A novel use of photo messaging in the assessment of nasal fractures

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Summary

We evaluated a new method of assessing patients referred to the otolaryngology department with nasal injury. Patients possessing a mobile phone with built-in camera took an image of their face and sent it to the department for assessment. A decision was then made as to whether the patient needed further consultation or treatment. This method of nasal fracture assessment might avoid unnecessary referrals to the department. A prospective single blinded study was carried out. Twenty-five patients with a nasal injury took photographs of their face using a mobile phone camera. These images were reviewed and assessment made about whether a nasal fracture was present. The patient was then clinically assessed, the clinical examination being the 'gold standard' method of assessment. There was little agreement between photographic and clinical assessment. Sixty-two percent of patients, who were clinically assessed to have a nasal fracture requiring manipulation, were not picked up on assessment of their image. The greatest agreement with clinical assessment was the patient's own opinion as to whether there was new deviation of their nasal bone.

Introduction

Electronic submission of clinical images for remote consultation has been successfully implemented and tested in most medical and surgical subspecialties.[1] Its application has been seen in dermatology,[2,3] endocrinology,[4] cardiology,[5] urology,[6] trauma,[7,8] plastic[9] and vascular surgery,[10] otolaryngology[11] and radiology.[12] Mobile phones incorporating digital cameras are now popular and widely used around the world. These make possible the visualization, storage and transmission of medical images, providing new ways of communication in medicine. In the UK, there has been a rapid increase in the number of mobile phones, with 80% of adults owning one.[13] The use of photo messaging is rapidly rising as the technology gets better, easier to use and cheaper.

Nasal injury is a frequent reason for referral to an otolaryngology department. Usually, patients with a nasal injury, who are seen in an accident and emergency department, or by their general practitioner, are given an outpatient appointment in the otolaryngology department for clinical assessment. However, a large proportion of these patients do not usually require any further treatment for their nasal injury.

We propose a new way of assessing the need for a patient to be referred to the otolaryngology department with a nasal injury. Patients possessing a mobile phone with a built-in camera can photograph their nose/face and send the image as a picture message to a mobile phone in the otolaryngology department. A doctor can then assess the image and decide whether the patient needs further consultation or treatment. This method has the potential of reducing unnecessary visits to hospital and the cost of hospital consultations.

The aim of the present study was to establish the feasibility of using a mobile phone with a built-in camera for the assessment of nasal injuries.

Methods

The study design was prospective and conducted over a five-week period. Consecutive patients were recruited directly from the nasal fracture clinic at the otolaryngology department at the Edith Cavell

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Figure 1 Images of a patient with an obvious nasal deviation taken with the mobile camera phone.

Hospital in Peterborough. All patients attending this clinic for a consultation during the study period were given an information leaflet explaining the purpose of the study and informed consent was obtained in all cases. Patients were asked to take a photograph of their nose and face using the departmental mobile phone with a built-in camera (Figure 1a and b). Images were obtained under normal lighting conditions and no special effort was made to improve illumination (for example, by using additional light sources or flash). The aim was to perform the evaluation in a realistic setting.

Digital images were taken with a mobile phone equipped with a built-in camera that captured and stored images as JPEG files (K750i, Sony Ericcson). The resolution of the screen was 176 × 220 pixels, although the built-in camera produced two megapixel images. The phone was chosen because of its affordability and ease of use.

Patients took three images of their face and nose. These pictures were reviewed by a clinician, who had not previously seen the patient, to mimic remote diagnosis. Assessment was made on the deviation of the nasal bones and presence of a possible nasal fracture. A decision was also made as to whether or not the patient would require any manipulation of the nasal bones. The same clinician then assessed the patient in person to see whether the findings based on image review agreed with the clinical examination. Clinical examination was considered to be the 'gold standard' method by which the decision for manipulation of the nasal bones was made. In addition, patients were given a simple questionnaire asking whether they thought the shape of their nose had changed after the injury and if they possessed a mobile phone with or without a built-in camera and the ability to send images.

Results

Twenty-eight patients were seen at the nasal fracture clinic and invited to participate in the study; three patients declined. Reasons for decline included language barriers which precluded full understanding of the study and embarrassment at being photographed. The study population therefore consisted of 25 patients (18 men and seven women). Their mean age was 34 years (range 17–77 years). Three mobile phone camera images per patient were reviewed.

Twenty of the 25 patients owned a mobile phone. Twelve of them owned a mobile phone with a camera and eight of those patients could send a picture message with the mobile phone. The mean age of those patients who possessed a mobile phone with a camera and could send picture messages was 26 years (range 17–30 years).

Based on the camera image assessment, 22 patients were found to have straight nasal bones and three were found to have deviated nasal bones. Findings based on the clinical assessment were different. Clinically, 17 people were diagnosed with straight nasal bones and eight with nasal bone deviation. Five out of eight nasal bone deviations were missed on camera image assessment. There were no cases in which a deviation was noticed on camera image and not on clinical assessment. In all three cases that a deviation of the nasal bone was noticed by the mobile phone image, there was a deviation apparent on clinical examination. All eight patients who were diagnosed with deviated nasal bones on clinical examination required a manipulation of their nose under anaesthesia (Table 1).

Table 1 Need for manipulation of the nasal bones following a nasal injury according to clinical examination (gold standard) and mobile phone image

	Need for manipulation based on clinical examination (no. of patients)		
Need for manipulation based on phone image (no. of patients)	Yes	No	Total
Yes	3	0	3
No	5	17	22
Total	*8*	*17*	*25*

Table 2 Need for manipulation of the nasal bones following a nasal injury according to clinical examination (gold standard) and patients' own opinion

	Need for manipulation based on clinical examination (no. of patients)		
Need for manipulation based on patients' opinion (no. of patients)	Yes	No	Total
Yes	8	4	12
No	0	13	13
Total	*8*	*17*	*25*

Table 3 Test statistics for each method of nasal fracture assessment

	Mobile phone image assessment (%)	Patient's opinion (%)
Sensitivity	38	100
Specificity	100	76
Positive predictive value	100	67
Negative predictive value	77	100

When the patients were asked if they thought the shape of their nose had changed after the injury, 12 thought that it had and the remaining 13 thought that it had not (Table 2). Of the eight people who were clinically found to have deviated nasal bones, all were in the group that thought the shape of their nose had changed after injury. The test statistics for each method of nasal fracture assessment are given in Table 3.

Discussion

Mobile devices such as telephones and personal digital assistants have been used as tools for telemedicine since they became available at a relatively low cost.[14,15] Technology has advanced with mobile phone handsets incorporating multimedia messaging services, thus allowing the sending and receiving of images and video clips. Mobile phones with these capabilities are simple to use, with image resolution of sufficient quality to make an accurate management plan in many different medical specialties.[16]

Mobile phones have been previously described for use in otolaryngology consultation in relation to assessment of radiological images, such as lateral soft tissue radiographs for suspected foreign bodies. There was a high degree of correlation for the diagnosis using mobile phone digital images when compared with the hard copies viewed on an X-ray box.[11]

The present study aimed to establish the feasibility of using mobile phones with a built-in camera for the assessment of nasal injuries. The results showed that while mobile phones were common, not all patients who owned a mobile phone possessed the ability to send photo messages. About one-third of patients owned a mobile phone with a camera with which they could send a picture message. As expected, elderly patients did not possess a mobile phone with a camera, nor did they know how to transfer an image. The confidence in making the correct diagnosis regarding the shape of the nose and the need for further intervention was higher for the consultation findings compared with the mobile phone image. There was some agreement between photographic assessment and clinical assessment. However, five patients diagnosed with fractured nasal bones requiring manipulation on clinical examination were not diagnosed on camera findings.

Image quality and resolution are especially important in deciding on the degree of deviation of a nose. Our main concern was the image quality, which precluded us from making an accurate diagnosis. Multiple images taken from different angles, rather than only straight-on views of the face, may be more useful to identify an abnormality in the shape of nose. It is unlikely that a clinician would base a management decision solely on the type of digital image produced by current mobile phones. A diagnosis is based on many factors, including the history. The greatest agreement with clinical assessment was simply asking the patient's own opinion as to whether there was a new deviation of their nasal bones. The question 'Do you think your nose has changed shape after the injury?' was a more sensitive indicator of whether the patient actually had a deviated nose and was a better screening tool than a camera picture alone (Table 3). A simple telephone assessment may therefore be a more accurate way of screening.

An important disadvantage of using mobile phone images may include the reduced confidence clinicians may feel when making management decisions based on a new and unfamiliar modality. The quality of the

image depends on the resolution of the camera, external factors such as lighting, movement and the skill of operator. The images are two-dimensional representations of three-dimensional pathology. Visualization is one of the four cardinal components of a physical examination. Miscommunication and mismanagement as a direct result of viewing an image are possible outcomes.[17,18]

Some limitations of this study were apparent. If a better phone with higher image resolution and larger size liquid crystal display screen were used, then the results might be different. In addition, it is possible that viewing the same image on a larger screen might improve accuracy. Further research is required.

In conclusion, the present study suggests that photo messaging used for remote evaluation of nasal deformities is not yet feasible with the technology we used. A telephone consultation asking patients whether or not the shape of their nose has changed and whether they experience any nasal symptoms would be useful. Perhaps using a telephone consultation in combination with a digital image would provide a more accurate means of diagnosis.

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