A Microwave Tissue Processor Trial in a Routine Hospital Anatomical Pathology Laboratory

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Introduction:

The Anatomical Pathology Laboratory at Canterbury Health Laboratories was given the opportunity to trial and evaluate the Milestone Histos 5 Microwave Tissue Processor (Fig. 1). In this evaluation over three months, a variety of tissues were sampled and processed using both conventional and microwave processing. The resulting tissue blocks were sectioned and the slides were stained using Haematoxylin and Eosin (H&E) as per normal laboratory operating procedures. A small number of immunohistochemistry and special stains were also performed. Stained slides were evaluated by a panel of seven pathologists. A grading system for the H&E slides was established and all of these slides were scored against this grading system.

Trial Objectives:

1. Objectively compare the performance of microwave tissue processing against conventional tissue processing as currently performed in the laboratory. A variety of tissues were to be tested with tissue section thickness from 1mm to 3mm. Quality of the stained H&E slides was measured using five different parameters.
2. Validate the claims made by the manufacturer of the microwave tissue processor with regard to rapid tissue processing and the quality of the resulting tissue blocks.
3. Determine the ease of use of the microwave processor with regard to instrument programming, and processing steps used.

Trial Design:

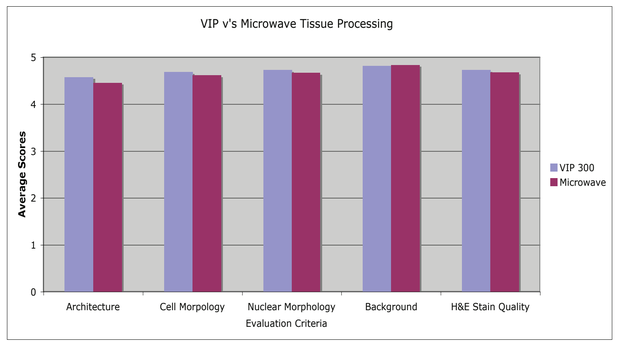
1. Gross tissue was cut using the CutMate device from Milestone. (CutMate allows the operator to quickly and easily cut tissue to a pre-defined thickness - 2, 3 or 4mm). 3mm is the standard tissue thickness used in the laboratory. Two cassettes for each tissue sample were prepared.
2. A log was kept which allowed identification of processing method for each cassette. Information from this log was kept confidential. This meant that no staff member could identify the processing method for any given tissue block or resulting slide.
3. For each tissue sample a labelled cassette from the pair was randomly assigned to either conventional or microwave tissue processing. The conventional tissue processor cycle relevant to the tissue type and thickness was used as per standard laboratory operating procedures. For the microwave cassettes the Milestone program relevant to either tissue thickness or number of cassettes was used. Where multiple thickness samples were processed within the same run, the greatest thickness determined the processing cycle. (In most runs this was a 3mm tissue thickness.)
4. All tissue samples were blocked, cut and stained for H&E using the standard laboratory operating procedures. There was no differentiation between either conventional or microwave processing through these procedures.
5. Stained slides were then randomly distributed to the panel of 7 consultant pathologists who perform diagnostic assessment. Each pathologist received a slide evaluation sheet. This sheet required the pathologist to complete a semi-qualitative score over five categories, as follows:

Evaluation Criteria	Stain Grading
1. Tissue architecture	1. Unacceptable
2. Cellular morphology	2. Fair
3. Nuclear morphology	3. Acceptable
4. Background staining	4. Good
5. Overall H&E assessment	5. Excellent

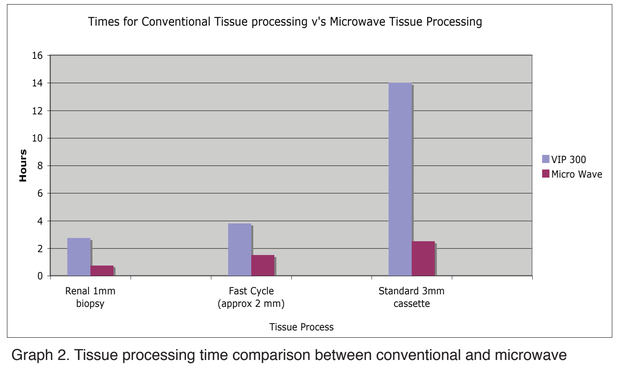
6. The results from the pathologists assessment sheets were collated on an Excel spreadsheet and analysed using standard statistical methods. The results are displayed in graph 1.
7. Processing times for the standard tissue processing method (Sakura Tissue Tek VIP 300) were recorded and compared to those for the Milestone Tissue Processor. This information is shown in Graph 2.
8. A small number of blocks were cut and the resulting slides stained for a representative selection of the immunohistochemistry antibodies used within the laboratory. Special stains were also completed for a small number of slides. Comments on these stains are contained in the discussion section.

Fig. 1 Milestone Histos 5 Microwave Tissue processor. The Microwave retort is on the left side. The unit on the right has the vacuum retort and the wax retort.

Fig. 2. The touch screen computer interface for the Milestone Histos 5. Program selection was intuitive, rapid and user friendly.



Graph 1. Average category scores for H & E slides from both conventional and microwave tissue processing. (The higher the score the better the result. Maximum score = 5)



Graph 2. Tissue processing time comparison between conventional and microwave tissue processing.

Results:

The results from the H&E slide evaluations performed by the pathologists were compiled into an Excel spreadsheet. Paired results from the VIP Tissue processor and the Histos 5 microwave tissue processor were grouped together for comparative purposes. The stain grade for each of the evaluation criteria was entered for each tissue. An average score was calculated for each of the evaluation criteria. These average results are shown in graph 1. For the majority of slides, there was agreement in stain grade for each evaluation criteria for both tissue processing methods.

A qualitative evaluation of a representative range of immunohistochemistry stains was completed. There was no observed difference in these staining results. A range of special stains were also carried out and there was no observed difference with these stains.

Processing times were compared between our current conventional tissue processor and those achieved with the microwave. These results are shown in graph 2. The microwave varied from being three times quicker for biopsies to five times quicker for tissues that are processed overnight using conventional methods. This meant that the microwave could achieve multiple processing runs during a normal working day.

From a technical perspective, there were no observed problems with any blocks processed with the Histos 5. During michrotomy, sections ribboned cleanly and no blocks crumbled. Blocks containing significant amounts of blood were easily and cleanly cut. This demonstrated that the Histos 5 did not cause any increase in technical problems.

The claims made by Milestone for processing times and processed block quality were found to be accurate and were validated by our study.

Conclusion:

During the last 20 years there has been little change in the way tissue is processed for anatomical pathology. There is an increasing expectation that results should be available rapidly (within 24 hours). A major obstacle to achieving this has been the conventional tissue processing methods used by New Zealand laboratories. International studies have shown that microwave tissue processing has the potential to reduce processing times dramatically. This trial was designed to objectively assess the slide quality achieved from blocks that had been processed using a microwave tissue processor, to see if processing times can be significantly reduced without any change in slide quality.

The Histos 5 microwave tissue processor has a variety of pre-stored programmes. This ensured that an appropriate choice, using the touch screen computer interface, could be made relative to tissue and thickness. The system has the potential for the user to easily optimise a specific programme to meet a specialised need. This makes this system very versatile. Computer software was user friendly and intuitive to use. (See Fig. 2)

Our trial had three objectives: assessment of results between conventional and microwave processing; validate the manufacturers claims; and determine the ease of use. We have been able to conclusively show that the slides resulting from tissue processed in the Histos 5 microwave tissue processor are equivalent to our conventional Sakura VIP tissue processor. The Histos 5 is easy to use and the manufacturers claims relating to processing time and block quality have been validated.

The use of accelerated tissue processing is a definite benefit to any laboratory that has a requirement to achieve same day processing of multiple tissue block batches. The Histos 5 has an added advantage that dual parallel processing can be achieved, where tissue dehydration occurs while another batch is undergoing wax impregnation.

The microwave tissue processor does not use xylene. From an environmental health perspective, it is desirable to reduce staff exposure to xylene. Use of the microwave tissue processor would help our laboratory to reduce our use of xylene. In conventional tissue processors xylene use causes wax contamination. This results in our laboratory having to make 2 - 3 wax changes each week. Conventional tissue processors require clean cycles at the conclusion of each run. Both of these problems are reduced on the Histos 5 microwave processor with clean cycles and wax changes being required once every 3 - 4 weeks, depending on usage. This saves both time and money.

All three trial objectives were successfully achieved during this study.