intel Corporation, 2200 Mission College Blvd., Santa Clara, CA 95052.
21. Wyse Technology, Inc., 3471 N. First St., San Jose, CA 95134.
22. Trademark of Symantec Corporation, 20330 Stevens Creek Blvd., Cupertino, CA 95014.
23. Hewlett-Packard, Palo Alto, CA.
24. Kirkpatrick & Associates, 5382 Mount Vernon Preserve Court, Murrayville, GA 30564.
25. Sesame Communications, 411 Strander Blvd., Suite 108, Seattle, WA 98188.
26. RB Paulson Consulting, 607 Lee St., Seattle, WA 98109.
27. One Merchant, Inc., 219 S. El Camino Real, San Clemente, CA 92672.
28. Trademark of Veritas Software Corporation, 350 Ellis St., Mountain View, CA 94043.
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