

Smartphones in orthopaedics

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Abstract With the introduction of the European Working Time Directive, surgical trainees are facing limited training opportunities and doctors are required to maximise their training opportunities. Smartphone sales have been rapidly increasing over the last five years and can be used as a training tool for the orthopaedic trainee and surgeon. Common uses include applications (AO, eLogbook and PubMed), Ebooks, online Logbooks, Guidelines and surgical techniques. In addition, smartphones can be used to immediately complete work-based assessments, in the absence of computers, hopefully increasing completion rates and reliability. Some journals now provide podcasts and video tutorials which may be accessed on smartphones, which is useful for higher examinations. Smartphones can also be used in the clinical setting to take photographs of wounds. Smartphones are enjoying increased uptake and application in the workplace and we review their use for orthopaedic surgeons and trainees to allow them to make the most out of their training opportunities.

Introduction

In early 2011, smartphone sales overtook personal computer sales for the first time since their introduction in 1997 [1], with the main proponents being the Apple iPhone and Google Android software platforms. They have now become an essential part of everyday life both within and out of clinical practice. Various applications have gained popularity in the medical working environment. Whilst certain

postgraduate deaneries such as Wales have fully embraced the smartphone revolution by providing their trainees with smartphones loaded with various medical textbooks, this practice is not, as yet, widespread within the National Health Service [2].

It has previously been found that junior trainees' knowledge of musculoskeletal conditions was poor [3, 4]. With the introduction of the European Working Time Directive the situation has deteriorated further. There has been a documented reduction in clinical and operative experience [5] with serious concerns being raised by surgical consultants that current registrars are less qualified for their role than previous generations [6]. The introduction of the foundation programme for junior doctors in the United Kingdom in 2005 was meant "to bridge the gap between medical school and specialty training" [7]. It was hoped this would improve training. However, in 2009 it was demonstrated that only 15% of trainees completing the foundation programme had any exposure to orthopaedics and only 8.9% passed a basic musculoskeletal competency assessment [8]. In the current climate of reduced working hours and reduced clinical and operative experience it is imperative that doctors in training adapt to this by maximising their training opportunities and seeking alternative avenues for furthering their knowledge whenever possible. Smartphones are uniquely placed to help in this regard. The vast majority of orthopaedic surgeons in training own one already [9], they are almost always immediately accessible by the trainee and their portability and Internet connectivity allows them to act as a reference tool when accessing a desktop or book would not be practical. Current smartphones are able to store large quantities of data, are easily updateable and there are already multiple applications available for them from both iPhone and Android platforms.

This review aims to discuss the uses of the smartphone for both the practising orthopaedic surgeon and, perhaps

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even more so, for the orthopaedic surgeon in training to allow them to make the most out of their training opportunities.

Smartphone platforms

All smartphones are defined by the operating system (OS) that they use. The current leading systems run off either iPhone, Android or Blackberry platforms. Palm and Blackberry were the initial developers of smartphones in 2001 and 2002, respectively. Unfortunately they were plagued with technical difficulties and criticised for their difficult user interface. In 2007 Apple introduced the iPhone. Although it offered little that was new, it provided a far more streamlined experience. They also introduced a virtual shop—the ‘App store’—for all downloadable applications, referred to as Apps, and more recently, textbooks. More recently Google developed the Android operating system, and their own application store called ‘Market Place’, and have quickly risen to market leader in the United Kingdom having more than 50% market share, compared with Blackberry’s 22.5% and Apple’s 18.5% [10].

Applications

Commonly used applications by the orthopaedic surgeon include the AO Surgery Reference (Fig. 1), PubMed (Fig. 2) and eLogbook (Fig. 3). AO Surgery Reference is available on all platforms and provides instant access to surgical approaches and relevant anatomy for most common orthopaedic procedures and may be used as a quick reference guide prior to a procedure. Other commonly used applications include ‘Zollinger’s atlas of surgical operations’ and ‘iSpineOperations’ which provide 3D animations of the cervical and lumbar spine procedures for orthopaedic and neurosurgical surgeons.

One of the most common ‘app’ uses in the United States is for coding or billing applications, which tends to be performed by doctors [9]. Although currently it has little use in the National Health Service, it may become more relevant in future as doctors have been repeatedly shown to be more accurate at clinical coding than non-clinical staff and may find themselves taking on this responsibility given the current financial environment [11, 12].

Books

A recent survey of orthopaedic trainees demonstrated that textbooks were the single most requested use for future ‘apps’, with many feeling high quality ebooks were not yet available in 2010 [9]. There has since been a boom in ebooks due largely to the Amazon Kindle, which within

AO Surgery Reference

Please select an anatomical area

AO Foundation

Mobile Web
AO Surgery Reference

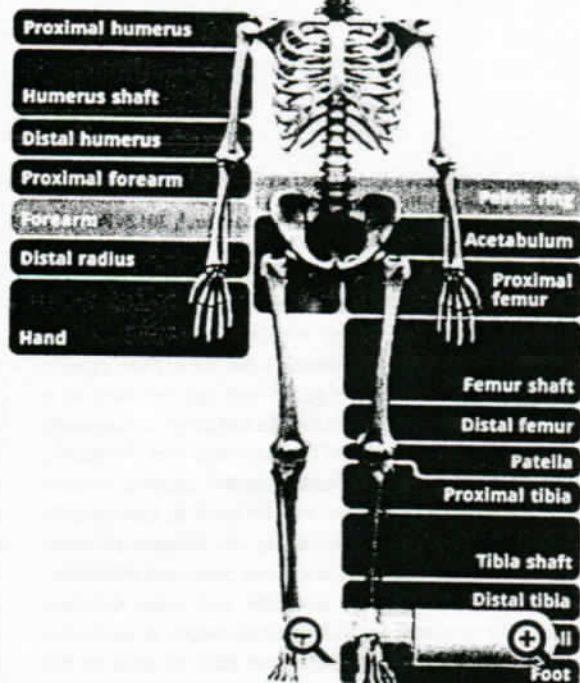


Fig. 1 AO Surgery Reference

three years, has taken over half of all the U.S. book business across all formats. Originally intended as a standalone hardware, Amazon has developed applications available for smartphones, allowing the surgical trainee to access virtually any book on his smartphone within minutes, at a reduced cost compared with hardcopies, due to savings on paper and distribution fees. All major textbooks now have a smartphone version, including the Orthopaedic Knowledge series and Campbell’s Operative Orthopaedics.

Logbook

Anaesthetists were the earliest adopters of logbook applications on their smartphones, allowing them to keep their records updated immediately by the patients. In addition, the iGas and Handbase applications having proven track records with regards to ease of data input, data confidentiality and versatility [13]. On the surgical side, uptake has been much slower with no official application having been



Fig. 2 PubMed

released from the eLogbook. A third party has now developed an application in cooperation with eLogbook, albeit only for the iPhone.

Guidelines

Whilst there has been much focus on the development of applications, virtually all websites have a mobile version, which allows for easier viewing on the smartphones smaller screens without the need for an application. Guidelines are easily accessible on smartphones, allowing quick and up-to-date references. The joint British Association of Plastic Reconstructive and Aesthetic Surgeons (BAPRAS) and British Orthopaedic Association's (BOA) guidelines on open fractures are easily accessible and downloadable from their website [14]. There has since been an application on the iPhone which summarises the guidelines and has key diagrams on surface anatomy and fasciotomy incisions (Fig. 4) [15]. There



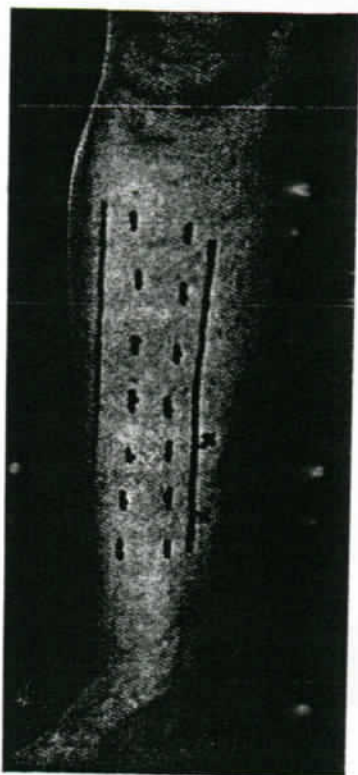
Fig. 3 eLogbook

are also numerous National Institute for Health and Clinical Excellence (NICE) guidelines and other BOA guidelines which can be viewed in portable document format (PDF).

Work-based assessments

The competency approach has become prominent at most stages of both undergraduate and postgraduate medical training. In the United Kingdom it forms part of the performance procedures of the General Medical Council (GMC) [16]. For surgical trainees it is assessed using workplace-based assessments (WPBAs). Prior to the advent of Internet-based WPBAs, trainees could ask consultants to immediately fill a paper copy after a procedure or other assessment. This helped ensure the event was fresh in both the trainees and trainers mind and the assessment form was reliably and accurately completed. With the advent of Internet-based forms, the trainee is required to send the WPBA to the consultant to complete. This means it is often validated at a later date and may not be an accurate reflection of the actual assessment. Furthermore, difficulties are often

Surface Markings



Green = Margins of subcutaneous border of tibia

Red = Medial perforators from posterior tibial artery

Blue = Fasciotomy incisions

g. 4 Key diagrams on surface anatomy can be found on some applications like the Leg.Fractures app

encountered in getting trainers to fill out these forms when they are not physically with the requesting trainee. Smartphones are useful in this circumstance as they allow the trainee and trainer to discuss and complete assessments in real time together, for example, between cases in theatre or clinic.

Surgical technique guides

Orthopaedics, perhaps more than in any other specialty, there are a huge number of implants used each with their own surgical technique and equipment. The number of implants has risen exponentially in recent years, particularly trauma, with the advent of locking plate technology. A thorough understanding of the AO/Synthes large fragment and small fragment sets is still required but is clearly not sufficient for the practising orthopaedic surgeon. There are many companies with so many implants that it is fortunately beyond the scope of even the most experienced practitioner to be familiar with them all. All four of the largest orthopaedic implant manufacturers

(Synthes, Stryker, Smith & Nephew, Depuy) provide surgical technique guides online for their implants. These are detailed and easily downloadable onto smartphones in their portable document format (PDF).

Videos and podcasts

All smartphones enable easy access to YouTube, which allows for access to a growing number of medical education videos, which show live surgical procedures and clinical examinations. Youtube has also provided a novel methodology for studying injury mechanisms using in vivo injury videos, which have challenged cadaveric fracture classification such as the Lauge-Hansen system [17]. Podcasts are episodes that allow for rapid distribution over the Internet, allowing the user to play back various areas of healthcare education [18, 19]. Orthopaedic podcasts are widely available over the Internet, with various implant manufacturers having their own series (Stryker). White et al. [20] found that podcasts were an acceptable learning resource for surgical training, and can be integrated into existing study habits with more than 80% of 93 students finding that they improved core knowledge and were interesting and engaging. Probably the most well-known internationally is the "Surgery 101" series which has over 160,000 downloads and covers a range of surgical specialities. Orthopaedic journals are now joining in the smartphone revolution, with the Journal of Bone and Joint Surgery (JBJS) now providing free podcasts and video tutorials.

Concerns of smartphones in the workplace

There has already been a rapid uptake of smartphone applications in clinical practice and it looks as though this is set to continue. The vast majority of these provide no risk whatsoever to patient confidentiality. However, concerns have been raised at some potential smartphone users. Namely, the input of patient data for logbooks, the use of their cameras to take clinical images and the concerns that unregulated content may find its way onto surgeons' smartphones, and may not have undergone the thorough validation programme of normal publication avenues [21, 22]. With regards to eLogbook applications, all have inbuilt data protection mechanisms and, to date, there have been no reported data-loss issues within the United Kingdom. Clinical photographs can just as easily be taken without appropriate consent with dedicated digital cameras and there is no evidence to suggest that phone cameras have caused an increase in this problem. Furthermore, it is not likely that they will, as image quality remains fairly low in phone cameras and is generally below that which most journals would consider acceptable for use.

The future

With the introduction of the telephone by Alexander Bell in 1875, doctors have been able to attain medical advice and information over great distances. However, there may be descriptive errors, and the advice is often not given in realtime. Telementoring allows a senior surgeon to guide, direct and interact with a surgical trainee, whilst at a different location during an operation or clinical encounter. The introduction of high speed fourth generation mobile Internet will allow live streaming of high definition media [23]. In an even further step, Johns Hopkins Hospital has used telesurgery to perform urological procedures at distances of up to 3.5 miles [24]. Certainly telesurgery may have a role in arthroscopic orthopaedic surgery. Whilst this is impractical on the smartphone due to their small screens, it may be a possibility on tablets which have been enjoying rapid sales in recent years.

Conclusion

Smartphones already have a wide range of uses for the orthopaedic trainee and this looks set to increase in the future. They are not only used as important learning and reference tools, but also provide a convenient way to keep on top of their logbook and WPBA's.

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