

Get unwired:

Mobile computing in the dental office

Join the wireless world. Tablet PCs, smart displays, and PDAs are among the wireless devices making mobile computing more practical in the dental office.

By Dr. Larry Emmott



DR. LARRY EMMOTT

Thanks to wireless technology, one of the most exciting developments in computer technology is that computers have gone from static, stand-alone, desk-bound lumps to completely mobile handheld devices that are in constant contact with the entire world.

We've come a long way. In 1951, UNIVAC (Universal Automatic Computer), the first commercial computer, made its way into computer history. Sold to the U.S. Bureau of the Census, UNIVAC stored information on magnetic tape rather than punched cards. It was 25 feet by 50 feet, weighed eight tons, and cost close to \$1 million. It had a data processing speed of 2.25MHz and a memory capacity of 1,000 words.

Today, just over 50 years later, we can buy a mobile computer that is smaller than a briefcase, weighs five pounds, and costs about \$1,000. It has a speed of 2 GHz and a storage memory of 40 gigabytes.

To put this in perspective: If cars had developed in the same fashion, a sedan that sold in 1951 for \$2,000 and got 12 miles to the gallon would today sell for \$2 and get 12,000 miles per gallon.

Computers have gone from exotic monsters filling an entire room, to simple handheld devices that anyone can own. However, it sometimes seems like we are still fighting to fit an eight-ton UNIVAC into our dental treatment rooms. This is because computers are bulky and take up scarce treatment-room real estate; their monitors are heavy and require expensive mounts to use, and there are wires everywhere. One solution to this problem is to use smaller mobile computers. Until recently, this meant a laptop computer.

Laptops are small, but using one in a dental treatment room presents many problems. The most significant problem is that, to be really useful, the data on the laptop needs to be connected to an office-wide network. To do this, the laptop needs a wired network connection, making it small, but immobile.

In the last two years, several new technologies have emerged that make the use of mobile computers in dentistry more practical. The first is the development of fast, reliable, and secure wireless networking. The second is the development of new mobile devices, such as tablet PCs and smart displays.¹

Welcome to the wireless world. In this article, we look at three mobile computing devices: tablet PCs, smart displays, and PDAs.

See also four related sidebars: "The limits of wireless devices" on page 52, "Mobile devices: a time line" on page 90, "Wireless specifications: the 802.11 family" on page 91, and "Computer terms" also on page 91.

1 Tablet PCs (Think computer)

A tablet PC is the next generation of the laptop. Tablets come in two basic variations—slate and convertible (see photos below).

Slate-style tablet. A slate-style tablet has no keyboard. It is simply a flat computer, like half a laptop. Data is entered by touching the slate's screen.

Convertible tablet. A convertible tablet is a traditional-looking notebook

1



(a)



(b)

Slate tablet (a) The portable Lightyear digital x-ray system from Lightyear Technology is available configured on a slate tablet computer (left). Here, a patient views her digital x-rays chairside with her doctor while holding the tablet in her lap. The tablet also can be carried around from operator to operator. The tablet incorporates touchscreen software and fully integrates with practice management systems. It also allows instant wireless communication to other practice computers and workstations. (For more information, go to www.lightyeartechnology.com; or call 866-946-2431.)

Convertible-style tablet (b) The Toshiba Portégé 3500 Convertible Tablet PC computer is a traditional-looking notebook (far left photo), whose screen can swivel and fold down to cover the keyboard converting it into a tablet PC (right photo). The Toshiba tablet is powered by the Microsoft Windows XP Tablet PC Edition operating system. It has a 12.1-inch diagonal display, weighs 4.1 pounds, and is 1.3 inches "thin." (For more information, go to Toshiba's Computer Systems Group (CSG) Web site: www.csd.toshiba.com; or call 800-457-7777.)

2

Smart display. Geared for office use, the DOT (Digital Operatory Tablet) smart display from Video Dental Concepts (below) allows users to access a wide range of practice- and image-management applications, including digital x-rays. An onscreen keyboard for data input pops up by pushing a button at the bottom of the screen. Another bot-

tom button can be pushed for e-mail access. A stylus, housed at the top of the screen, allows for touchscreen input. The smart display can be used chairside, in the reception room, or in the consultation room. (For more information, go to www.videodental.com; or call 800-323-2690.)



whose screen can swivel and fold down to cover the keyboard and become a tablet.² Its benefit is that you always have a full keyboard with you.

Both slate and convertible tablets connect to the office network using one of the protocols in the 802.11 wireless family—most often, the 802.11b protocol (see details on page 51.) The wireless connection allows the user true mobility. A user carrying the tablet can move from room to room; make entries while walking down the hall; send a message to the front desk; and access charts, photos, x-rays, health information, prescription data, and even the Internet from anywhere in the office.

Tablets most often use Microsoft's Windows XP Tablet PC Edition, a version of Windows XP. In theory, though, any software application that runs on XP can be run on a tablet. In practice, some applications do better than others. Be sure to check with your software-support department before trying to use a tablet PC.

2 Smart displays (Not a computer)

A smart display looks like a slate-style tablet, but it is really quite different (see photo above). To use a smart display you still will need a computer; the smart display, however, will take the place of the monitor, the mouse, and the keyboard.

In other words, a smart display is not a computer. Rather, it is a wireless, flat-panel, touch-screen monitor and an input device. The roles of the monitor and the input device are as follows:

Monitor. A smart panel is a monitor. You use it to view the output of your computer.

Input device. A smart panel is also an input device. You use it to enter data, for example, by tapping on the screen. The input device, though, could be anything used to input data, including a mouse, a keyboard, a glide pad, a barcode scanner, or

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a touch pad.

The smart display connects to a typical computer box, again using one of the wireless specifications in the 802.11 system. (To date, most smart displays use an 802.11b wireless connection, but some are set up for 802.11g.)

And here are some other characteristics of smart displays. Like tablets, smart displays require Microsoft Windows XP and will work with any Windows XP compatible software.

From a practical standpoint, the use of a tablet and a smart display in the dental office will be virtually the same. They

look a lot alike and seem to function much the same. So what is the difference?

A good analogy is the telephone.

A *smart display* is like a cordless phone. It needs a base phone to operate, and it is only useful in your home. If you take it out of town, it is useless.

A *tablet PC* is like a cell phone. A cell

phone is a fully functioning phone that will work anywhere. A tablet PC is a fully functioning, self-contained computer that will work anywhere.

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The limits of wireless devices

Wireless devices have their limits, as Dr. Larry Emmott explains below.

What makes the use of mobile computing devices practical in the dental office is their wireless network connection. However, while the 802.11 protocol that drives that connection has been a great advancement in wireless, it has its limits in terms of speed, range, security, power, and imaging capabilities.

Speed. The data-transfer rate with a wireless device is about one-tenth as fast as it is with a wired network. Nevertheless, the rate is fast enough for most every computer task we do in the dental office, with the possible exception of full-motion streaming video. However, advanced wireless specifications already are coming out that will increase the data transfer speed dramatically.

Range. Although generally reliable, wireless networks do have a limited range of about 100 feet. Building walls will degrade wireless connections and reduce their maximum range. Also, other electrical activity in the area can interfere with a signal.

Security. Another wireless concern is security. It is possible for anyone walking by your office with a wireless-network receiver to connect to your office computer system. To prevent this, the wireless network needs to have in place security measures, such as encryption, passwords, and firewalls.

Power. Another mobile limitation is power. Mobile devices run on batteries, and batteries have a limited life. At best, a mobile device will deliver three to four hours of service, and it could be much less time depending on how the device is used. To get a full day's use from a mobile device, the user either will need to have multiple battery packs or will need to constantly return the mobile device to a docking station for charging.

Imaging. Some dental computing functions—such as image capture, patient-education videos, and cosmetic imaging—will be difficult or impossible to do with a mobile device like a tablet or smart display. Some treatment rooms still will need a regular box-style computer for these functions.

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3 PDAs (Personal Digital Assistants)

A third mobile device (and more common than the tablet and the smart display), is the handheld Personal Digital Assistant (PDA). PDA refers to a family

PDA. The Discus Dental Rover handheld pocket PC (right) provides ready access at home or in the office to appointments, task lists, and e-mail, along with the ability to view all past, current, and future scheduled appointments by day or by chair. The PDA also provides ready access to referral contact information. Its Rover software also is password protected to bring it into compliance with the Health Insurance Portability and Accountability Act (HIPAA) privacy rules. (For more information, go to www.discusdental.com; or call Discus Dental Inc. 800-442-9448.)



of handheld computers, such as the Palm (from Palm Inc.), the Visor (from Handspring), and the iPAQ pocket PC (from Hewlett-Packard).

Actually, PDAs don't seem to have a lot of practical applications in the dental office, but they are a great way to take office data home with you. Many practice-management programs allow users to download practice information to a PDA. The data can include a daily call list, prescribing information, patient data, and limited schedule information.

Some PDA programs even allow for two-way data transfer. For example, suppose you take an emergency call at home in the evening from a patient. Then on your PDA with two-way data transfer, you check your office schedule for the next day and make an appointment for the emergency patient. When you return to the office the next morning, you transfer the new appointment for that patient from your PDA to the office's main computer system.

And new handheld devices, such as Handspring's Treo communicator, come with a PDA and wireless phone in the same device. Treo includes a mobile phone, a 16-megabyte Palm operating system (OS) organizer, e-mail, and Internet access.

In the last 50 years, we have gone from the eight-ton UNIVAC to the five-pound tablet. I can't predict what the next 50 years will bring, but I do know this: The future

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What's online

You'll find more information about tablet PCs, smart displays, PDAs, and related products along with links to companies that make these products on our Website—**dentalproducts.net**—under the "Computer Technology—Hardware" category. Go to "Search Contents—Products" on the home page to begin your search.

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is coming and it will be amazing! **DPR**

Dr. Larry Emmott, a recognized authority on dental technology in America, is a practicing general dentist in Phoenix. He also is an award-winning professional speaker, a featured instructor at the Las Vegas Institute, and a member of the American Academy of Dental Practice Administration. He has written hundreds of articles on dentistry,

computer use, and management. He also writes a monthly electronic newsletter, "Emmott on Technology," on using dental technology effectively. Dr. Emmott offers hands-on technology seminars to selected dentists in his Phoenix office (the next one is Oct. 3-4). Plus, this summer (July 14-17), he is holding a technology seminar in Sedona, Ariz., that combines biking in the morning and classes in the afternoon. At these seminars you will receive personalized advice on setting up your office to maximize your high-tech future. Topics include digital radiology, cosmetic imaging, and treatment room design. To find out more, check out Dr. Emmott's Web site at www.drlarryemmott.com, or call him at 602-279-1641.

References

1. Emmott, L. Report from Comdex 2002: 6 up-and-coming dental office technologies. Dental Products Report. 2003;37(1)34-39. (Note: To access this article online, go to our Web site, dentalproducts.net, move your cursor to "Search Content," and scroll down to "Article Index." The article is listed in "Management Articles" for January.)
2. Konstantinos, K. The Tablet PC strives to redefine. PC Magazine Nov. 7, 2002. Available at: www.pcmag.com/article2/0,4149,669346,00.asp. Accessed May 6, 2003.

Photo credits

- Photo of Lightyear portable digital x-ray system/slate tablet on page 50, courtesy of Lightyear Technology.
- Photo of Digital Operatory Tablet (DOT) smart display on page 51 and to the right, courtesy of Video Dental Concepts.
- Photos of Toshiba's Portégé 3500 Convertible Tablet PC on page 50, courtesy of Toshiba's Computer Systems Group (CSG), a division of Toshiba America Information Systems Inc.
- Photo of Rover handheld pocket PC on page 54, courtesy of Discus Dental Inc.

Mobile devices: a time line

Dr. Larry Emmott takes a look at the development of mobile devices, from the early 1980s to the present.

1980s-1990s

Laptops—First introduced in the early 1980s, laptops came into general use in the 1990s. Although laptop components have improved, its basic design hasn't changed in years. Laptops were a great mobile computing breakthrough, but they were stand-alone computers. To connect to a network or the Internet required a wired connection, which meant the computer was no longer mobile.

1993-1996

Palmtops—Now called Personal Digital Assistants (PDAs), a palmtop is a handheld computer that fits in your palm. Apple Computer introduced these devices in 1993. They didn't become popular, though, until the Palm (from Palm Inc., then owned by U.S. Robotics Corp.) introduced them in 1996. Most PDAs are used as nothing more than electronic appointment books and phone books. However, they have the potential to do much more.

2000

Tablets—The first tablet prototypes were introduced in 2000. However, the concept had been in development for years. Tablets are like laptops without the keyboard. That makes them lighter and more like using a notepad or piece of paper. The user simply holds the slate in one hand and writes or taps on the screen with the other.

2000

Wireless—What truly makes a computer mobile is the ability to send or receive information on the move. As long as the computer needed a wired connection, it wasn't really mobile. The wide acceptance of the 802.11b Wi-Fi highspeed wireless network specifications in 2000 finally freed the computer from the cord.

Note: Wi-Fi is short for "wireless fidelity"; it is meant to be used generically when referring to any type of 802.11 network.

2002

Smart Displays—A smart display (photo left from Video Dental Concepts) is not a computer; it is a mobile monitor and input device: The computer is static, but the user can move around. She is not bound to a desk by a wired monitor, keyboard, and mouse. Again, what makes this possible is wireless 802.11 connections.



Wireless specifications: the 802.11 family

"802.11 refers to a family of specifications developed by the Institute of Electrical and Electronics Engineers (IEEE) for wireless Local Area Network (LAN) technology," according to Webopedia, an online dictionary for computer and Internet technology (www.webopedia.com).

Webopedia's explanation of the 802.11 wireless protocol follows:

802.11 specifies an over-the-air interface between a wireless workstation and a base station or between two wireless stations. The IEEE accepted the specification in 1997.

There are several specifications in the 802.11 family as follows:

802.11 Applies to wireless LANs and provides 1 or 2 megabits per second (Mbps) transmission in the 2.4GHz band.

802.11a An extension to 802.11 that applies to wireless LANs and provides up to 54 Mbps in the 5GHz band.

802.11b (Also referred to as 802.11 High Rate or Wi-Fi)

An extension to 802.11 that applies to wireless LANs and provides 11 Mbps transmission in the 2.4GHz band.

Note: 802.11b is the standard used in most devices for dentistry

802.11g Applies to wireless LANs and provides 20+ Mbps in the 2.4GHz band.

Source: Webopedia; accessed May 12, 2003.

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Computer terms

Bit Short for binary digit, the smallest unit of information on a machine. A single bit can hold only one of two values: 0 or 1.

Byte Abbreviation for binary term, a unit of storage capable of holding a single character. On almost all computers, a byte is equal to 8 bits.

Giga- One billion

Gigabyte (G or GB) A unit of computer memory/data storage. One G represents 1 billion bytes.

Gigahertz (GHz) A measure of processing speed. One GHz represents 1 billion cycles per second. The speed of microprocessors often is measured in GHz.

Mega- One million

Megabits (Mb) One million bits. The speed of data transfer is often measured in megabits per second (**Mbps**).

Megabytes (MB) A unit of computer memory/data storage. One megabyte represents 1 million bytes.

Megahertz (MHz) A measure of processing speed. One MHz represents 1 million cycles per second.

Sources: Webopedia; accessed May 12, 2003.
The American Heritage Dictionary, 4th ed. New York, NY: Dell Publishing/Random House Inc.; 2001.

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