Application of Mobile Phones in Ophthalmology

Siamak Moradian[1], MD; Sare Safi[2], MS

[1]*Ophthalmic Epidemiology Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
[2]*Ophthalmic Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran*

There have been significant advances in the field of mobile phone technology in the last decade. Smartphones are increasingly considered as handheld computers instead of simple phones because they have powerful computing capabilities, remarkable onboard memories, high resolution screens and, more importantly, open operating systems that permit development of applications. Operating system platforms that are now available on mobile phones include the Android operating system by Google, iOS by Apple, BlackBerry by RIM, Symbian, and Windows Mobile and Windows Phone.[1]

Mobile phones with advanced computing abilities are able to run multiple advanced applications and have tremendous applications in medical specialties. This causes a major attraction by mobile phones for physicians and medical personnel. Mobile phones can combine tools that are commonly used for clinical examination and education into a portable, simple to use application. These medical apps have converted mobile phones into useful tools for implementing evidence-based medicine, clinical communication, patient education and patient monitoring.[2]

Mobile phones have increasing utility in the field of ophthalmology. An American Society of Cataract and Refractive Surgery (ASCRS) survey in 2010 showed that approximately 83% of members used their mobile phones to accomplish some of their professional tasks. Keeping up with the latest information available in the field of medicine is impossible; if a medical application can gather and prepare data and then present it in a simple way, it is undoubtedly valuable and efficient use of a physician's time.[3]

Ophthalmological applications have converted mobile phones into medical devices that are used ordinarily by ophthalmologists to evaluate their patients. About 342 different ophthalmological applications are available for eye caregivers. Of these, more than 121 applications apply to ocular surgery and can be used by ophthalmologists to improve their surgical skills or for better patient education.[4] Ophthalmological applications can be divided into six groups: Patient assessment and education, physician reference and education, calculators, photographic and image processing, patient records (EHR) and administrative tools, branding and marketing tools.[5]

PATIENT ASSESSMENT TOOLS

This group of apps include near vision cards, color vision plates, pupil gauges and rulers, penlights, fluorescein lights, pediatric fixation targets, Amsler grids, Worth 4 Dot tests, accommodation targets, red desaturation tests and optokinetic nystagmus (OKN) drums.

It should be noted that, although these tools can be particularly useful for inpatient consultations and emergency room visits, they cannot replace office-based testing under ideal conditions[1,2] [Figure 1].

PATIENT EDUCATIONAL TOOLS

Applications have been developed to promote patient awareness of ophthalmic conditions. These include 3D applications that introduce anatomy, and broad

Access this article online	
Quick Response Code:	**Website:** www.jovr.org
	DOI: 10.4103/2008-322X.163775

information about signs, symptoms, management of ophthalmic diseases and surgical procedures [Figure 2].

PHYSICIAN EDUCATIONAL AND REFERENCE TOOLS

Ophthalmologists, as do all physicians, find it difficult to keep up with the latest results from published studies. Mobile phones and pertinent apps make the latest results and findings of these studies available. Classifications and grading systems for some anatomical variations and diseases, such as angle anatomy, macular holes, optic nerve edema, diabetic retinopathy, and melanoma are easily available. Some applications make clinical trials databases available and allow searches in biomedical databases such as PubMed/MEDLINE.[5]

Some applications offer videos and atlas images which are useful for training and advancement of surgical skills. Other applications provide lists of important diseases that should not be missed, definitions and differential diagnoses, color–coded diagrams of retinal drawings, questionnaires for common ophthalmic diseases and summaries of outstanding randomized controlled trials in ophthalmology.[6] Several applications provide information on general medical conditions,

including symptoms, diagnoses, differential diagnoses, pathogenesis and treatment options. The most popular of these are Medscape, Epocrates and UpToDate which prepare up to date information that is useful for performing evidence-based medicine.[6]

Apps like Normal Lab Values or Pocket Guide to Diagnostic Tests provide information regarding common laboratory tests, including reference values and interpretations, causes for abnormal values and conversions of laboratory unit. Applications about drug information such as Skyscapes RxDrugs or SafeMed Pocket provide the names of drugs, indications, dosages, pharmacology, drug interactions, contraindications and prices[7] [Figure 3].

CALCULATOR TOOLS

Apps like MedMath and MedCalc provide options about calculating clinical scores and individual drug dosages. Ophthalmic calculator apps include age-to-bifocal add, amplitude of accommodation, cross cylinder calculator, diopter to radius conversion, glaucoma risk calculator, intraocular lens (IOL) calculator, intraocular pressure (IOP)-central corneal thickness (CCT) calculator, transposition calculator, vertex conversion, and visual acuity (VA)calculator[8] [Figure 4].
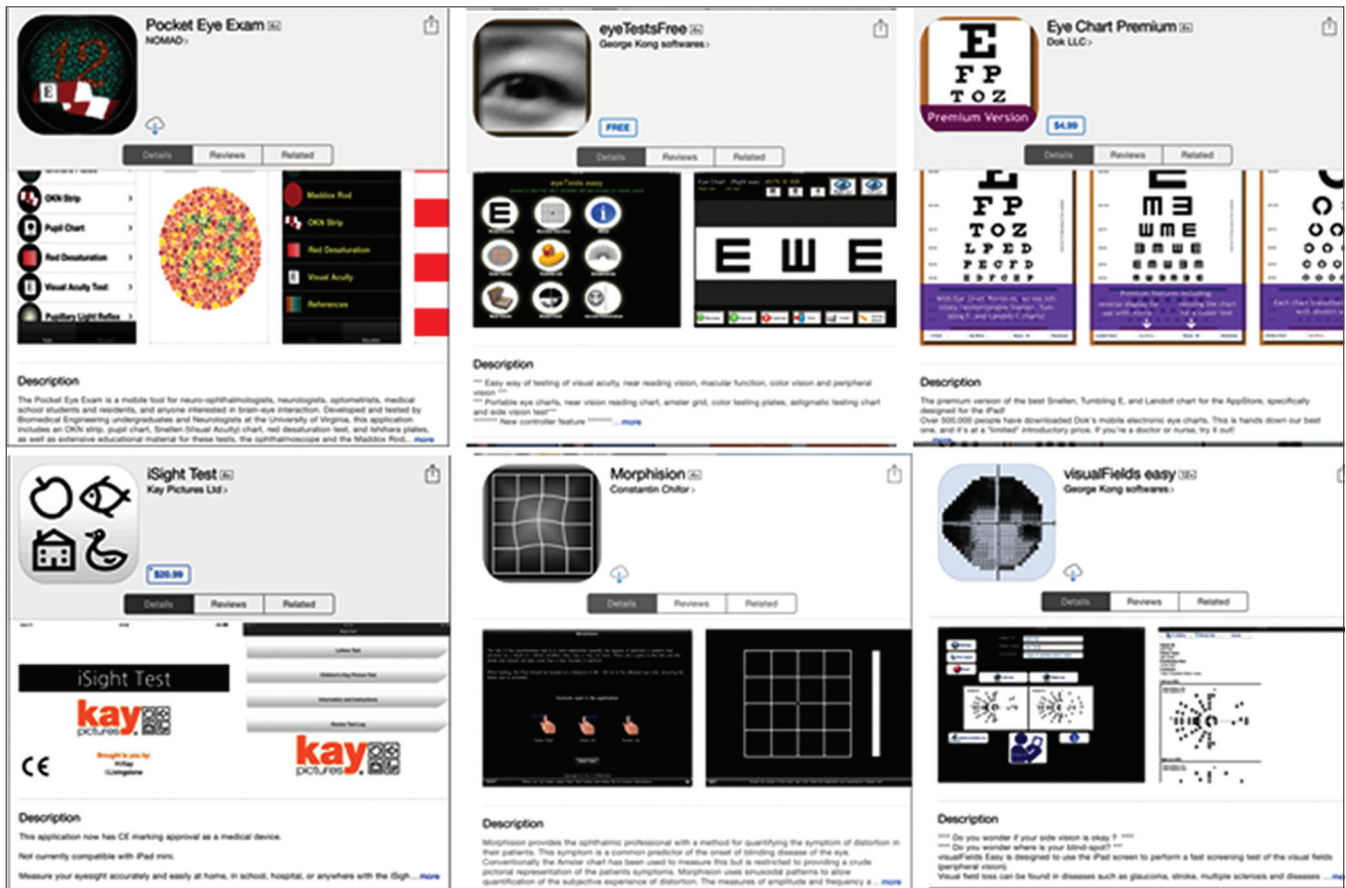

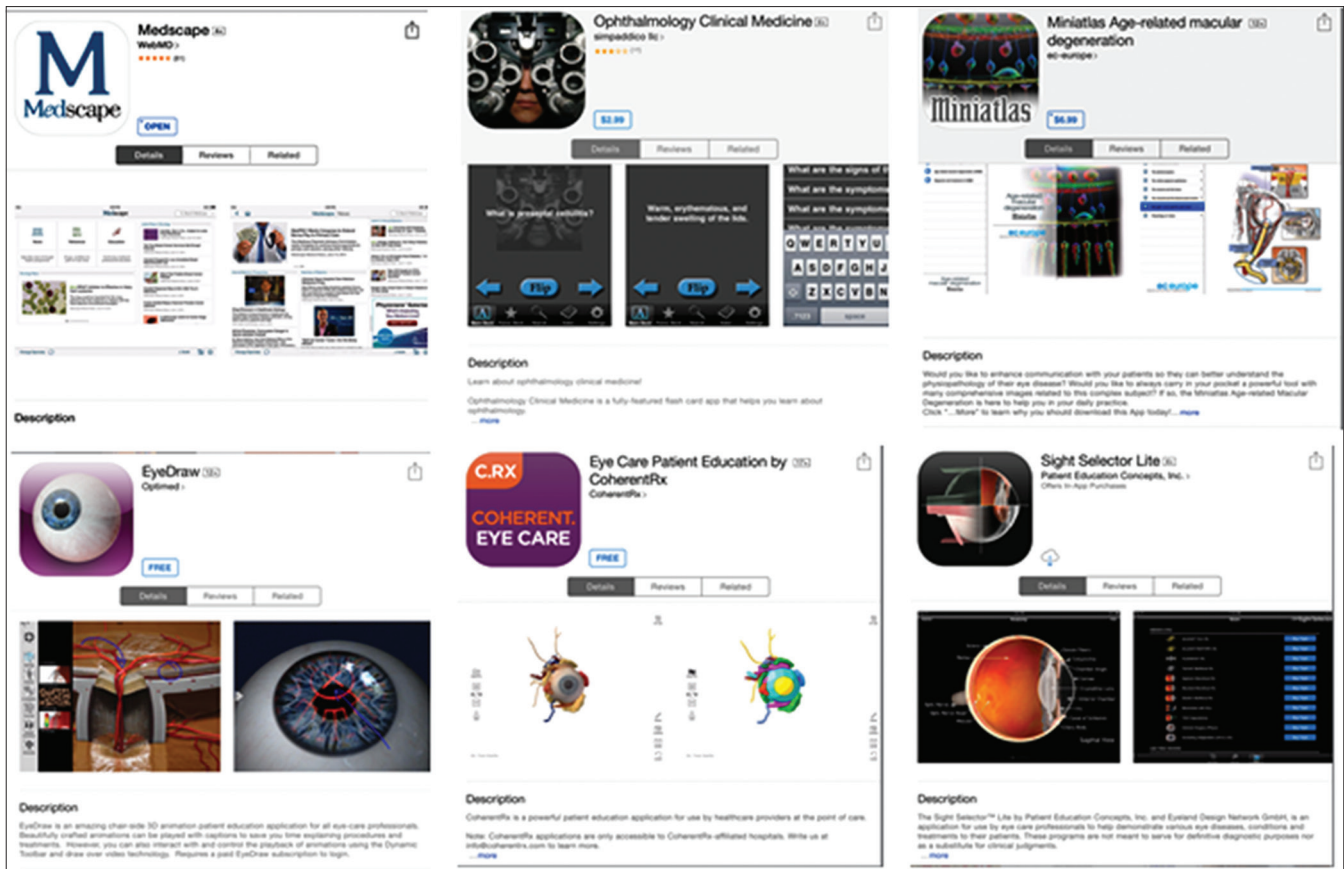**Figure 1.** Patient assessment applications.

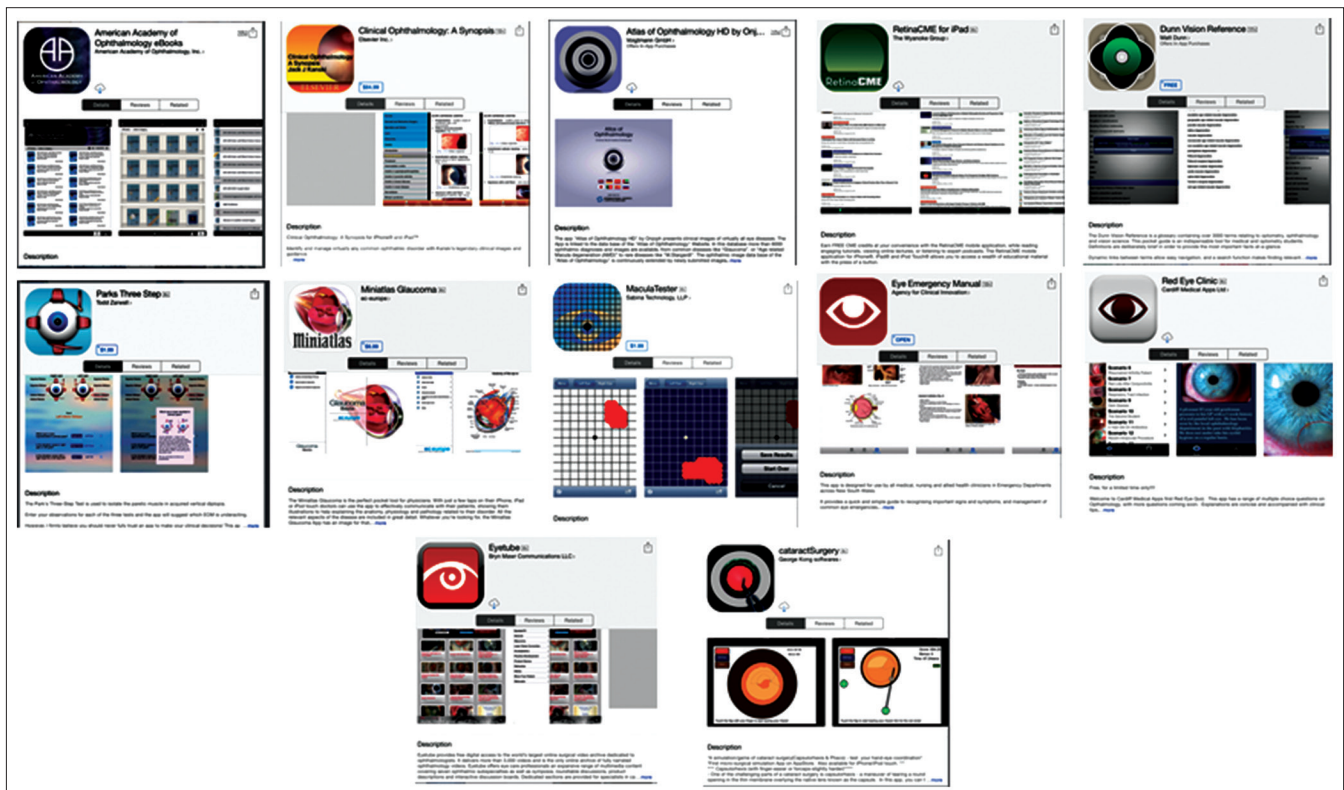**Figure 2.** Patient educational applications.

Figure 3. Physician education and reference applications.

PHOTOGRAPHIC AND IMAGE PROCESSING TOOLS

Most recent generation mobile phones are equipped with a high quality camera that can be used to take fundus photographs through a slit lamp or record videos from an operating microscope and display images from optical coherence tomography (OCT) systems and other high-tech devices. Ophthalmologists can share these images with colleagues via several communication apps and make the optimal diagnostic and therapeutic decisions[6] [Figure 5].

PATIENT RECORDING TOOLS

Apps like Ophthycharts and EyePatients permit

recording of patient examination results that can be saved in an office databank[5] [Figure 6].

BRANDING AND MARKETING TOOLS

In modern life, mobile phones are in constant use and most are used by patients to search for their medical problems online. As little as a decade ago, no physicians felt the need introduce themselves and their capabilities on the web for better marketing. Today, if a physician is not present on the web, it is as if he/she does not exist. Personalized applications like Doctor App, and EyeDocApp allow patients to get in touch with their doctors, apply or change their appointments, refer a friend or patient, or
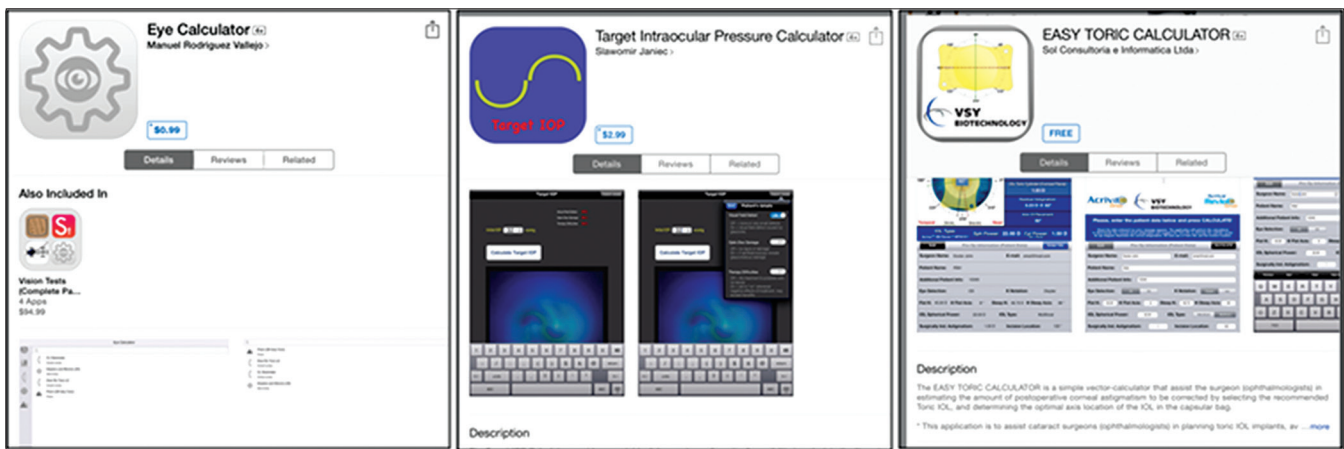

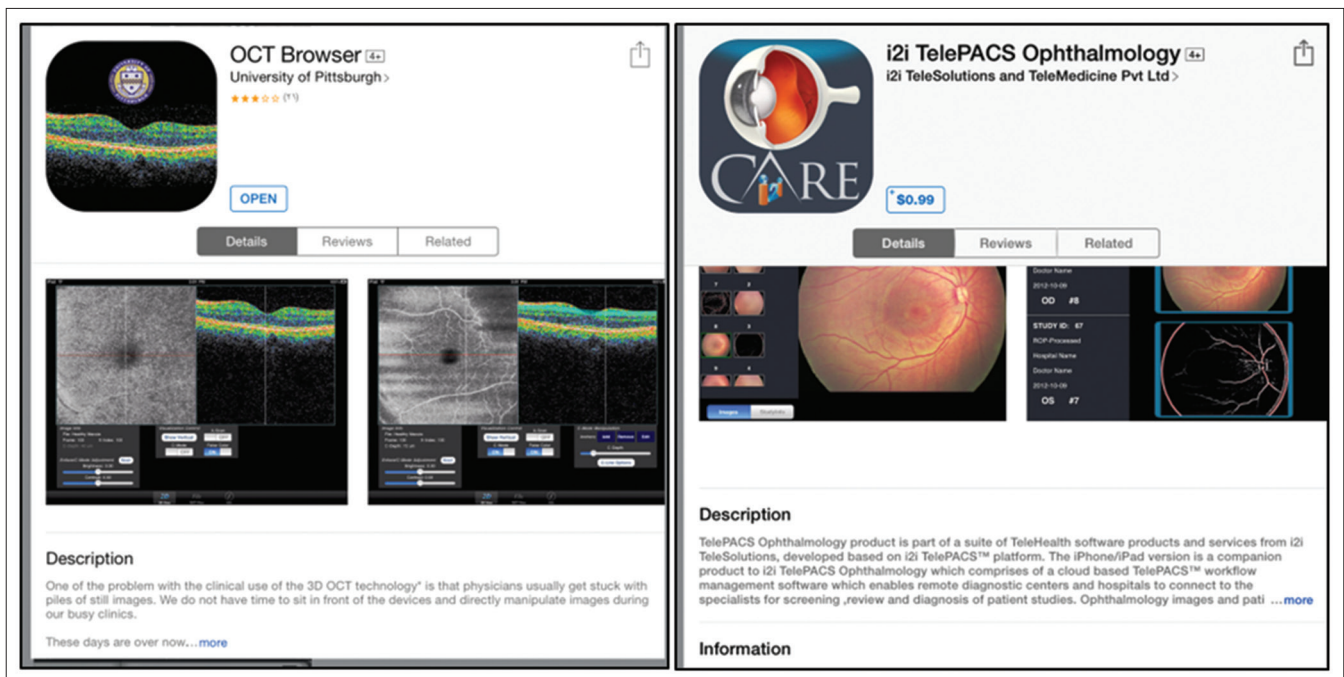**Figure 4.** Handy calculator applications.

Figure 5. Photographic and image processing applications.

provide educational material that the doctor has loaded onto his/her app for patient. "Push notification" is an option of these apps provide the opportunity for doctors to communicate with their patients[6] [Figure 7].

EYE HAND BOOK APP FOR OPHTHALMOLOGISTS

The Eye Hand Book (EHB) is a unique app includes all the above-mentioned tools, moreover an eye atlas, access to meetings and societies links, and some useful information about ophthalmic instruments. Several literature sources for genetics of ophthalmic diseases, ophthalmic eponyms and acronyms, classifications and differential diagnoses of ocular diseases and, ophthalmic dictionaries, and mnemonics are available. Coding systems that available include ICD-10, E and M, and CPT codes. Access to important journals and their websites are available on EHB.
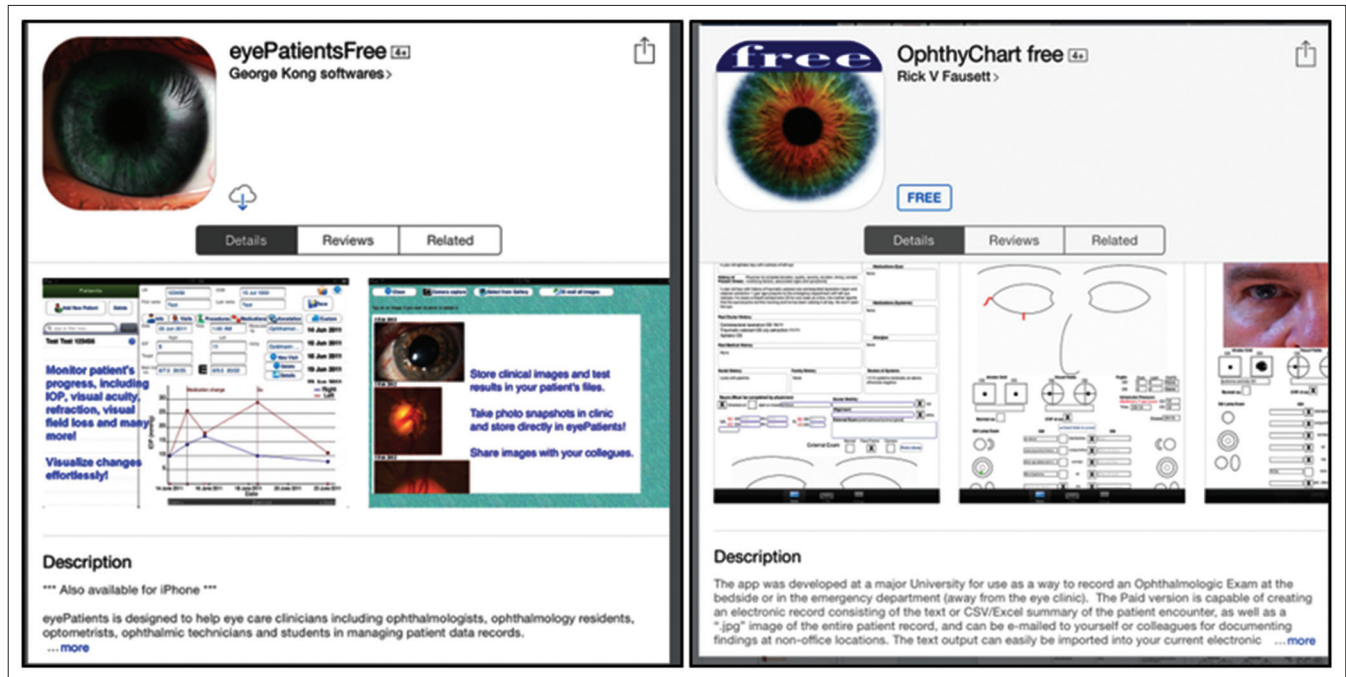

Figure 6. Patient medical record tools.

Figure 7. Branding and marketing tools.

In the treatment section of EHB some information about ophthalmic medications, how to prepare fortified antibiotics, and settings for ophthalmic laser procedures are provided. Educational movies for patients and physicians, downloads of lectures, flash cards about important diseases are available. Educational videos, summary benchmarks, blink quiz, and EyeNet are available through its collaboration with the American Academy of Ophthalmology. The Ophthalmic News and Education (ONE.) network is also available. Access to EyeWiki has been enabled. Media consent is also available in this app that can be verified through patient digital signature.[6]

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

REFERENCES

1. Shah VA, Lord RK, Kaja S. Smartphones in Ophthalmology (Workshop). Association for Research in Vision and Ophthalmology Annual Meeting 2010, Fort Lauderdale, FL; Program #487; 2010.

2. Lord RK, Shah VA, San Filippo AN, Krishna R. Novel uses of smartphones in ophthalmology. *Ophthalmology* 2010;117:1274.

3. Davis EA, Hovanesian JA, Katz JA, Kraff MC, Trattler WB. Professional life and the smartphone. *Cataract Refract Surg Today* 2010:21-22.

4. Tahiri Joutei Hassani R, El Sanharawi M, Dupont-Monod S, Baudouin C. Smartphones in ophthalmology. *J Fr Ophtalmol* 2013;36:499-525.

5. Bastawrous A, Cheeseman RC, Kumar A. iPhones for eye surgeons. *Eye* (*Lond*) 2012;26:343-354.

6. Chhablani J, Kaja S, Shah VA. Smartphones in ophthalmology. *Indian J Ophthalmol* 2012;60:127-131.

7. Zvornicanin E, Zvornicanin J, Hadziefendic B. The use of smart phones in ophthalmology. *Acta Inform Med* 2014;22:206-209.

8. Mosa AS, Yoo I, Sheets L. A systematic review of healthcare applications for smartphones. *BMC Med Inform Decis Mak* 2012;12:67.