

# 銜接單鏡頭使用之 3D 影像轉換系統應用於消化系內視鏡：一案例研究

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## Application of A Single Camera Stereo System in Gastroenterological Endoscopy: A Case Series

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### Purpose:

Endoscopy examination is an indispensable procedure from current gastroenterological practices. Conventional endoscopic systems produce 2D colored video images, which do not provide surgeons or endoscopists an actual depth perception of the scene. There are two cameras stereo endoscope system, which synthesize a stereo image from the images obtained with the cameras enclosed in a single endoscope tube. Such stereo system utilizes rigid endoscope and has limitations, including the fixed distance between two cameras in the endoscope which does not allow it to simulate the convergence of the human eyes. Furthermore, the diameter of the endoscope tube is not suitable for wide angle camera system and it needs an installation of a complete new system of the stereo endoscope. These disadvantages hinder the current state-of-the-art to become popular among surgeons or endoscopists who are already using single camera system endoscopes. Considering the limitations of the current state-of-the-art, a single camera stereo endoscope was developed in IRCAD-Taiwan (Taiwan patent No. M467436). We present here the preliminary result of using this novel single camera stereo system in gastroenterological endoscopic examinations.

### Materials and Methods:

**Patients:** Patients (n=8) who were planned for gastroscopy and colonoscopy examinations were included in the study. The study was approved by Institutional Review Board of Show Chwan Memorial Healthcare system. All patients were informed about using the new equipment in the endoscopic examinations. Patients with chronic heart diseases were excluded from the study. Average age of the patients was 51±9 years. Six patients were male and 2 were female. There were 6 patients for gastroscopy and 8 patients for colonoscopy examinations.

**Equipment:** The 3D system used in this study consists of a moveable computer-monitor system, which can be plugged into the conventional 2D endoscope system to acquire 2D images. The acquired 2D images were further processed in the computer of the 3D system and displayed as a stereo video on its 3D monitor (Figure 1). The stereo images can be visualized only after wearing a polarized light glass (Figure 2). The best stereo images can be seen if the user is directly facing the monitor.

**Endoscopy Examinations:** All the patients underwent gastroscopy or colonoscopy examinations under intravenous sedation. All endoscopies were performed by one senior

endoscopist. The flexible endoscopic system monitor of Olympus® was used to display the 2D video and the stereo video was visualized in the 3D monitor of the new equipment with the help of the polarized glasses from a distance of around 0.5m from the monitor. The endoscopy was performed under the visualization of stereo video. After the endoscopic procedure, the endoscopist answered the questionnaire and gave user feedback.



Figure 1: (Left) MonoStereo® 3D visualization system from single camera endoscope.

Figure 2: (Right) set up of the MonoStereo® system in the operation room

## Results:

For eight included cases, the procedures could be completed by watching the converted stereo images without any serious adverse event. Results of user experience questionnaire are shown in Table 1. The levels of the score are 5: Strongly agree 4: Agree 3: Neither agree nor disagree 2: Disagree 1: Strongly disagree.

Table 1: Questions and average score of its response.

#	Questions	Average Score
1.	The 3D perception of tissues and organs are good	4.0 $\pm$ 0
2.	The 3D perception of instruments are good	4.0 $\pm$ 0
3.	The 3D images displayed smoothly	4.0 $\pm$ 0
4.	It's comfortable in watching 3D without any nausea or fatigue	3.6 $\pm$ 0.5
5.	The 3D image helps in endoscopic procedure	3.0 $\pm$ 0
6.	The 3D is good compares to the original system	3.6 $\pm$ 0.5

## Conclusion:

The results of this case series showed the safety and low risk of using this novel single camera stereo system in the gastroenterological endoscopic examinations. Further well-designed comparative study may be needed to elucidate the clinical usefulness of this novel single camera stereo system.