

Current Trends In Photographic Imaging For Rhinoplasty Surgery

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Abstract

Photographic imaging of the nose is widely practiced in the planning and analysis of rhinoplasty surgery. It is valuable as an adjunct to the process of informed consent and for medicolegal documentation. The use of digital photography has become widespread and has led to the development of digital image manipulation. This study reviews current evidence for the use of imaging for rhinoplasty and assesses current practise through a cross-sectional survey by postal questionnaire of United Kingdom consultant otorhinolaryngologists.

305 surgeons replied. 68.5% of respondents perform rhinoplasty/septorhinoplasty surgery, of whom 99% use imaging. 28.2% never have images taken postoperatively. Digital photographs were more common than film, but only 5.7% used digital image manipulation. The use of digital image technology is common in the recording of pre and postoperative images for rhinoplasty, but the use of digital image manipulation has yet to gain popular acceptance amongst UK otorhinolaryngologists.

INTRODUCTION

Photographic imaging allows surgical planning^{1,2,3,4} and provides a means to enable frank discussion with patients during the consent process.⁵ Imaging can provide an intraoperative reference and enables postoperative comparison of aesthetic outcome.³ The necessity of imaging as medicolegal documentation has increasingly become a consideration in its use.⁵

Rhinoplasty photography aims to capture detailed images in order to delineate the features of the external anatomy of the nose.¹ Photographs have traditionally been taken using the 35mm format. While producing excellent images, they provide problems in terms of storage and time delay for development. Digital photography allows images to be easily previewed, stored and retrieved. These obvious advantages along with the increase in image quality and lowering in price of digital cameras over the past decade, has allowed their use to increase. Digital imaging has also led to the advent of digital image manipulation. Studies of computer image manipulation use in rhinoplasty have shown that predicted results correlate well with actual postoperative appearances^{6,7} and that patient satisfaction can be significantly improved when compared to cases where image manipulation was not used.⁸

Much has been published regarding the technical aspects of photography for rhinoplasty surgery including information regarding equipment, lighting, printing and the views taken.^{2,3,4,9,10} The potential advantages of digital photography and digital image manipulation are clear. However, cost of equipment and the time-consuming process of digital image manipulation do provide constraints, especially within the National Health Service (NHS). Although rhinoplasty surgeons are undoubtedly aware of the importance of imaging in their practice, there is no universal standard protocol. This study evaluates current evidence for imaging use in rhinoplasty and ascertains imaging protocols used by United Kingdom (UK) consultant otorhinolaryngologists through a cross-sectional survey by postal questionnaire.

MATERIALS AND METHODS

DESIGN AND SAMPLING

A cross-sectional survey by postal questionnaire regarding imaging in rhinoplasty surgery was sent only to UK consultant otorhinolaryngologists who were full members of the British Association of Otorhinolaryngologists - Head and Neck Surgeons (BAO-HNS) in January 2005 (Figure 1). 535 confidential questionnaires were sent with a prepaid, self-addressed reply envelope. A three month delay was allowed

for return of the questionnaires. Only fully completed questionnaires were included in the study.

Figure 1

Figure 1: Rhinoplasty imaging questionnaire

*Please tick the boxes of **all** statements that are true for your practice*

I do not perform rhinoplasty/septorhinoplasty surgery

I perform rhinoplasty/septorhinoplasty surgery in my:

NHS practice

Private practice

If you do not perform rhinoplasty, please still return the questionnaire in the pre-paid envelope provided and thank you very much for your time.

I perform approximately the following number of these procedures each year:

1-10 11-20 21-30 31-40 41-50 >50

I have photographs taken:

		Always	Sometimes	Never
Preoperatively:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Postoperatively at approximately:	<4 weeks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4 to 6 weeks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2 months	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3 months	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	6 months	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1 year	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	> 1 year	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The photographs taken are by:

a medical photographer

me

The photographs taken are:

film

digital

I views that I have taken are:

frontal (AP)

laterals (profile)

obliques (¾ laterals)

basal (tip)

half basal (supratip)

cephalic (sky)

Figure 2

other (please state).....

I use the photographs preoperatively:

with the patient to aid explanation of the operation and consent

to plan my surgical technique

for medicolegal documentation

For intraoperative reference I use:

photographs

digital images on a computer in theatre

projected images in theatre

nothing

other (please state).....

I use digital image manipulation Yes No

*If you **do** use digital image manipulation:*

I use digital image manipulation for patients in my:

	Always	Sometimes	Never
NHS practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Private practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I use digital image manipulation in patients where the indication for surgery is:

	NHS practice	Private practice
functional	<input type="checkbox"/>	<input type="checkbox"/>
cosmetic	<input type="checkbox"/>	<input type="checkbox"/>
combined	<input type="checkbox"/>	<input type="checkbox"/>

I use digital image manipulation preoperatively:

with the patient to aid explanation of the operation and consent

to plan my surgical technique

Thank you for taking the time to complete this questionnaire. Please return it to us in the pre-paid envelope provided.

MAIN OUTCOME MEASURES

The questionnaire was devised to ascertain the frequency of rhinoplasty surgery amongst UK otorhinolaryngologists. The timing of pre- and postoperative photographs, the views taken and format used were questioned. The use of the images by surgeons in terms of medicolegal documentation, preoperative planning and intraoperative reference were ascertained. The questionnaire explored use of digital image manipulation.

RESULTS

RESPONSE RATE AND FREQUENCY OF RHINOPLASTY SURGERY

305 questionnaires were returned fully completed giving a response rate of 57%. Rhinoplasty/septorhinoplasty surgery was performed by 68.5% of responders. The mode in terms of number of procedures performed each year was 1 to 10 (Table 1). 10.0% performed more than 50 procedures each year.

Figure 3

Table 1: Frequency of rhinoplasty surgery

Number of procedures/year	1-10	11-20	21-30	31-40	41-50	>50
Number of responders n (%)	68 (32.5)	58 (27.8)	29 (13.9)	19 (9.1)	14 (6.7)	21 (10.0)

PHOTOGRAPHY AND TIMING

Rhinoplasty imaging was used by 99.0% of surgeons with only 3 responders never using imaging. Of those surgeons who use imaging, photographs were always taken preoperatively by 90.9%. Postoperative photographs were most commonly taken at 3 months. 28.2% never took postoperative photographs (Table 2).

Figure 4

Table 2: Use of pre and postoperative imaging

		Always	Sometimes	Never
Preoperative		90.9%	7.7%	1.4%
Postoperative	<4 weeks	1.4%	29.2%	28.2%
	4-6 weeks	3.8%		
	2 months	5.7%		
	3 months	20.1%		
	6 months	6.2%		
	1 year	4.3%		
	>1 year	1.0%		

PHOTOGRAPHER AND FORMAT

Photographs were taken exclusively by a medical photographer in 55.5%, by the surgeon in 28.7% and by either in the remainder. 5.9% used exclusively digital photography and 36.4% traditional film, the remainder using either.

IMAGING VIEWS

All responders used frontal and 98.5% lateral views (Table 3). The most common number of views taken was 4 (45.4%). The most common combination of views was frontal, laterals, obliques and basal.

Figure 5

Table 3: Use of different views in rhinoplasty imaging

View	Number of image users n	(%)
Frontal (AP)	206	(100)
Laterals (profile)	203	(98.5)
Basal (tip)	182	(88.3)
Obliques (¾ laterals)	103	(50.0)
Cephalic (skyline)	65	(31.6)
Half basal (supratip)	16	(7.8)
Other	4	(1.9)

USE OF PHOTOGRAPHS

Of those who have photographs taken, 60.9% use the photographs for medicolegal documentation, 30.1% to aid

explanation and consent with the patient and 26.9% to plan surgical technique. Photographs were used by 50.2% for intraoperative reference. 44.7% use nothing for intraoperative reference. 3 surgeons used digital images on computer in theatre, 1 projected images in theatre, 4 their notes and 1 pictures on the theatre stack taken with an endoscope.

DIGITAL IMAGE MANIPULATION

Digital image manipulation was used by 5.8% of rhinoplasty surgeons which is 9.0% of those who use digital photography. Of these 12 surgeons, 8 performed over 50 procedures each year. 50% never used digital image manipulation in their NHS practice (Table 4) and most used it for cosmetic or combined cosmetic and functional cases (Table 5). 91.7% of these surgeons used digital image manipulation to aid explanation and consent with the patient and 41.7% to plan surgical technique.

Figure 6

Table 4: Use of digital image manipulation

	Number of surgeons using digital image manipulation		
	Always	Sometimes	Never
NHS practice	1	5	6
Private practice	2	9	1

Figure 7

Table 5: Indication of surgery where digital image manipulation used

Indication	NHS practice	Private practice
Functional	2	2
Cosmetic	4	9
Combined	4	7

DISCUSSION

We believe that standardised high quality photographs are required for rhinoplasty analysis. Preoperative photographs provide information to aid communication in the assessment by the surgeon and patient together in the process of informed consent. The goals of the patient in terms of aesthetic outcome can be evaluated by the surgeon, who can then educate the patient to ensure that they have a realistic idea of what can be achieved. We agree with Zijlker et al. that thorough preoperative analysis and planning is crucial to meet the psychological and aesthetic goals of rhinoplasty.¹⁰

This cross-sectional study does have limitations as the response rate was just below the 60% reported to be ideal for meaningful inferences to be made.¹¹ However, the questionnaire was confidential, targeted only experienced clinicians and was quick and easy to complete. Stamped addressed envelopes were used to increase response rate. As

such, these results should be considered worthy of discussion.^{12,13}

Rhinoplasty surgery is performed by 68.5% of responders. Many are not performing this operation regularly with around one in three operating once each month or less. The distribution demonstrates increasing evidence of rhinology and nasal plastic surgery as a subspecialty in its own right as, although not truly bimodal, there was a second peak with one in ten consultants performing rhinoplasty at least once each week.

Although other methods have been used, photographs are the cheapest and simplest method of providing preoperative documentation. Indeed, virtually all responders have preoperative photographs taken although only 30% of these use them to aid explanation of the operation and consent and 27% for planning surgical technique. Half of surgeons use photographs for intraoperative reference.

Medicolegal documentation was the most common use of preoperative photographs. Accurate documentation certainly gives the best defence for the surgeon in cases of litigation and standardised photographs provide essential objective documentation in rhinoplasty surgery.⁵ In the current climate of increasing medicolegal litigation, surgeons would be well advised to have pre- and postoperative photographs taken for this reason alone. Good communication between doctor and patient remains essential to avoid litigation, but photographs are a valuable tool in the consent process.

Photographs can be taken quickly and easily by the surgeon or a dedicated medical photographer. Postoperative photographs provide an accurate record of outcome and enable independent analysis. They facilitate education; both of the trainee and the operating surgeon. Around two thirds of responders have postoperative photographs taken, most commonly at 3 months with an otherwise scattered distribution from under 4 weeks to over 1 year. This reflects the fact that there is little evidence to support the timing of postoperative photographs. While a reasonable judgement of surgical outcome can be made by three months, postoperative swelling can in some cases persist beyond a year. The importance of long-term follow-up has been emphasised by Webber, who reported cases where significant changes in aesthetic outcome took place up to two years following surgery.¹⁴ However, patients satisfied with their surgery may not attend for follow-up, and repeated appointments following rhinoplasty are difficult to justify within the time and budget constraints of the NHS.

Standardisation of photographic documentation in rhinoplasty surgery is widely recognised as being critical in enabling accurate evaluation of individual patient outcome and also comparison between different patients.^{1,2,3,4} Standardisation reduces the variables such as distance to subject, patient positioning, background, lens distortion, exposure, and lighting that can alter our perception of anatomical detail and give false postoperative surgical appearances.^{2,3,4, 9, 10}

Although many otorhinolaryngologists may have a basic working knowledge of photography, it is unlikely that they have the technical expertise, time and appropriate set up to allow them to take standardised photographs in every case. It seems appropriate that the skills of a professional medical photographer are best utilised to achieve this, which is reflected in the fact that over half of responders exclusively used a medical photographer to take the photographs. Under one third only took the photographs themselves. The involvement of a skilled medical photographer where locally possible is beneficial, as the competence of the photographer is paramount in achieving standardised high quality photographs. Dialogue and feedback between surgeon and photographer will optimise the images recorded.

Many authors have reported their opinions as to the relative importance of different views taken in rhinoplasty photography.^{1,2,3,10,14,15,16} Webber reports the “six standard views” without specifically naming them.¹⁴ Staffel believes that 95% of visual information for rhinoplasty is contained in three views: Frontal (anteroposterior), laterals (profile) and basal (tip).² This is a view endorsed by Zijlker et al. although both agree there is a place for obliques (3/4 laterals), cephalic (skyline) and half basal (supratip).¹⁰ UK practice reflects these opinions as all responders used frontal views, virtually all laterals and 88% a basal view. Only half have obliques taken and other views were less frequent. The most common combination taken was frontal, laterals, basal and obliques although many different combinations were reported.

A change in format of photography from 35mm film to digital is taking place in UK otorhinolaryngology practice with 46% now using exclusively digital photography and a further 18% digital as well as film. This follows the change over to digital photography by most professional photographers. Digital photography technology has overcome the problems of the time delay for photographic development, storage and recall that traditional film

provided. The first digital camera was available for commercial sale by 1990. Since that time, the image quality of digital cameras has significantly increased and the prices lowered, which has facilitated their widespread use. Digital photography does of course provide its own challenges. The quality and resolution of the printer and the accuracy of colour balance and contrast are paramount. Galdino et al. performed a direct comparison of commonly used digital cameras and found that this significantly affected the quality of the photographs.⁴ Image quality is maximised by high photographic resolution of the camera and the avoidance of image compression in their storage.¹

Digital imaging has led to the development of digital or computer image manipulation. This was first reported in rhinoplasty surgery in 1987 with the digitisation of 35mm pictures.¹⁴ Many software packages are now available which enable the surgeon to modify the appearance of the nose on preoperative digital images. Computer image manipulation provides a valuable tool in facilitating preoperative communication between surgeon and patient. The patient can be shown the likely result of operative changes to the nose. Although there are concerns regarding the accuracy of computer image manipulation use in rhinoplasty, studies have shown that predicted results correlate well with actual postoperative appearances.^{6,7} Sharp et al. have shown that patient satisfaction following cosmetic rhinoplasty can be significantly improved when compared to no image manipulation, although this was true only in patients where the indication for surgery was cosmetic.⁸ They demonstrated that the confidence of the patient in the surgeon was improved and importantly, some surgical changes previously considered by patients were abandoned following the image manipulation consultation. We found that digital image manipulation is used mainly for cosmetic or combined cosmetic indications for rhinoplasty.

Despite these advantages, digital image manipulation is only used by a minority of UK otorhinolaryngologists. Digital image manipulation does require significant resources to finance both the computer and digital image manipulation software. It also requires a reasonable level of computer literacy. The time required for consultation is longer. These costs in terms of time and resources are reflected in the fact that UK surgeons use digital image manipulation more in private than NHS practice. We found that digital image manipulation used more often by surgeons performing over 50 procedures each year than those performing under 50 i.e. those likely to consider themselves nasal plastic surgeons.

This reflects the fact that this group of surgeons are more likely to develop an interest in the use of this technology and also have more opportunity to use it, which may justify the expense.

CONCLUSIONS

Preoperative photography for rhinoplasty surgery is standard practice amongst UK otorhinolaryngology consultants. Most use this for medicolegal documentation, although we would also encourage the wider use of photographs to aid the process of informed consent. Postoperative photographs are used by two thirds of surgeons and are taken most commonly at three months. Most surgeons conform to the recommended photographic views of frontal, laterals and basal and have these taken by a medical photographer, which facilitates standardisation.

Digital technology has been embraced by UK otorhinolaryngologists in the recording of images for rhinoplasty, although the use of digital image manipulation has yet to gain popular acceptance. It is used more often by surgeons performing rhinoplasty surgery regularly and more in their private patients, which may reflect the time and cost restraints of NHS practice.

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