ORIGINAL RESEARCH PAPER

Pathology

COMPARING DIAGNOSTIC QUALITY BETWEEN JENOPTIK AND SMART PHONE-BASED SLIDE IMAGING OF APPENDICITIS CASES.

KEY WORDS: Jenoptik, Smartphone, Photomicrography

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ABSTRACT

Context – Digital pathology involves collecting, managing, sharing and interpreting pathological information including slides and data in a digital environment. [1] In the age of digitization, these two alternative solutions were developed to evaluate and compare smartphones and JENOPTIK based photomicrographs slide imaging. This will help you create your own digital library archive for future reference.[2] The COVID-19 pandemic has brought novel challenges to educational programs worldwide, with pathologists adopting new imaging techniques for slides that mandate social distancing while maintaining effective delivery of educational materials.[3,4] Care centers are adopting digital technology slide imaging. Improve the quality, innovation and convenience of case reporting. **Summary:** In this study, percentage of measure of agreement was 85.3%, 89.1% and 81.5%, 83.7% for the slide images taken in the JENOPTIK and smartphone-based photomicrographs and analyzed by Observer 1 and Observer 2, respectively. It can be seen that the serial photomicrographs taken by JENOPTIK has better diagnostic accuracy as compared to SMART PHONE based photomicrographs.

INTRODUCTION

Microscopic observation of the tissues has come a long way from the time of Anton van Leeuwenhoek to today's sophisticated techniques.[5] In era of digitalization, two emerging alternative solutions in the field of academic as well as in commercial field has made analysing slides quicker and even rapid access to prior cases. [2] Also COVID 19 pandemic has brought unpredictable challenges for pathologist to adapt to a new environment that mandates appropriate social distancing while maintaining effective delivery of reporting.[3] Thus keeping this in mind, two solutions have been brought forward, one is slide imaging by Jenoptik software based photomicrography which helps in easy capturing, storing and transporting data and other solution is smartphone mounted on the eyepiece of an optical microscope, which gives a twist to the normal slide method. A pathologist can scan the whole slide and take multiple serial images and can stitch together to cover the whole tissue bit. This is simplified and affordable way of capturing and processing slides which can be widely distributed among clinical professionals, thus lowering the start-up cost to near zero.[2] Worldwide many pathologists capture single field view pictures of important spots on the slide for a later review or reference which may lead to miss out of some important fields, in comparison to our study where we captured multiple serial panoramic photomicrographs in horizontal axis until the whole tissue was captured followed by stitching the images together using an image processing software.[3]

AIM:

Comparison between JENOPTIK Optical system-based slide imaging and smart phone-based slide imaging of different types of appendicitis cases.

SUBJECT & METHOD:

The study was conducted at Dept of Pathology, JJMMC, Davangere. The samples included in study were 50 Hematoxylin & Eosin (H & E) stained Histopathology slides of Appendicitis cases, received within last six months duration. Old and unclear slides and cases other than appendicitis were excluded.

The procedure of the study was as follows:

1. H & E stained slides of histopathological diagnosed appendicitis cases were retrieved from departmental archives, observed and photomicrographs were taken under 20x and 40x magnification by using ProgRes CapturePro 2.7.7 – Jenoptik Optical system (Figure 1)
2. The same slides were also observed using an iphone 13 which was attached to "Elephantboat Telescope Spotting Scope camera cell phone adapter mount kit" which was attached to eye piece of compound microscope (Labomed LX400i) (Figure 2) to get a better photomicrograph.
3. Image accession was started from one corner of slide and multiple serial panoramic photomicrographs in horizontal axis until the whole tissue was captured.
4. The images were then saved and transferred to the computer followed by stitching the images using Photoscape software
5. The images were saved in a folder for easy retrieval for reviewer.
6. Images taken by both methods were reviewed by 2 blinded investigators to compare the accuracy of two methods.

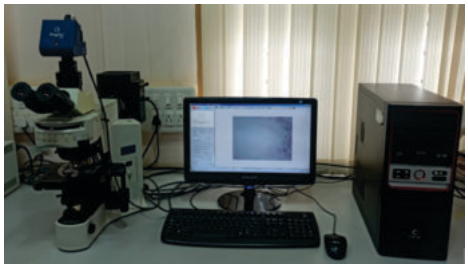

Fig 1 - ProgRes CapturePro 2.7.7 – Jenoptik Optical system.

Fig 2 - Elephantboat Telescope Spotting Scope camera cell phone adapter mount kit attached to Labomed LX 400i

Statistical Analysis -
The statistical Chi-square test was done using Statistical Package for the Social Sciences (SPSS) version 22 Software.

RESULT

On analysis of the results, it was seen that the percentage of measurement of accuracy was 85.3% (chart 1), 89.1% (chart 3) in Jenoptik photomicrographic based slide imaging and 81.5% (chart 2), 83.7% (chart 4) taken in smartphone-based slide imaging analyzed by observer 1(L1) and observer 2 (L2), respectively.

Observer 1

Chart 1– Percentage of accuracy of Jenoptik by observer 1

Chart 2– Percentage of accuracy of smartphone by observer 1

Observer 2

Chart 3– Percentage of accuracy of Jenoptik by observer 2

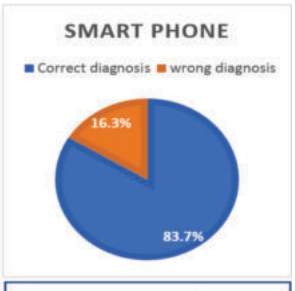

Chart 4–Percentage of accuracy of Jenoptik by observer 2

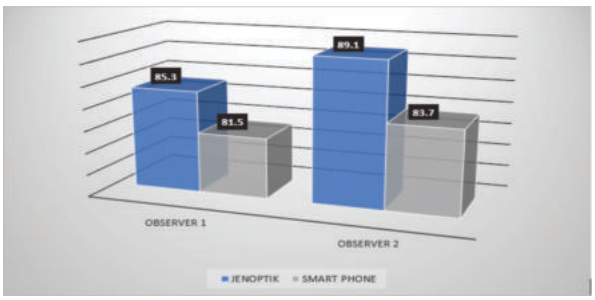

Chart 5- COMPARISON OF accuracy rate between JENOPTIK and smart phone-based photomicrograph in case of Observer 1 and Observer 2Observer 1 and Observer 2

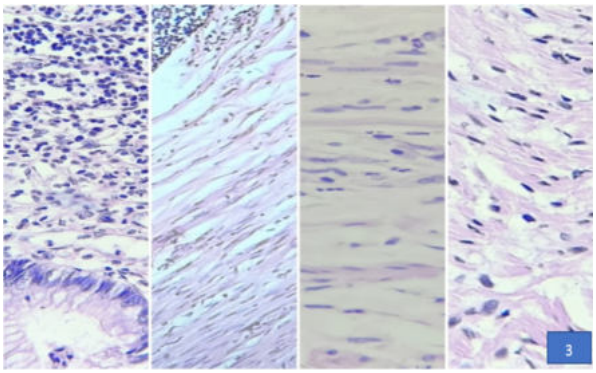

Fig 3- Smartphone Based Photomicrograph - Chronic appendicitis

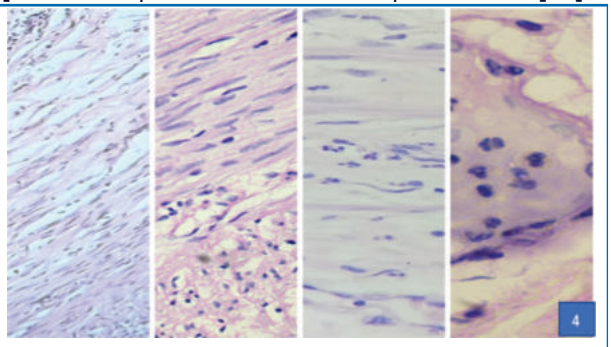

Fig 4- Smartphone Based Photomicrograph - Acute appendicitis

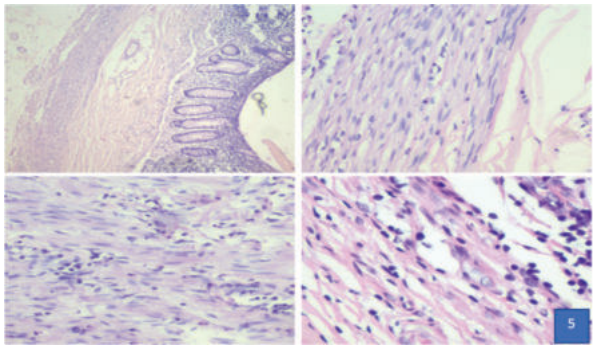

Fig 5 - Jenoptik Based Photomicrography - Chronic appendicitis

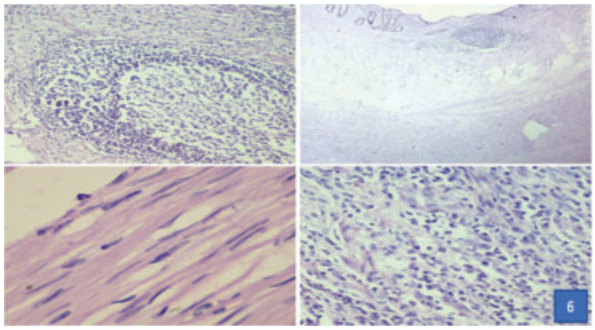

Fig 6 - Jenoptik Based Photomicrography - Acute appendicitis

DISCUSSION:

Traditional glass slides and standard microscopes have been used for decades in pathology teaching and reporting. This was a problem, however, as over time the stain faded, damaging the slides and sometimes making them difficult to replicate. [6] Early in the last century photomicroscopy enabled the pathologist to avoid some of these pitfalls. Digital pathology's roots go back to the 1960s, when telepathology was first experimented. At the turn of the 20th century, the scientific community increasingly agreed on digital pathology to demonstrate its commitment to digitization in pathology. Manual examination of histological slides under a microscope is a classically used method, but it is time-consuming, limited, and believed to be associated with intra- and inter-observer variability.

However, the method can be used to improve the assessment of histologic features in both applications - clinical and laboratory. It enables the acquisition of tissue morphology from glass slides and translates it into a photomicrographic collage covering whole slide, comparable to a conventional microscope thus reducing diagnostic errors, and also several advantages such as easy image accessibility and storage, portability, qualitative and quantitative image analysis, and use for educational purposes.[6,7,8]

To make the process more affordable and efficient, in this era,

a new promising tool by capturing and stitching multiple serial images to cover whole tissue bit can be used. Assessors will be able to assess stored files and folders from their own office, decreasing cost and time which can be used for future reference also.[9,10] A pathologist can request a second opinion from a distant colleague for an expert referral from a subspecialist.[11] It provides a high photomicrographic quality between jenoptik based and smart phone-based slide imaging to enhance workflow, easy accessibility. These static images were of limited clinical utility because they capture only specific regions of a glass slide whereas idea of capturing multiple serial images covering entire tissue can come up with this limitation. [2,12] Overcoming this major drawback may revolutionize the surgical pathologist's activity and slide storing.[13]

This method is helpful as it benefits avoidance of physical storage space, no risk of deterioration of staining quality or breakage of slides.[14] Patients themselves can carry, share the image soft copies via emails and report to physicians and reduces paperwork, turn-around time.[2,15]

The COVID-19 crisis will have many implications for healthcare, including pathology which taught us how to adapt new way of working, enabling social distancing and still being productive.[16] Some assets of this new way of working will be maintained beyond the crisis also by storing the soft copies of photomicrographs of different cases for reviewing or future reference.[3] Most importantly, it would provide a safe environment where trainees could develop skills and gain competency as well as greater autonomy to assist with the transition to independent practice.

In this study it was seen that the percentage of measurement of accuracy was 81.5%, 83.7% taken in smartphone (Fig 3 and Fig 4) and 85.3%, 89.1% in Jenoptik photomicrographic (Fig 5 and Fig 6) based slide imaging and analyzed by observer 1(L1) and observer 2 (L2), respectively. Thus, percentage of accuracy and quality of photomicrograph using jenoptik camera is better as compared to smartphone-based photomicrograph. The only limitation of this study is it will be difficult to apply for large tissue bits.

Study done by Shruthi et al, it was seen that Percentage of measure of agreement was 79.5%, 83.7% and 86.3%, 89.1% for the whole slide images taken in the smartphone and JENOPTIK photomicrograph and analyzed by Observer 1 and Observer 2, respectively, which is almost similar to our study.[2]

CONCLUSION:

In this study, it can be seen that the serial photomicrograph taken by JENOPTIK has better diagnostic accuracy as compared to SMART PHONE based photomicrographs (Chart 5).

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