

## FEATURES SECTION

# Current Products and Practices

## Personal Digital Assistants in Orthodontics

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Personal Digital Assistants (PDAs) have certain advantages over conventional diaries and are thought of as the 'electronic filofax'. They can be backed up, used for personal and professional organization, integrated with mobile phones for email and Internet access, image storage, logbook functions and audit. They are limited when used for desktop functions. This article attempts to highlight the current advantages and disadvantages of PDAs for use in orthodontics, and provides some guidance to those who are considering the purchase of such a device.

*Key words:* Personal digital assistants, orthodontics

### Introduction

Personal digital assistant (PDA) is a generic term for a variety of portable hand-held electronic devices, which share many of the functions of desktop computers. They are controlled with a stylus and a touch screen, where the user can click on icons/buttons. Like the desktop computer market, the PDA market is constantly and rapidly advancing, with faster, more powerful PDAs becoming available on a monthly basis (Figure 1). This is paralleled by the vast range of PDA software available. These advances have enabled PDAs to be put to use in a range of clinical settings, which would not have been possible 5 years ago. They can provide a readily available, point-of-care clinical reference, patient information and data communication system.

PDAs are already used in a number of healthcare specialties, such as pharmaceuticals, radiology, nursing care, medicine, paediatrics, psychiatry, head and neck surgery, urology, anaesthetics and nephrology.<sup>1–11</sup>

PDAs are a convenient way to:

- organize daily schedules
- take notes
- record voice memos and lectures

- write and rehearse PowerPoint presentations
- collect audit data in clinics
- compile logbooks in clinics/theatre
- view journal articles, clinical photos and movies

Questions such as 'What were the details of that interesting patient I saw last year that I want to write up?', 'What clinics do I have today and in which hospital?' and 'Where did I put those post-it notes containing a colleagues contact details' may become a thing of the past, with the help of PDAs.

However, there are currently limitations with PDAs:

- *Screen size.* The typical screen size of a PDA is in the region of 240 × 320 pixels. A laptop is typically 1024 × 768 pixels, i.e. a factor of 10.
- *Battery life is limited.* A colour screen consumes more battery power than a monochrome screen and battery life is typically a few hours with continuous use.
- *Memory limitations.* At the time of writing, the best PDA has 128 Mb for storing programs and as RAM. The average laptop has 80 Gb for program/data storage and 512 Mb working memory (RAM).
- *There is no standard connection to charge them up.* They all use different chargers (even between the same companies) and there is no universal charger



**Figure 1** Some varieties of PDAs available (past and present)

available. This can result in excessive accessories for the heavy user.

## Choosing a PDA

There are a plethora of different models of PDA available from a variety of manufacturers, making it difficult to know which one to choose. Apart from asking yourself what you will mostly use a PDA for (e.g. diary/address book versus recording clinical data/looking up clinical information), there are several questions to consider before deciding which model is most likely to match your needs:

- Which Operating System should I go for?
- How much am I willing to spend?
- What processor speed will I need?
- Do I want a monochrome or colour screen?
- How much memory do I need?
- Which data-entry system do I prefer?
- Do I need wireless Internet connectivity?
- What extra options do I want? For example, voice recording, MP3 player (this is a high quality, but compressed audio file and is abbreviated for Motion Picture Expert Group 1, level 3) or digital camera.
- Can I use the PDA as a mobile phone as well?

The following paragraphs provide information on each of these questions and will hopefully make it clearer as to which type of PDA to opt for.

### *Operating system*

The vast majority of new PDAs use one of 2 major operating systems (OS), Palm OS or Pocket PC (a third OS known as EPOC exclusive to Psion has now been

phased out). The main difference between the two is that the Pocket PC looks like Microsoft Windows, whose familiarity may be appealing to those already used to this style of interface on their personal computer. However, Palm OS has its own, user-friendly style, which is generally more efficient, as it uses less processing power to run and has been designed solely for a hand-held interface. As Palm OS has the greater market share, there are more healthcare programs available for these devices, adding to their potential uses. Also, it may be worth finding out which OS most of your colleagues use, as information can only be transferred (beamed) between devices that use the same OS. Available brands running on Palm OS include Palm, Acer, Handspring and Sony. Pocket PC brands include Compaq, Dell, Casio, HP, Acer, NEC, Phillips and Toshiba.

### *Price*

Palm OS devices are usually cheaper than Pocket PC machines, reflecting their smaller processing power required. High end Palm OS models however, are comparable in price and specification to high end Pocket PCs. At the time of writing prices can range from £60 for basic Palm OS devices, to £500 for higher range Pocket PC and Palm OS models. £150 is sufficient to buy a device with enough memory and processing speed to meet the needs of most healthcare PDA users and take advantage of the majority of uses discussed in this article.

### *Processor speed*

In general, the faster the processor speed, the faster a PDA will perform tasks. Palm OS devices tend to be extremely efficient, so are able to perform a wide range of tasks at processing speeds of 33–144 MHz. For comparable levels of performance, Pocket PC devices require faster processors. If you want to frequently search large databases (e.g. detailed logbooks) or view a lot of high resolution images or movies, then you should opt for the fastest processor you can afford (400 MHz is the fastest processor currently available on a PDA).

### *Colour*

More basic Palm OS machines tend to have cheaper, monochrome displays, with Pocket PC devices and high end Palm OS machines, using colour screens. Opt for a colour screen if you can afford it, as it will greatly enhance the pleasure of using a PDA. These provide clearer images in low light conditions and allow impressive picture images, although this results in a

shorter battery life. Another aspect that determines quality of image, is screen resolution. Generally speaking, the higher the resolution, the sharper the images and text will appear. All Pocket PC devices come with a screen resolution of  $240 \times 320$ , allowing excellent viewing. This used to be far superior to older Palm OS devices, which only had a  $160 \times 160$  resolution, but now, many medium to high range Palm OS devices come with a  $320 \times 320$  screen resolution.

### *Memory*

Memory is required to store software applications and data files. Pocket PC devices usually have 32 or 64 MB of built-in memory, with Palm OS devices coming with 8, 16, 32 or 64 MB. Both systems allow extra memory to be easily added to most models, through the insertion of Secure Digital (SD) or MultiMedia memory cards into expansion slots. These can be used like very small floppy discs (although they hold far more information than floppy discs) and are available in sizes from 32 to 512 MB, costing from £20 to £180 depending on their capacity. It is worth being aware that memory requirements between PDAs and desktop computers differ such that, a document which may occupy 15 MB memory on a desktop, may only use 1 MB on a PDA. A memory of 32 MB is a reasonable level to begin with, as this allows for a good range of information storage and software applications.

### *Data entry system*

Instead of a keyboard, the majority of PDAs use a pen-like stylus with handwriting recognition software and a touch-sensitive screen for data input. Alternatively, an on-screen keyboard can be used where you tap each letter with the stylus. Palm OS devices come with a program called *Graffiti*, while Pocket PC devices come with *Transcriber*. Both these programs require that you learn a predefined set of pen strokes to form characters.

If you do not want to learn to use the handwriting recognition method, you should opt for a PDA that has a miniature built-in keyboard to enable data entry. It is also possible to purchase folding keyboards that plug into PDAs to allow reasonable typing.

### *Communications/email*

Most PDAs are able to access the Internet through either wired or wireless connections. Wireless connections are available with the more expensive PDAs and come in the form of either Bluetooth or Wi-fi (wireless fidelity) technology, which allow the sending and receiving of email, downloading articles of interest and

looking up information whilst on the go. However, general web browsing is not ideal on a PDA because of the small screen size. Bluetooth also enables PDAs to communicate with devices (such as printers, digital cameras, other PDAs and computers) that also have Bluetooth technology, allowing easy wireless transfer of information. Neither Bluetooth nor Wi-fi give you direct access to the Internet; typically one has to be within a few metres of an Internet connection.

### *Extras*

Pocket PC and higher end Palm OS devices generally come with features such as voice recording or audio and video players as standard. Some models have integrated digital cameras, although add-on cameras are available for both systems. However, the picture quality is generally not as good as that obtained using a standard digital camera and is unlikely to be of value for orthodontic use. Although it may be tempting to spend a bit more for these extra options, they are by no means essential if a PDA is to be mostly used for organizational and simple patient management purposes.

### *Migration of mobile phone and palm device*

A PDA can act like a standard GSM (Global System for Mobile communication). The misnomer is to confuse GSM with GPS, which is 'Global Positioning System' or satellite technology.

Examples of mobile phone's and palm devices are the Handspring Treo series 270, 300 and 600 (Figure 2). They are available (Subscriber Identity Module 'SIM' or SIM free) and no contract is required. It can be used for connecting to the Internet by either using standard GSM technology as used in most mobile phones or by GPRS (General Packet Radio Service). GPRS has the advantage that you are billed for the band width you use, that is, you are billed per megabyte, rather than per second. With GPRS you pay for the data transfer, i.e. for band width, cost per megabyte basis, rather than cost per line basis. GPRS is expensive, is also available for standard laptop machines and does not require another computer in order to connect to the Internet. Whether you connect via GSM or GPRS, it is a very expensive way of connecting to the Internet.

With the increasing development of more sophisticated mobile phones, many of the functions currently available as PDAs may be incorporated into mobile phones.

New devices are reaching the market all the time and Table 1 is an example for illustrative purposes. It does not constitute any recommendations for devices.



**Figure 2** The Handspring Treo PDA is able to function as a mobile phone

## Synchronization

To use a PDA to its full potential, it needs to be connected and synchronized with a desktop/laptop PC. Synchronization allows data on the PDA and main computer to be the same. It also allows data back-up as PDAs are very easily lost and damaged. Palm devices batteries fail, and all memory can be lost via loading faulty software, internal battery failure and physical damage. Regular synchronization with a PC will allow data recovery. Initial data input into a new PDA may be easier via a desktop/laptop and their transferred onto the PDA.

Synchronization may be achieved by one or several of the following methods:

- *Infra-red*: This is one of the easiest ways of synchronizing with a computer. No cables are required and it allows data to be kept up-to-date.
- *Cradle*: The PDA is placed in a supplied cradle, which is then connected to a desktop/laptop, but it is awkward to carry.
- *Cable*: This consumes space and can become confusing as the user eventually moves on to different PDAs
- *Bluetooth*.
- *Wi-fi*.

In addition, each PDA comes bundled with a different range of software sufficient to perform the most basic functions, however, to take full advantage of the capabilities of your PDA, additional software is usually required. Some programs are listed in Table 2. Most programs are available as free time-limited demos so you can give them a try before you buy.

## Uses of a PDA in Orthodontics

There are some practical examples of how a PDA can be employed in the clinical environment by orthodontists.

**Table 1** Comparison of different PDAs and their capabilities

	Diary, address book, organizational purposes	Patient management, reference source and recording clinical information	Patient management, reference source, etc., + wireless Internet connectivity, voice recording, etc.
Examples of PDA models	Palm IIIxe Palm III Palm Zire	Palm Tungsten E Palm m130 Dell Axim X3	Palm Tungsten T3 HP iPAQ 45550 Toshiba Pocket PC
Approximate cost	£60	£150	£250–£500
Processor speed	16–33 MHz	33–300 MHz	400 MHz
Colour screen	No	Yes	Yes
Memory	2–8 MB	8–32 MB	32–128 MB

### Reading/accessing journal articles

Manufacturers claim that PDAs are a useful way of keeping journal papers available for quick and easy reference. They can be used for this, but are far from ideal due to their small size. Patients can be provided with the latest, evidence-based information regarding the feasibility of clinical procedures including risks.

There are a number of ways to transfer a paper from a journal onto your PDA (as long as the copy is for personal use only, journal copyrights will not be infringed):

- A PDF (Portable Document Format) copy of the paper may be downloaded from the journals website and copied directly to the PDA and viewed with specific PDF reading software (e.g. Acrobat Reader)—this is the best option as colour figures and tables will be retained.
- A paper copy of the journal paper can be scanned onto a desktop computer and processed with optical character recognition (OCR) software to convert it into a text file. The file can then be transferred to the PDA. This method has the advantage that the text file can easily be edited with the PDA word processing software, but the disadvantage is that images will not be viewable due to their large file size.
- Digital photographs of the journal paper can be transferred onto the PDA in JPEG format and viewed with image viewing software (e.g. AcidImage or PhotoBase). This method is cumbersome, but allows clinical images to be viewed on the PDA when PDF versions of the paper are unavailable.

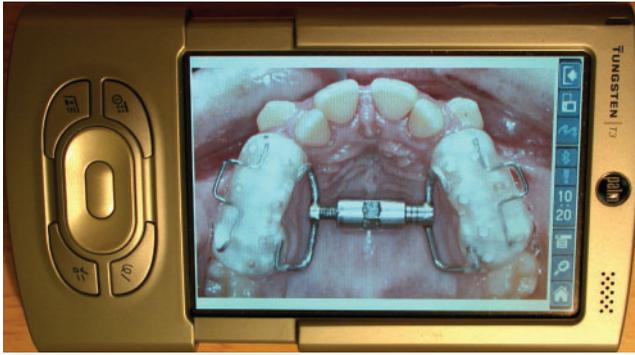
### Lecture/meeting notes

Short notes can be taken during lectures, presentations and meetings, and can serve as a useful and easily edited permanent record for later reference. However, detailed and extensive note taking is difficult because of the limited speed of data entry possible using the standard data input methods available on most PDAs. There are two ways to significantly increase data entry speed to enable full note taking during lectures:

- External portable and foldable full-sized keyboards are available for most PDAs and allow full-speed touch-typing, e.g. Palm Keyboard or Foldable Keyboard for Pocket PC. Some users find this awkward to set up and very hard to use. These cost approximately £80.
- Data entry speed enhancement software allows automatic completion of words and phrases during typing, e.g. TextPlus. With this software, when one or more letters of a word or phrase is entered, the program displays a list of words and phrases whose spelling begins with these letters and can be automatically inserted into the text. The limitations are that any pre-emptive text processor can misinterpret abbreviations. This can be re-programmed, but is time-consuming.
- Some devices like the Treo and Blackberry have built in mini keyboards (Figure 2). The keys are small, but are usually back-illuminated and can be used in the dark. However, they are slow and suited for Short Message Service (SMS) messages, rather than for writing long essays.

**Table 2** Useful PDA software

Title	Manufacturer	Functions
Documents to Go premium edition	DataViz	Enables storage and editing of Word, Excel, PowerPoint and Outlook email files
Adobe Acrobat Reader for Palm OS or Pocket PC	Adobe	Allows viewing of portable document files (PDF) complete with images
HandBase	DDH Software	Customizable database ideal for audit, surgical logbooks and collecting clinical data. Useful for clinicians.
AcidImage	Red Mercury	Facilitates viewing of all common digital image formats. Images can be magnified—ideal for viewing clinical photos (for Palm OS only)
TextPlus for Palm OS	Smartcell Technology	Intelligent dictionary-based program, which greatly increases the speed of text entry (for Palm OS only). The Textplus Medical database includes medical terminology.
TealLock for Palm OS or SafeGuard PDA for Pocket PC	TealPoint software Utimaco software	Advanced security software which encrypts and password protects data on your PDA—essential if you intend to store patient data



**Figure 3** Clinical cases can be monitored

- Hand-writing recognition software, such as Palm Graffiti. This allows you to write in directly, but it is slow and doesn't always recognize what you write.

#### *Digital image/video storage*

Digital images and video clips can be transferred from digital cameras or camcorders via a computer onto the PDA. These can then be viewed with appropriate software (e.g. PhotoBase or AcidImage for still images, and Kinoma Player for movie clips). Clinical photographs and movie files transferred in this way can be useful for monitoring case progression or treatment stages (Figure 3). The small screen and limited memory restrict this function. Some people may find insufficient resolution from these images (76.8 Kp versus an average digital camera of 3 Mp—1/40th of a resolution of a digital camera).

#### *Presentations*

PowerPoint presentations can be stored and edited on the PDA using software such as Documents To Go or QuickOffice Pro. This works very well for presentations with text and images only, but not for those with animations or video clips (Figure 4).

Presentations can also be viewed and rehearsed with an on-screen timer. However, the lack of memory and small screen size make this cumbersome and awkward. PDAs are generally more suitable for text presentations and for small tables.

Using additional hardware presentation devices (e.g. Pitch Solo), it is also possible to deliver PowerPoint presentations from the PDA via a VGA video projector, without the need for a laptop or desktop computer.

#### *Audit*

PDAs are ideal for performing on-going personal audit or clinical audit projects. Audit data can easily be



**Figure 4** PowerPoint presentations containing images are generally of low quality

collected at the point of contact (e.g. in the clinic) and recorded in a spreadsheet, text or database file. There are several powerful database applications ideal for audit purposes, such as HandBase, which allows highly customizable data entry and facilitates easy transfer of collected information into a spreadsheet allowing statistical analysis. In the UK, to ensure patient confidentiality and compliance with the Data Protection Act, patient data must be stored carefully (see Security and data protection).

#### *Clinical logbooks*

Clinical logbooks are now an essential part of most clinical training programs. PDAs are ideal for collecting data in clinic/theatre.

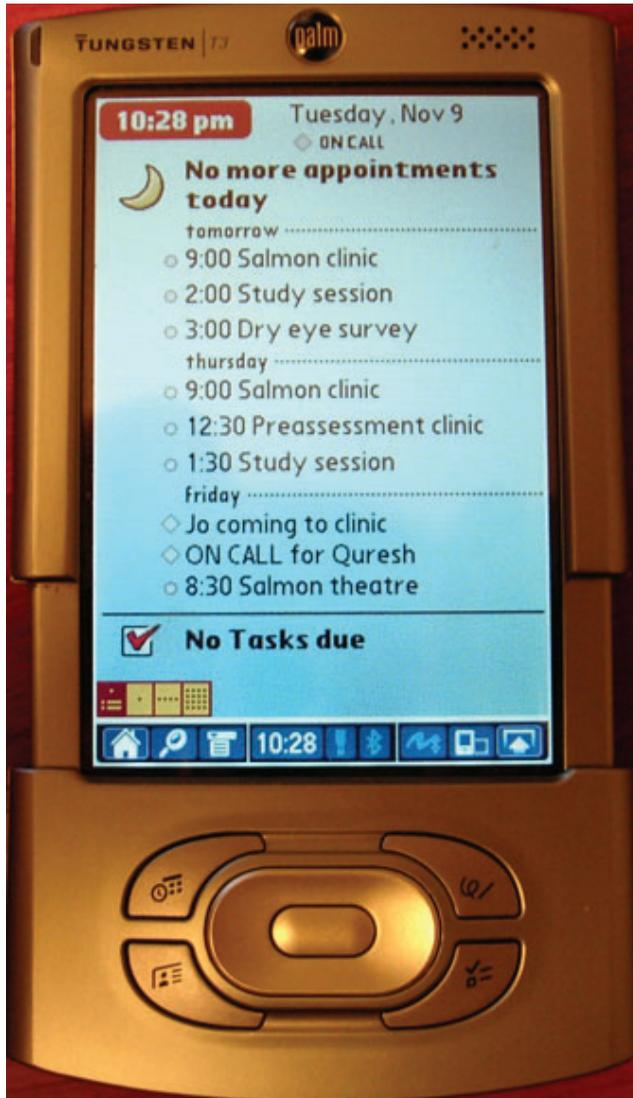
#### *Personal information management*

Standard diary, personal contacts and note-taking functions help to organize personal and work-related information into one compact package, eliminating the need for multiple scraps of paper or large diaries (Figure 5).

Information can be securely protected by a password, and readily backed-up and synchronized with a home or office computer.

#### *Patient information management*

Using commercially available patient tracking software or easily configurable database programs (e.g. HandBase), patient details (such as diagnosis, treatment plan, investigation results, follow-up dates, etc.) can be safely stored in password protected and encrypted files, ensuring patient confidentiality. In addition to using built-in security measures, it is important to ensure that no personally identifiable patient data is stored on your



**Figure 5** PDAs allow at-a-glance organization of one's personal and professional commitments

PDA (see Security and data protection). Using such programs, it is easy to build up clinical databases of groups of patients with common diagnoses, and this is particularly useful when conducting clinical studies and trials.

As far as the authors are aware, only one specific type of orthodontic software for patient management is available for use and is available as a trial version as freeware.<sup>12</sup> It functions mainly as a patient database, records the treatment plan and cephalometric data.

## Security and data protection

All PDAs have basic built-in security features, which allow the information stored on the PDA to be protected

by an owner-defined password. However, sophisticated criminals may be able to bypass these passwords. Proprietary software such as TealLock (for Palm OS) or SafeGuard PDA (for Pocket PC) enables advanced encryption of data and offers a high degree of data protection in the event that your PDA is lost or stolen.

In the case of identifiable patient data, the 1998 Data Protection Act in the UK requires you to gain the patient's consent to process personal data. The act also specifies that data must be: processed for limited purposes; relevant and not excessive; not kept for longer than necessary and secure.

## Conclusions

- PDAs are increasingly popular handheld devices.
- They have many useful applications in the clinical environment, e.g. recording data in outreach clinics, handover of information to colleagues, recording operation dates, recall visits, etc.
- They are useful for accessing journal papers and clinical reference sources, taking lecture notes, performing research and audit, compiling patient log-books, aiding clinical decision-making and examination, preparing presentations and improving personal time management.
- Many healthcare colleagues are already using them.
- A niche exists for more Orthodontic software.
- Frequent synchronization and data back-up is essential for protecting valuable data.
- One needs to consider what they will be using the PDA for and only then can the appropriate PDA be purchased.

## Useful Websites for PDAs

[www.brighthand.com](http://www.brighthand.com)—for reviews on different models of PDAs (accessed 9 November 2004).

[www.pdabuyersguide.com](http://www.pdabuyersguide.com)—for reviews on different models of PDA (accessed 9 November 2004).

[www.pdamd.com](http://www.pdamd.com)—an American website with reviews on the latest PDAs and software (accessed 9 November 2004).

[www.medicalpocketpc.com](http://www.medicalpocketpc.com)—another American based site, dedicated to Pocket PC users (accessed 9 November 2004).

[www.handheldsfordoctors.com](http://www.handheldsfordoctors.com)—a good site, especially useful for those considering buying a PDA (accessed 9 November 2004).

[www.doctorsgadgets.com](http://www.doctorsgadgets.com)—a comprehensive site with information on available machines, software and useful links (accessed 9 November 2004).

www.handango.com—a site for purchasing software, with free trial periods available (accessed 9 November 2004).

www.palmgear.com—for Palm OS software (accessed 9 November 2004).

www.palmsource.com/interests/dental/—contains information on software specific to dentistry (dental reference, dental practice management, drug and medical reference; accessed 9 November 2004).

www.adobe.com/products/acrobat/readerforpalm.html—Adobe Acrobat reader for Palm OS allows document conversion to .pdf format for hand-helds (accessed 9 November 2004).

www.dentalpda.com/—this site is dedicated to handheld computing resources in dentistry (accessed 9 November 2004).

Forums also exist at many of these websites that allow discussion of the latest available PDA models and new software releases.

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