Preparing a Digital Video Examination of Urinary Sediments

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INDEX TERMS: microscopic analysis; urinalysis.

Clin Lab Sci 2004;17(1):4

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Teaching the microscopic examination of urine sediments with patient samples is limited to the availability of appropriate, labile material. The alternative is to use static, flat, single views in 35 mm slides or on CD-ROMS. This paper discusses the preparation of material that mimics photographically what is seen through a microscope and presents a dynamic view of samples. Sediments were viewed through a binocular, light microscope using a TeachCam. The video feed was transmitted to a SVHS recorder for maximum resolution. The videotapes were digitized, and processed through a computer based non-linear video editing system. The final formats produced are on VHS videotape and DVD. Each specimen is presented with changes in focus and fields. Each sample is presented unstained and stained, and appears under low and high power. Six discrete segments allow viewing of selected elements. The video is accompanied by a narrative describing the identification and clinical significance of each formed element. The program has been well accepted by students.

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Many medical conditions and aspects of the body's biochemistry can be identified through the simple means of examining a patient's urine for metabolic waste products, therapeutic or recreational chemicals and their metabolites, cells, and other products of the urinary tract. The ability to identify the formed elements of a urine sample is a subjective process that can be difficult to teach and to perform. Done properly, the identification of these elements may be the difference between an accurate diagnosis and a faulty one. A limiting factor in the teaching of identification of formed elements to student clinical laboratory scientists is the availability of labile material found in urinary sediments. Thirty-five mm slides or CDs can be used as substitutes for fresh samples, but are not totally satisfactory. Due to the subjective nature of the identifications, subtle variations in morphology are frequently missing from these static pictures.

The purpose of this paper is to illustrate a method of preparing a digitized, professional quality, audiovisual program that addresses deficiencies in available teaching material. The finished program presents a dynamic view of patient urine sediment samples, and is as close as possible to an examination in a clinical setting.

METHODS

Urine sediments were made available by the laboratories at St Francis Hospital and MDS, Hudson Valley Laboratories, both in Poughkeepsie NY. These sediments were videotaped in a college laboratory within two hours of submission. A binocular light microscope was used, attached to a TeachCam from Video Labs Inc, Golden Valley MN, with 8 mm optics and a 291K pixel count. Approximately six hours of videotape were made. The video feed was transmitted to a SVHS recorder for maximum resolution. The specimens were taped as they were examined through the microscope, with changes in focus to examine specific formed elements in each field and changes in the fields viewed for each specimen. The samples were examined unstained and stained, using low and high power magnifications. When crystals were examined, a polarizing lens was added to the procedure.

Videotaping occurred over a three month period. Editing of the tapes and production of the narrative was done during regular semesters over a year and a half time period.

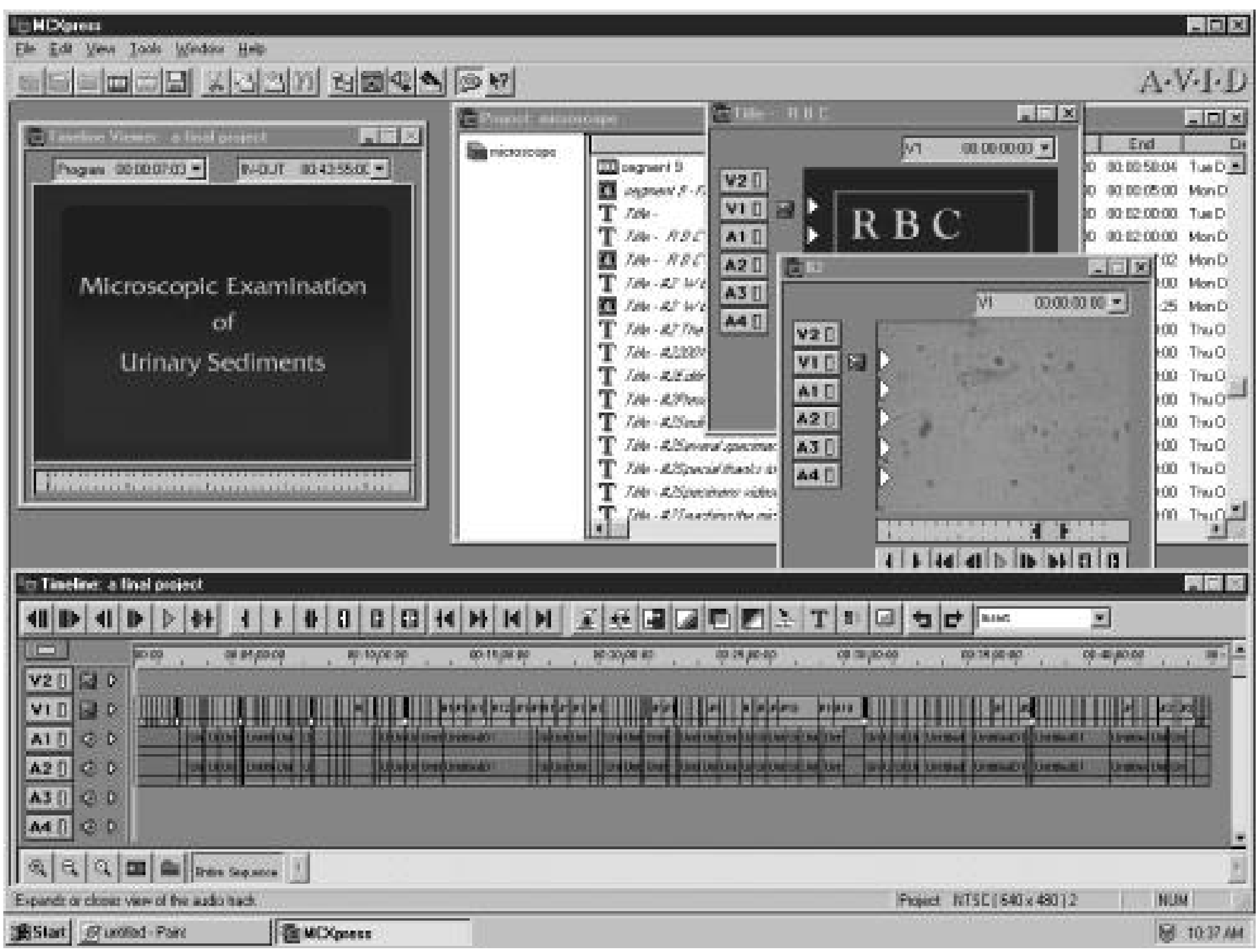
A media professional from the Media Center of Marist College played the role of video producer on the project. At the commencement of the project, SVHS was the college's highest quality video format available so this format was chosen.

Approximately six hours of sample materials, or raw footage was recorded. This was edited to approximately 40 minutes for the final product. The editing consisted of taking all the raw footage and reducing it down to the best and most desired portions.

The first phase of editing is logging the content of the videotapes. This entails watching all of the material on the tapes and creating a table of contents, or log. During the review of the content one can make notes referring to portions of the recordings that are to be included in the final product. For this project, approximately one hour of footage was determined to be particularly useful. That one hour was made up of approximately 50 segments representing the six categories to be presented. Each segment was named, numbered, and indicated on the log sheet reference. Having a clearly defined plan or script enables matching the script content to what was actually captured on tape.

Figure 1. Screen capture of the Avid desktop

The lower half is the timeline window, which graphically represents the entire 40-minute video. The left window shows a frame of the video. In the background center/right is the project bin window that lists all the sequences, clips, and titles. In the foreground/right are two clip windows displaying content that could be dragged into the timeline.



Once the videotaping of the samples was complete the raw footage was fed, or digitized, into the computer editing system running Avid MCXpress software (Avid Technology Inc, Tewksbury MA), a Windows-based application (Figure 1). The footage was brought in as individual segments. The result was a collection of dozens of clips representing the six sample categories. Each clip was named as it had been originally referred to on the logs. This consistency made managing and organizing the clips much easier.

Once in the software, six sequences of clips were constructed, one sequence for each of the categories. Each clip was viewed individually in a window and appropriate start and stop points were determined. In the nonlinear environment, footage can be reviewed a number of times, verifying the appropriateness of each clip shown. The selected portions of the clips were 'clicked' and 'dragged' into a timeline window. A timeline is a graphical representation of the sequence. As additional clips are added, the actual video sequence can be viewed in a composer window.

The sequences were arranged and rearranged by 'cutting', 'copying', and 'pasting'. There are multiple layers of 'undo' and 'redo'. Also available are numerous effects, such as slow motion and freeze frame. A freeze frame of the sample being presented was used to introduce each sequence. To clarify further for the audience that would be watching, graphics, in this case an arrow, were superimposed over the freeze frame pointing to the desired object in the sample. An additional graphic, that of the title of the sequence, was created and added at the beginning of each sequence.

Once the six sequences were complete they were recorded on videotape and used almost immediately in class. The video was a helpful instructional aid but it was clear that it could be used as a stand-alone study guide with the addition of voice-over narration.

The existing videotape was used to prepare a study guide narrative that would be heard as students viewed the video. This was recorded using a sound booth at the college, while watching the video. Later, that narrative was digitized into Avid and edited into the sequences at the appropriate places.

To create an opening for the video, stock footage shots of the campus were edited together into an additional sequence. Superimposed over the images was text introducing the video and suggesting how the video would be best used as a study guide. Closing credits were created as a final sequence and consisted of text over a black background.

The final phase of creating the video was assembling all the sequences, including the opening introduction, the six sequences of the samples, and the closing, into one sequence. The entire video, over 44 minutes in length, was played out of the computer and recorded to videotape to be used as a study guide available to students. The last step of the project was creating a DVD of the work.

The Avid workstation used for this project predates DVD burner technology. Therefore, an external DVD burner drive was needed. The one used was a LaCie DVD-RW Super Drive (LaCie LTD, Massy, France) bundled with Sonic MyDVD DVD (Sonic Solutions, Novato CA) authoring software. The Avid was able to save the entire video as an MPEG2 file. This is a high resolution DVD quality file. The MPEG file was imported into the Sonic software where the DVD was created.

RESULTS

The finished tape is about forty minutes long and consists of six major sections: Red Blood Cells, White Blood Cells, Epithelial Cells, Crystals and Casts, Microorganisms, and last, Assorted Specimens with Multiple Formed Elements. The narrative explains the identification of each formed element and its clinical and pathologic significance.

The final product is a VHS tape and a DVD disc. Both the videotape and DVD were used in a clinical microscopy course, and used by students to review the material. Verbal feedback from the students was positive.

Authoring means that the video isn't only burned to DVD as it would appear on a videotape, but also appears with menus, much like what you watch from the local video store. The sequences were broken apart onto two menus. The main menu contains options to view the introduction or the credits with a link to another menu. The second menu contains options to view the six sequences of the samples. Students can watch any or all of the sequences, search through each, or freeze the video for closer examination. The DVD can be viewed on a PC or with any home set top box (DVD player).

Since only a few copies were needed, the entire process was completed in-house. If multiple copies were required the digital video would have been duplicated at a professional production company.

DISCUSSION/CONCLUSION

This paper describes a process that took time, patience, and professional help from a media specialist. The primary author of this work started out with a need for his classroom, a way to present very labile material when it was not available, but no real idea how to do it. Examination of available options showed that excellent pictures were available, both as 35 mm slides and as CD-ROMs. As good as these pictures were, they were static forms that did not allow the viewer to change focus, look at other fields or examine the material as they would through a microscope, all of which are vital to students learning clinical microscopy. It was hoped that some sort of videotaping would produce the desired effects and allow students to view urine sediments in a more 'real' fashion.

The equipment needed to produce this product fell into two categories, what was needed to initially tape the microscopic images, and what was needed to process these images into a finished product.

A standard binocular microscope and a TeachCam were used to obtain the images of the sediments. The TeachCam attaches to an eyepiece of the microscope. The camera has an infinity focus and 'sees' whatever is available through the eyepiece. The resolution of the system is more than adequate for these purposes. The signal can be sent directly to a monitor for viewing, to a media projector for wider viewing in a lecture hall, or to a recorder. For this project, the signal went to a recorder, then to a monitor for viewing and focusing. The TeachCam is fairly inexpensive when compared to video for microscopes.

The editing equipment was in the media center at the college. This equipment is used by students and faculty to digitize and produce material for class projects. The second author on this paper is the Director of the Media Center at the college and provided the professional expertise to edit and complete this project. The authors worked together through the editing process, using the expertise of each in selecting and editing the material.

This project was an ideal candidate for nonlinear computer based video editing. There are many benefits of nonlinear editing that made it perfect for this. Three of these benefits are:

- The video is fed into a computer where editing takes place. All manipulation done to the video in no way degrades the quality. It remains high quality digital until it is played out to physical videotape. The final video would be useless if it was so degraded from copying and editing that a potential student would not be able to tell the difference between an epithelia cell and a cast.
- It had been planned that the final product would appear on CD or DVD format. If the editing is done on a computer, burning out to disc is straightforward.
- There was an enormous amount of raw footage on tape in no particular order. Initially it wasn't clear how the content would be organized or how and where voice-over narration would be used. Graphics would be superimposed later. The nonlinear environment meant flexibility of the sequence in which content was assembled. Nonlinear is to traditional taped-based editing as a word processor is to a typewriter.

An added advantage of using digitized data for this project is that it will allow additional material to be added as it becomes available. New images and narrative can be processed in the same way as the original material and inserted into the video and DVD product.

A portion of the finished product can be seen on the following web site: http://www.academic.marist.edu/~jzku. Please click on the highlighted "Research Interests" link at the bottom of the screen.

This paper demonstrates that it is possible to produce professional quality audiovisual material that satisfies a real need in the classroom and laboratory. An idea, time, patience, and the cooperation of other professionals are needed. The videotaping is fairly easy to accomplish. The necessary equipment is not expensive and has potential for a variety of audiovisual uses. Editing can be accomplished through the media or communications department of an institution or hospital. The project could be used by students to fulfill a course requirement. Companies that will do the editing for a fee can be found in the yellow pages.

RESOURCES

The following is a list for the sources of hardware and software used in the preparation of the material described in this paper: Avid Technology Inc, Tewksbury MA, www.avid.com; LaCie LTD, Massy France, www.lacie.com; Sonic Solutions, Novato CA, www.sonic.com.

A poster of the finished product of this project was presented at the World Congress 2002, 25th World Congress of the International Association of Medical Laboratory Technologists and the 70th Annual Meeting of the American Society for Clinical Laboratory Science, July 30-August 2, 2002, Orlando FL, USA.