The Benefits of Continuous Workflow
Improving speed, productivity and quality in Histopathology

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SUMMARY

This paper compares the main tissue processors on the market and provides insight into their ability to improve turnaround times, productivity, reduce hospital costs and facilitate a continuous efficient workflow. Reviewing the details, we can conclude that the Sakura Tissue-Tek® x Series is outperforming all available systems on the market in terms of speed, efficiency and productivity improvement. Competing systems are claiming to offer the same benefits while in practice they offer no real solution to improve the workflow. These batch processors offer fast tissue processing, but do not make the total laboratory process faster and more efficient. You will find more details in this whitepaper.

Introduction

Sakura’s Tissue-Tek® Xpress® x Series, core product of SMART Automation, is an unique tissue processing system due to its continuous loading and rapid processing for all tissue types. Based on LEAN and SIX Sigma principles the Xpress® x series facilitates a continuous workflow leading to dramatically reduced turnaround times, significantly improved productivity and consistent high quality throughout the laboratory. Other systems on the market, the overnight conventional processors (e.g. Thermo Excelsior, Leica ASP6025) and the newer multi-batch processors (e.g. Leica Peloris and Milestone Pathos) create major bottlenecks, delays and inefficiency.

Some offer fast tissue processing, but do not make the total laboratory process faster. In other words: “Traffic jams are not solved with faster cars”.

Laboratory process improvement is just as important as choosing the right technology to become LEANER, but do remember that laboratories need to choose a technology that facilitates such a fast and efficient process as well.

This paper compares the main tissue processors on the market and provides insight into their ability to improve turnaround times, productivity, reduce hospital costs and facilitate a continuous efficient workflow.

Primary data for this study was collected from the SMART Analysis Tool (Sakura’s simulation tool), with input from several laboratories across Europe. Secondary data sources used were scientific literature, industry articles and case reports.

No waiting, immediate loading

Innovative labs have widely embraced SMART Automation as a clever way to improve lab performance. Examples are: Avera McKennan Hospital and University Health Center in the USA¹, Hillerød Hospital in Denmark² and Maastricht Medical University in the Netherlands³.

¹ Serrano L et al. : Using LEAN Principles to Improve Quality, Patient Safety and Workflow in Histology and Anatomic Pathology, Adv Anat Pathol, Volume 17, Number 3, May 2010
² Histopathology at Hillerød hospital: LEAN and patient-focused, Clinical Laboratory Internat., June 2010
³ Giesen F.: Faster diagnosis of cancer, Clinical Laboratory Internat., September 2011
The biggest bottleneck in histopathology is the batch processor

The main reasons behind the success of these SMART labs is the LEAN principle of continuous workflow and the removal of the biggest bottleneck in histopathology, the batch processor. Figure 1 shows the effect of eliminating waiting, continuous loading (every 15 minutes) and rapid 1 hour processing reducing the turnaround time from several days to 2-3 hours.

Even labs using the newer multi-batch processor (e.g. Peloris and Pathos) are waiting a long time before they have enough samples to load the instrument and start tissue processing. As a result the entire process is delayed. In practice these systems are only used 3 times per day, with different protocols and cycle times for different tissue types. Just ask yourself, at what time during the day do you have enough cassettes to load a batch processor with a capacity of 300 cassettes? Most labs wait the whole morning before to do their first run of biopsies. Many labs wait even longer due to the inefficiency of running a large capacity instrument with so little samples. A balancing act between speed and efficiency does not pay off, because these large retort batch system are not designed to accommodate a LEAN lab.

Figure 2 shows the effect of (multi) batching versus continuous loading and the number of cassettes waiting throughout the day before they are going on the processor.
The benefits of continuous workflow

Samples are reported in a fraction of the time

The best histology workflow is one fewer than 50 samples processed sequentially

Xpress® x120 is the only system on the market that can be loaded every 15 minutes with 40 cassettes

Improved turnaround times

Continuous workflow, also called single piece flow (SPF), enables a laboratory to improve speed next to efficiency. Sample results can be reported in a fraction of the time compared to a batch process.

SPF in the histology laboratory is not ideal due to technical limitations, but what is the optimal number of samples to be handled in one time. Reported as the best histology workflow is one of fewer than 50 samples processed sequentially in the shortest time possible. Larger loads determine a total workflow too lengthy and create an inefficient lab.\(^5\)

The tissue processor determines to a very large extend the flow in the laboratory. Continuous loading is the cornerstone for creating an efficient workflow. The Tissue-Tek® Xpress® x120 is the only system on the market that can be loaded every 15 minutes with up to 40 cassettes, facilitating this continuous workflow.

As a result labs have been able to report a 80% same day diagnosis rate.\(^6\) Compared to other publications relating to multi-batch processors such as Milestone’s Pathos (comparable to the Peloris) this number is much lower, namely 28%\(^7\).

**Assumptions:**
- 3 operators
- 3 process steps
- 1 minute to process a specimen
- 10 specimens

**Fig. 3. Batching versus Continuous Flow\(^4\)**

**Fig. 4 Turnaround time improvements continuous versus multi-batch processing**

\(^4\) Presentation Valumetrix Services, Lean consulting agency, part of Johnson & Johnson
\(^5\) Buesa RJ: Microwave-assisted tissue processing: real impact on the histology workflow, Annals of Diagnostic Pathology Volume 11, Issue 3, June 2007, Pages 206-211
\(^7\) Pathos Processing, the Liverpool Experience, Pathology in practice, August 2008
The benefits of continuous workflow

Staff can be freed up to do more value adding work and deal with the growing number of cancer cases each year

SMART labs are not waiting before they have enough samples. They load the system even with 5 samples, as the next run can be loaded after only 15 minutes. Not just biopsies processing and only 3 runs per day, but all tissue types every 15 minutes.

Improved efficiency & productivity

A continuous workflow means working with small numbers of samples at the same time resulting in workload levelling. Staff can be freed up to do more value adding work and deal with the growing number of cancer cases each year. Figure 5 shows the difference between continuous and (multi) batch processing and staff occupancy.

Less systems are required, which increases lab efficiency

A multi-batch process shifts the workload to the afternoon and hardly frees up capacity. In practice, at the end of the day still a lot of samples are waiting to be picked up the next day.

In most conventional labs the first samples are loaded on the processor at the end of the morning to be ready for embedding early afternoon. To overcome this you can buy more batch processor and load them more frequent. But how will this effect your lab efficiency? Is loading a batch processor with 300 cassette capacity retort with only 30 or 50 cassettes LEAN and efficient?

Continuous processing resulting in workload levelling also positively effects the number of downstream systems and capacity required. For instance, with the same daily number of samples that is evenly distributed throughout the day, less microtomes are required. The example below shows the potential for improvement.

<table>
<thead>
<tr>
<th>Example Laboratory</th>
<th>Xpress</th>
<th>Multi-batching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average # cassettes per day</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Cassettes per hour per technician</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Available hours per day</td>
<td>8 (all day)</td>
<td>4 (between 8.30-12.30)</td>
</tr>
<tr>
<td>Required microtomes</td>
<td>(1.4 =) 2</td>
<td>(2.9 =) 3</td>
</tr>
<tr>
<td>Efficiency improvement Xpress vs. batching</td>
<td>50%</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 6 Efficiency improvement Xpress vs. (Multi) batching
Conclusion:
Sakura’s Tissue-Tek® x Series is outperforming all available systems in the market in terms of speed, efficiency and productivity improvement. Competing systems claim to offer the same benefits while in practice they offer no real solution. These batch processors offer fast tissue processing, but do not make the total laboratory process significantly faster or more efficient.

References


Buesa RJ: Microwave-assisted tissue processing: real impact on the histology workflow, Annals of Diagnostic Pathology Volume 11, Issue 3, June 2007, Pages 206-211


Giesen F.: Faster diagnosis of cancer, Clinical Laboratory International, September 2011

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