J. Maxillofac. Oral Surg. (Oct–Dec 2014) 13(4):355–358
DOI 10.1007/s12663-013-0497-4

REVIEW PAPER

The maxillofacial surgeon's march towards a smarter future—smartphones

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Received: 23 January 2013 / Accepted: 13 March 2013 / Published online: 30 March 2013

Abstract The latest mobile phone in addition to being a communication device now is also able to do most functions of a computer. These mobile devices are now called smartphones. These smartphones can use various applications (called apps) which have revolutionized the use of these devices. We discuss the uses of smartphones in maxillofacial surgery and how they have made the work of the maxfac surgeon easier.

Keywords Smartphone apps · Maxillofacial trainees · WhatsApp · Telediagnosis

Introduction

A smartphone is a mobile device with advanced computing ability and connectivity, combining the functions of a computer and a cellular phone [1]. Although devices combined telephony and computing were conceptualized as early as 1973 and were offered for sale beginning in 1994, the term "smartphone" did not appear until the year 1997, when Ericsson described GS 88 "Penelope" concept as a Smartphone. Ten years later in 2007, Apple released the iPhone with its capability of installing and running additional applications called apps, the popularity of smartphones accelerated.

Smartphones can do the following:

- Mobile telecommunication—via voice, text,multimedia messaging and email
- Run applications otherwise called apps
- Provide a torchlight which is invaluable during patient examination in the ward, A&E, etc
- Provide a camera for documenting interesting cases
- Carry downloaded books as PDF and word files
- Presentation devices for powerpoint presentations—the latest phones have the necessary jacks to connect to a multimedia projector and the future may even have a projector in-built into the phone
- Allow internet access on the go

Applications otherwise called apps are really what differentiate the current generation of smartphones from the phones of the past. An app is a software that has been developed specially for the smartphone. Keywords or titles are entered into search functions to identify applications of interest. Each of the four current popular smartphone operating systems, each has a respective online "store" to browse and download applications. These stores have various names:

1. BlackBerry operating system- App World
2. Google Android—Google play store having over 6 million plus downloadable applications
3. iPhone—App Store/iTunes having 6.5 million plus downloadable applications
4. Windows- Marketplace having 1 million plus downloadable applications

The cost of downloading such apps/applications varies, but many are free. Useful applications for maxillofacial surgery which are free include Glasgow coma scale app which helps the postgraduate trainee remember the GCS scale. Vision test/Vision droid/Snellen are smartphone apps that are used to assess the visual acuity of the patients with fractures of the orbit (Fig. 1). This helps the PG trainee avoid carrying a snellen chart as it is available on the phone

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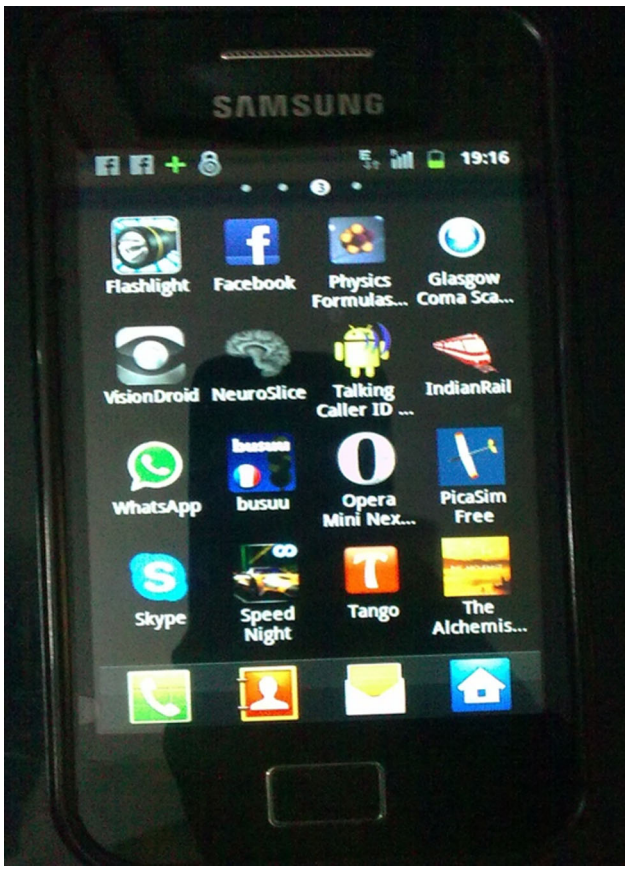

Fig. 1 WhatsApp application icon in our smartphone

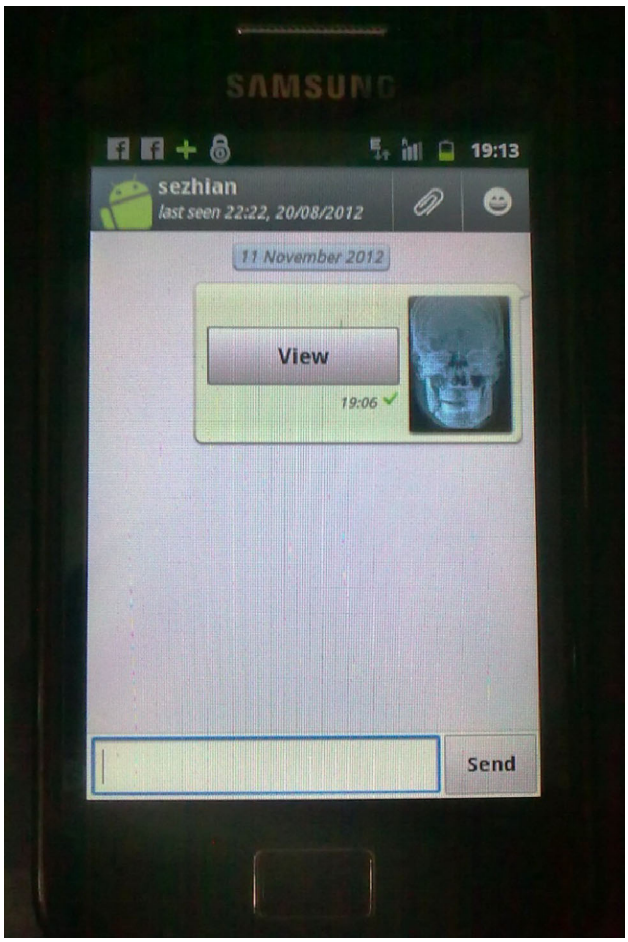

Fig. 2 Skull PA of a patient shared with other colleagues of our maxillofacial unit

itself. Numerous logbook apps are also present though most of these are currently not free and require payment to download them.

Method of using a smartphone in telecommunication/telediagnosis [2]

We describe a protocol which we now follow in our unit using WhatsApp messenger application which has improved the communication within our unit.

"WhatsApp Messenger" is a cross-platform instant messaging application for smartphones. Cross platform means that the software is available for iOS, Blackberry OS, Android, Symbian, Series 40 and Windows Phone and allows seamless communication between the various devices, be it a Windows phone, Blackberry phone, Android phone or apple phone. In addition to text messaging, users can send images, video and audio media messages to each other. The entire process of sending the message/image is free. "WhatsApp" synchronizes with the phone's address book on installation, so users do not need to add contacts in a separate book. Since all the users are registered with their phone numbers the software synchronises all the WhatsApp users in one's contact (Fig. 2).

PG trainees frequently need to provide a maxillofacial opinion away from the outpatient department, such as in the case of outside referrals; in wards and in the trauma care room. This often requires opinion from senior maxillofacial surgeons. Electronic transmission of clinical images for remote consultation is done using WhatsApp in our maxillofacial unit.

Protocol that existed in our maxillofacial unit before "WhatsApp" use

Any consult calls from the emergency department is first attended to by the on-call maxillofacial post graduate trainee. The patient's problem is then discussed over the telephone by the PG trainee and his senior colleagues (lecturers, readers and professors) who instruct the PG trainee about the appropriate treatment to be provided to the patient. This method of consultation relied on the diagnostic accuracy and verbal

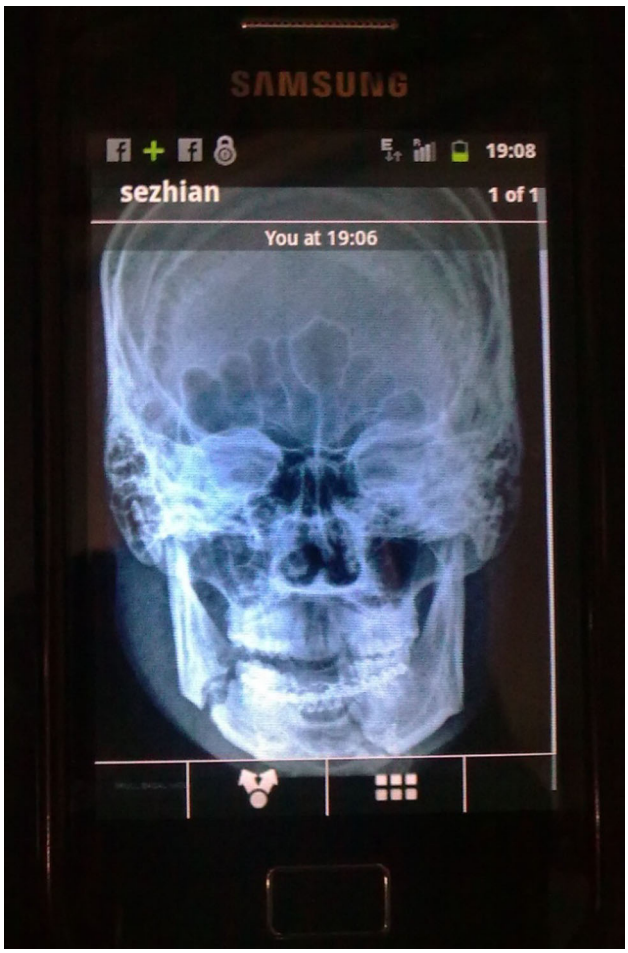

Fig. 3 Skull PA view showing fracture right body and left Parasymphysis of the mandible

communication skills of the PG trainee. The first on-call PG trainee is usually the junior-most doctor in the team with the least experience. This can lead to misdiagnosis or inappropriate management of the maxillofacial patient.

The protocol after the advent of use of WhatsApp messenger is

The first on-call postgraduate trainee takes a photograph of the patient and his/her x-rays and shares the images with all his junior and senior colleagues (Other PG trainees/lecturers/readers/professors) who are now able to provide their expertise with greater accuracy (Fig. 3). The use of this application has eliminated the communication gap and gives minimal room for arbitrary misdiagnosis/mismanagement. A picture is worth a thousand words. Messaging is instantaneous and free of cost.

This messaging platform is also being used in our unit routinely to share the theatre list for the following day along with the pre-operative photos and x-rays. Post-operative photos and x-rays of the patient are also reviewed. This keeps everyone in the unit well informed of the theatre list, patients, and their treatment plan and treatment outcomes and creates a digital record for future reference/use.

Discussion

The evolution of wireless digital technology has created the ability for immediate remote medical/dental teleconsultation. Often maxillofacial surgical consults from the emergency department occur after hours when the senior surgical specialist is no longer in the medical center. It is up to the junior-most PG trainee to see, examine and treat the patient. This relies on the diagnostic accuracy and verbal communication skills of the on-call individual—providing room for an error if the on-call individual is inexperienced which in turn can result in the misdiagnosis/mistreatment of the maxillofacial patient. The advent of smartphones and telemedicine technologies makes the consultation more accurate by allowing the senior surgical specialist to view digital images from outside the medical center from anywhere in the world. The other Smartphone apps make life for a maxillofacial surgeon/PG trainee easier. Its role in patient care continues to evolve as the technology improves. This in turn allows for improved efficiency of the specialty consultation and improved triaging, ultimately providing improved care for the maxillofacial patient. We chose Whatsapp as it was the most commonly used messaging platform used by most of us prior to starting telediagnosis and we were familiar with its use. Similar free messaging platforms include Viber, Tango, Nimbuzz messenger, Skype, Kik messenger and so on. As long as the entire surgical team uses the same messaging platform there are no problems.

In our unit, most PG trainees, lecturers, readers and professors now have smartphones [3]. This has given us the opportunity to make use of this technology to communicate better and also decrease the "carrying load" of our PG trainees. The "carrying load" of all our PG trainees used to consist of a torch for intraoral/pupil examination, Oxford handbook of clinical medicine for ward reference, a small digital camera to document the cases and a snellen chart. All of this has been replaced by a single smartphone which can perform these functions much easier and with less weight to carry around.

In addition it also creates a digital record of all the x-rays, photos, etc., which can be useful in preparing presentations and so on at a later date. Lost x-rays are a thing of the past as in an emergency the x-ray can be viewed on the smartphone itself as long as it was photographed at the time of admission. Logbooks can also be kept digitally and

Table 1 Glimpse of the numerous apps available

Some useful apps	Apple OS	Windows OS	Android OS	Blackberry OS
1. Torch apps	Flashlight ®	Flashlight X	Flashlight	Blackberry torch 9800
2. Free messenger apps	Whatsapp, Viber, Tango, Nimbuzz messenger, Skype, Kik messenger	Whatsapp, Viber, Tango, Nimbuzz messenger, Skype, Kik messenger	Whatsapp, Viber, Tango, Nimbuzz messenger, Skype, Kik messenger	Whatsapp, Viber, Tango, Nimbuzz messenger, Skype, Kik messenger
3. Reference book app (based on the book you want)	Oxford handbook of clinical medicine, Harrison's manual of medicine	Oxford handbook of clinical medicine, Harrison's manual of medicine	Oxford handbook of clinical medicine, Harrison's manual of medicine	Oxford handbook of clinical medicine, Harrison's manual of medicine
4. Glasgow coma scale app	Glasgow coma scale	Glasgow coma scale	Glasgow coma scale	Glasgow coma scale
5. Eye observation chart	Snellen's chart HD medical eye diagnostic chart and test 1.0	Snellen's chart HD medical eye diagnostic chart and test 1.0, Test your eyes	Vision droid	Eye test v 1.1
6. Log book	E- logbook		Surgeons logbook, I-surgery notebook	
7. Presentations/word documents for seminars and dissertations for PG trainees	SmartOffice	Windows office	Thinkfree office	Blackberry SmartOffice (name changes with each model)

synchronized with the trainees desktop preventing any loss of data.

The drawbacks of this technology include patient confidentiality and cost of the device. There are no clear guidelines for patient confidentiality from both the Dental Council and Medical Council of India currently and as such is less of an issue in India as compared to the developed countries. However in the future, clear guidelines will help in determining patient confidentiality. The cost of the smartphones is also dropping by the day and in the near future will probably replace the conventional phone. Most apps are now free and do not burden the PG trainee or trainers financially. The other drawback is that smartphones are extremely "power hungry" and thus the battery life lasts only for a day typically. As battery technology improves this will probably be resolved and battery life will most likely be better.

This is just a glimpse of the numerous apps (over a million per operating system) available (Table 1) [4]. The number of apps is increasing every day. One can thus customise their smartphone according to their needs. In addition, a technology savvy person can also create his own apps using downloadable programming software (similar to making a power-point presentation). Lately smartphones are also coming with a projector feature which can be used for presentations during seminars.

Applications have revolutionized the current smartphone and continue to evolve. It is up to us to keep up with technology and use it to our advantage in the correct way.

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