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Photography of operative techniques and pathology during arthroscopy using a second arthroscope

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The use of two arthroscopes is recommended to reduce the time needed for photography eliminating the need to remove video control from the main arthroscope, to record pathology and operative techniques for teaching without an additional light source.

Introduction

The use of video cameras attached to ordinary arthroscopes and more recently purpose-built glass-to-glass video arthroscopes has led to a decrease in the ease with which photographic records can be made.

The time delay for removing a video camera and accompanying drapes has been exacerbated by the need to attach a 22 mm eyepiece to a glass-to-glass type scope for use with an endoscopic lens. This has increased surgeons' reluctance to take time out for photography.[1] The detail obtainable with conventional silver technology, for lectures and publication, is still superior to that of a charged couple device (CCD) video camera.

Brown[1] recommended using a second arthroscope with a camera lens already attached to replace that used for observation with video control. This paper describes the added advantage of using two arthroscopes at the same time.

An introduction to the use of endoscopes is available on http://vertigo.derby.ac.uk/BiologicalImaging/Tutorials/EndoPhot.html and by Scott Kilbourne in *Biomedical Photography*.[2]

Materials and methods

The method devised to reduce the time factor in photography was to use a second arthroscope, either a 30° or 70° angle of view depending on which one was in use by the surgeon, or an older non glass-to-glass model which had become redundant after the purchase of new equipment. The routine use for complex arthroscopic surgery of at least two portals means the use of two arthroscopes is possible without making additional portals.

Method A – Light source on second arthroscope

Initially the second arthroscope was used to replace that under video control, as suggested by Brown,[1] with only the light source being changed over and occasionally the water inlet or outlet. The pathology could then be viewed and positioned by the surgeon with the light source turned down before the attachment of camera and lens for photography with the light source at full power (*Figure 1a*).

Method B – No light source on second arthroscope

In this further development the main arthroscope is left with the video camera and light source in place and the second arthroscope is introduced without a light source (water valve closed) so the main arthroscope and any instruments can be visualized (*Figures 2* and *3*).

The equipment used was a Baxter glass/glass arthroscope (Edwards AR6000-P) for video control with old style Olympus arthroscopes for photography. Photographs were taken using a Nikon 301 camera through a Storz 105 mm arthroscopic lens on Fuji 400D professional transparency film. This lens has a fixed aperture diaphragm of about f/8 and exposures with the Baxter 300W daylight light source (6000 °K) at maximum ranged from $\frac{1}{30}$ s to $\frac{1}{60}$ s, except for *Figure 1b* which required $\frac{1}{8}$ s.

Results

Lighting and exposure

The photographs produced using the two techniques were as good as normal. This would be expected with method A as the set up is the same as for routine arthroscopic photography and viewing without video control.

Method B produced equally good images (*Figures 2* and *3*). However, greater control was needed when recording scope positioning to ensure that the light from the main

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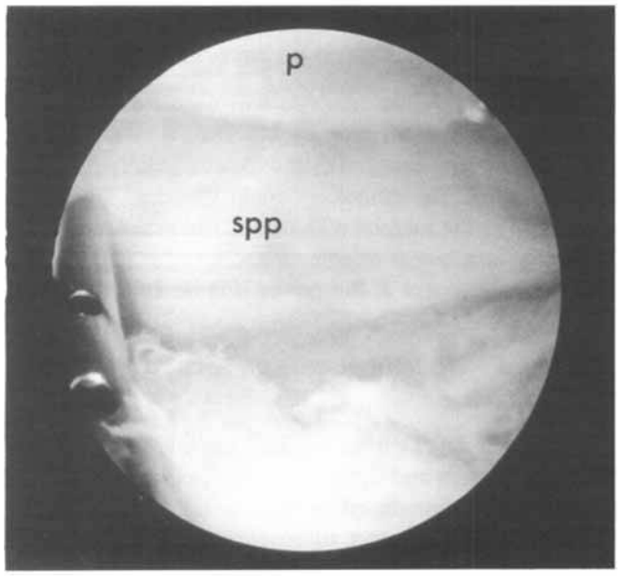
(a)



(b)

Figure 1 *(a) View from infralateral portal with the knee in extension looking superiorly at the suprapatellar membrane, light source on second arthroscope, method A. (b) View as (a) with the light source on the main arthroscope behind the suprapatellar membrane, method B (p – patella, spp – suprapatellar plica patella).*

arthroscope was pointing away from the second arthroscope to avoid flare. *Figure* 2 shows some flare from the edge of the arthroscope. Care also had to be taken to prevent the second arthroscope from knocking against the main scope or any instruments.

Method B produces good images of scope positioning but as the light comes from the main arthroscope it is seen as directional with shadows under the meniscus and condyle. In a normal arthroscopic view the lighting is axial, producing a 'shadowless' view. A photograph taken by method B without the arthroscope in view could be confusing to arthroscopists.

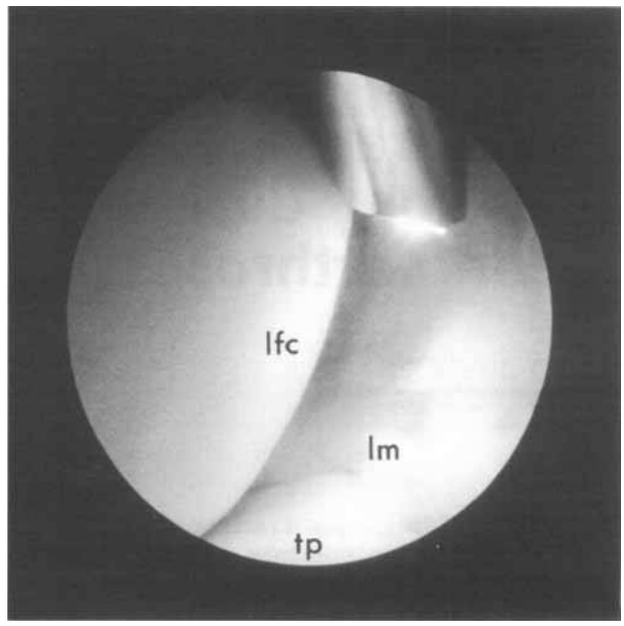


Figure 2 *View of lateral meniscus from the second arthroscope, method B, with the main arthroscope coming over the top from a superomedial portal. Note the slight flare from the tip of the scope (lfc – lateral femoral condyle, lm – lateral meniscus, tp – tibial plateau).*

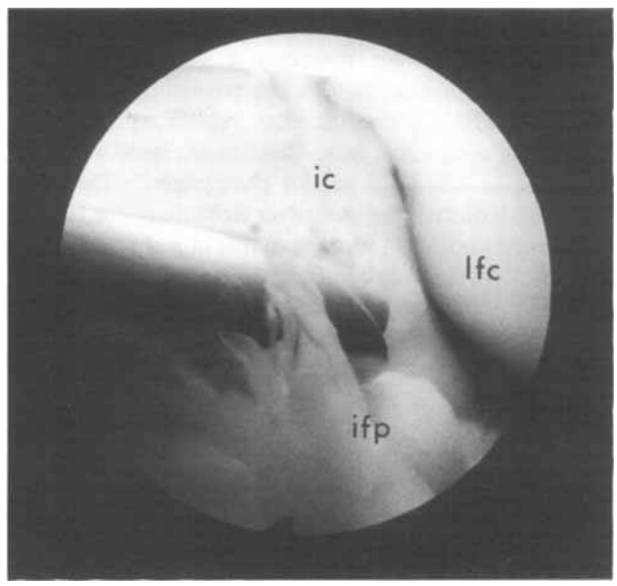


Figure 3 *View from the second arthroscope method B, through a lateral suprapatellar portal, looking at the main arthroscope positioned to examine the intercondylar notch (ic) and anterior cruciate ligament, infrapatellar fat pad (ifp) behind the arthroscope (lfc – lateral femoral condyle).*

Time saving

Method A was the most efficient at reducing the time for photography provided that the older type arthroscopes were made available in theatre. Method B took longer mainly to establish correct positioning and required the surgeon's

assistant to keep it in place but still less time than using the main arthroscope.

Demonstration of pathology and operative techniques

A combined use of the two techniques can be seen in *Figures 1a* and *b*. A suprapatellar membrane was observed from an infrapatellar portal and then entered from a suprapatellar portal under video control. *Figure 1a* shows the pouch photographed from below using a second arthroscope, method A, while the scope with video control was left in the pouch. *Figure 1b* shows the same view but with the light source now on the main arthroscope, method B. This transilluminated view shows the thickened hypertrophic nature of the suprapatellar membrane.

Method B was found to be ideally suited to demonstrating arthroscopic techniques as well as allowing the surgical assistant to view the instrument/main scope positioning while the surgeon is operating. *Figure 2* shows the main arthroscope coming over the top from a suprapatellar portal. The difficulties in obtaining a good view of the intercondylar notch can be seen in *Figure 3* with the close proximity of the infrapatellar fat pad behind the arthroscope.

Discussion

The use of a second arthroscope decreased the time needed for photography of knee pathology and reduced the nuisance factor of having to remove and reattach the drapes and video camera. The techniques, especially method A, make it easier to take photographic records routinely.

Using a second arthroscope without a light source, method B, provides a novel way of demonstrating pathology and operative techniques, giving an added dimension to visualizing the coordination of instruments and arthroscope in the knee joint.

Several illustrative techniques such as diagrams of cut away sections[3] and dissections of cadavers with arthroscopes in place have been used to show arthroscopic techniques but these do not convey the tightness of space or working in a fluid filled environment that can be seen using a second arthroscope, method B.

The use of these two methods should provide the means to alleviate the surgeon's natural concern over the length of time needed to undertake photographic recording during arthroscopy and provides an added dimension to endoscopic photography in general.

References

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3. Gillquist J Operative arthroscopy. *Endoscopy* 1980; **12**: 281–287.