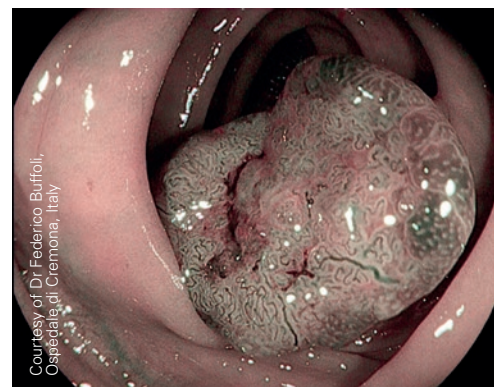
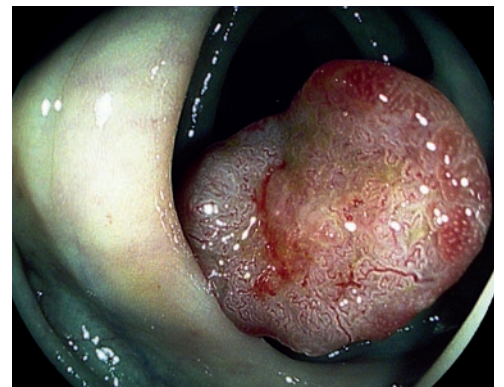
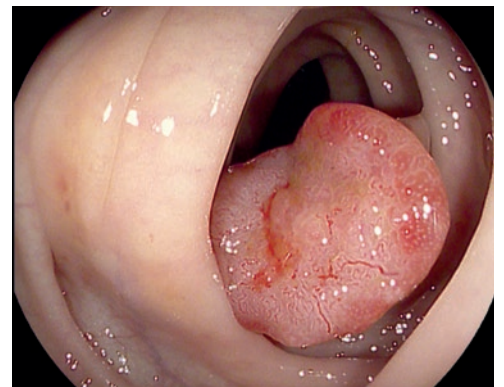


# i-scan Atlas for Gastroenterology

*Case studies from clinical practice with HD+, i-scan and i-scan OE*



Courtesy of Dr. Federico Buffoli,  
Ospedale di Cremona, Italy



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# Visible excellence.

Gastrointestinal endoscopy with HD+, i-scan and i-scan OE.

Dear readers,

i-scan OE (Optical Enhancement) is a new technology which facilitates surface and vessel recognition of the gastrointestinal tract. Today, PENTAX Medical is the only manufacturer which offers you the combination of optical narrow band technologies (i-scan OE) and digital processing filtering (standard i-scan), developed to further refine endoscopic tissue diagnosis and endoscopic therapy. The i-scan OE Atlas will provide you with image examples throughout the gastrointestinal tract with remarkable details of vessel and tissue architecture. This level of detail can be used to clarify the nature of lesions and to define the malignant potential allowing endoscopic therapies to be accurately planned and performed.

Using filter techniques that alter the light emitted to the mucosa, i-scan OE's narrowed light spectrum is especially useful for identifying discrete vessel changes and fine tissue alterations. Historically, these details were only recognized with advanced endoscopic techniques, such as endomicroscopy.

Internationally renowned experts have already tested the new system and provided a comprehensive atlas. All technological features are described, image examples are provided with settings and clinical algorithms recommended. Future studies will clarify the scientific value of i-scan OE for different diseases. I am sure that you will find this atlas extremely useful in your daily practice and helpful in familiarizing you with the new OPTIVISTA system. I wish you efficient work, precise diagnosis and accurate treatment – I am sure that i-scan OE will support you best.

Wiesbaden, April 2016

Prof. Dr. Ralf Kiesslich  
Professor of Medicine  
HELIOS Dr. Horst Schmidt Kliniken Wiesbaden, Germany



## A leap forward for *in vivo* histology

i-scan is an established digital enhancement technology supporting detection, characterization and demarcation. i-scan 1 Surface Enhancement (SE) highlights surface tissue architecture which may be used for the detection of circumscribed lesions or to highlight diffuse alteration (e.g. inflammation, atrophy). i-scan 2 or Tone Enhancement (TE) focuses on vascular and tissue architecture, supporting characterization.

The introduction of the new i-scan Optical Enhancement (OE) in addition to the existing i-scan family, will bring additional information on mucosal and especially vascularization patterns providing also additional confidence for the physician to accurately perform *in vivo* diagnosis. Greater understanding of the epithelial surface pit-pattern and vascular pattern helps to correctly characterize

mucosal lesions, allowing the differentiation of the neoplastic vessel and tissue patterns from the non-neoplastic, helping to define subsequent therapeutic decisions. In addition, the usage of optical zoom endoscopes in combination with virtual or dye-based chromoendoscopy can support the prediction of invasiveness of the neoplastic lesions.

Detection and characterization are important steps during routine endoscopy. First, all suspicious areas have to be identified. Subsequently, the endoscopist has to decide if an endoscopic intervention (e.g. biopsy, endoscopic resection) is needed. The unique combination of digital and optical enhancements, i-scan and i-scan OE technologies, supports both steps and raise routine endoscopic practice to an even higher level.

## Proven i-scan settings OPTIVISTA EPK-i7010 video processor

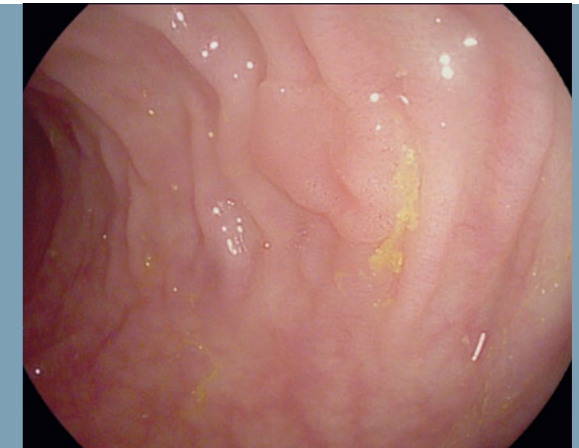
The i-scan and i-scan OE modes used in the i-scan Atlas used the following settings:

	Profile i-scan 1	Profile i-scan 2	Profile i-scan 3
	i-scan SE	i-scan TE	i-scan OE 1
Brightness	0	+1	+3
Ave / Peak	Ave	Ave	Ave
Blue	0	0	0
Red	0	0	0
Enhancement	Low / +2	Low / +2	Low / +4
SE	+5	+4	NA
CE	off	off	NA
TE	off	c	NA
OE	off	off	Mode 1
	<b>Supports detection</b>	<b>Supports pattern characterization and demarcation</b>	<b>Supports vessel characterization</b>

## i-scan and i-scan OE, a unique combination of digital and optical enhancements to support the clinical pathway

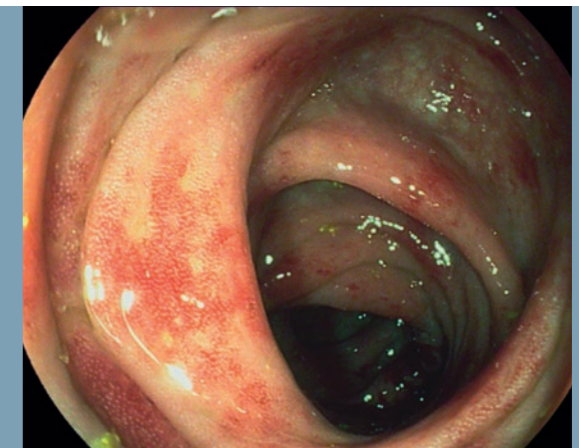
### Detection and delineation support with i-scan 1 – Surface Enhancement (SE)

Accentuates tissue structures supporting the detection of flat lesions and subtle abnormalities in a natural color tone.



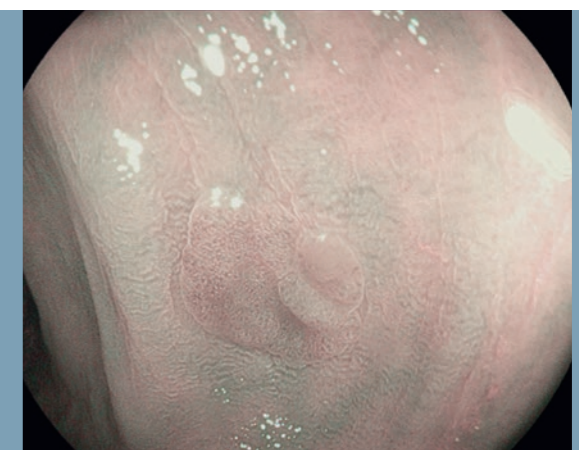
### Pit-pattern characterization with i-scan 2 – Tone Enhancement (TE)

Accentuates the display of minute mucosal structures and subtle changes in a color tone, supporting pit-pattern characterization and demarcation.



### Vessels characterization with i-scan 3 – Optical Enhancement (OE)

Accentuates the display of the surface structures of the blood vessels, glandular ducts and mucosal membranes in a color tone, supporting vessel characterization.



# The i-scan Leaders

The i-scan task force is a community of highly experienced doctors who have used i-scan in their clinical practice for many years.

PENTAX Medical has been working closely with this group so that their best practices and scientific evidence in i-scan can be shared in a peer environment. Its members participate in training and case discussion forums and ultimately contribute to the highest quality of care to patients.



**Professor Dr. Ralf Kiesslich**  
HSK Wiesbaden, Germany



**Professor Dr. Pradeep Bhandari**  
Queen Alexandra Hospital, UK



**Dr. Silvia Sanduleanu**  
Maastricht UMC+, The Netherlands



**Dr. Michael Häfner**  
St. Elisabeth Krankenhaus, Austria



**Dr. Federico Buffoli**  
Ospedale di Cremona, Italy



**Dr. José Miguel Esteban**  
Hospital Clínico San Carlos, Spain



**Professor Dr. Helmut Neumann**  
University Hospital Erlangen, Germany



**Dr. Rehan Haidry**  
University College Hospital London, UK



**Dr. Marc Giovannini**  
Institut Paoli-Calmettes, France



**Professor Dr. Raf Bisschops**  
UZ Leuven, Belgium



**Dr. Bartolomé López Viedma**  
Hospital General Universitario Ciudad Real, Spain



**Dr. Arthur Hoffman**  
HSK Wiesbaden, Germany





**How do you use i-scan and i-scan OE in your clinical practice?**

*"In my own practice I rely on i-scan 1 (SE) as my default initial mode for interrogating the upper GI tract. This has superseded the white light mode for me and helps me to assess and detect early cancers. The depth and image resolution is excellent at defining mucosal patterns that when disordered or irregular lead one to suspect neoplasia. My own preference is then to switch to i-scan 2 (TE) to better characterize the lesion in terms of borders but also it allows one to interpret vascularity in great detail. Coupled with the magnification range of endoscopes I have used this mode with much success, for example in patients with early squamous cell cancer of the esophagus. With the combination of conventional chromoendoscopy and agents such as acetic acid it can provide very accurate delineation of flat lesions. Over the past six months I have been using the new optical enhancements that PENTAX Medical have developed beyond the conventional i-scan modes described above. The filtering technology here provides a very distinct and lighter image of the vascularity and mucosal pit patterns that become disordered in early cancer and coupled with i-scan 1 (SE) have in my practice become the two most commonly used enhanced imaging modalities that I use."*

**Dr. Rehan Haidry**  
University College Hospital London, UK

## Diagnosis of early squamous cell carcinoma with i-scan, i-scan OE and MagniView

**Patient history**

A 68 year old lady with symptoms of dysphagia to solids underwent upper endoscopy. She had a history of diabetes and hypertension. There was no significant weight loss or alarm symptoms. Initial upper endoscopy showed candidiasis and random biopsies suggested squamous neoplasia. She then underwent follow-up endoscopy that demonstrated an early squamous cell carcinoma (ESCN) as demonstrated below.

**Endoscopic findings**

Early squamous cell carcinoma is the precursor to squamous cell cancer – it can be very difficult to detect endoscopically and often relies on adjuncts such as lugol's chromoendoscopy to show

unstained lesions indicative of neoplasia.

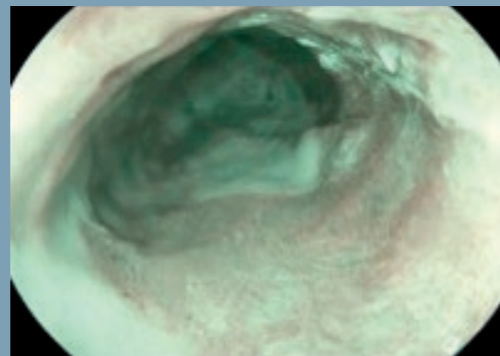
Magnification endoscopy with i-scan imaging and Optical Enhancement can very accurately demonstrate the abnormal vasculature that is the hallmark of ESCN – these are referred to IPCL (intra-papillary capillary loops) as demonstrated below.

**Patient outcome and follow-up**

The patient underwent endoscopic resection with circumferential ESD. The histology showed HGIN with a clear deep margin and m3 penetration. At follow-up endoscopy, 2 months later there was a stenosis requiring dilatation but no residual neoplasia on biopsy.

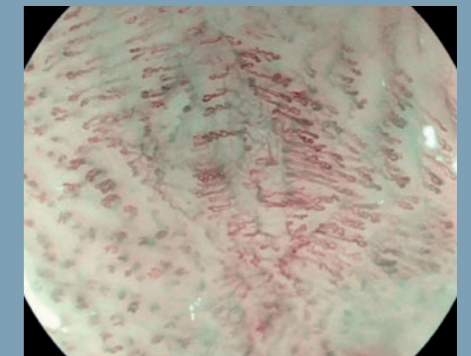
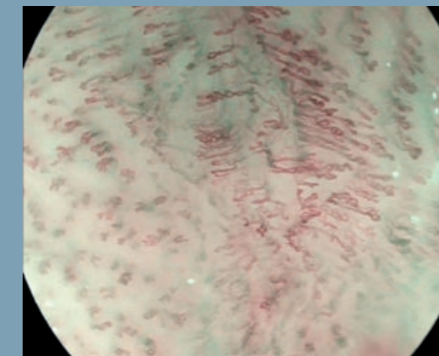
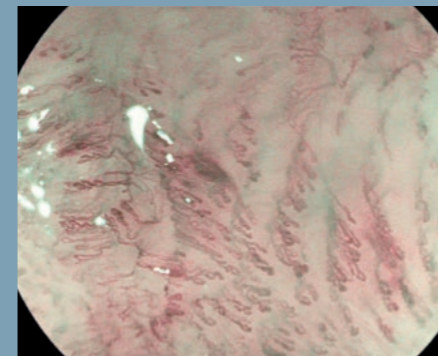
**Summary**

The case highlights that i-scan OE in combination with optical zoom endoscopy clearly helps visualization of the intra-papillary capillary loops supporting an accurate diagnosis.



**Image 1 and 2**

Non magnification images of an area of ESCN with i-scan 2 (TE) followed by i-scan 3 (OE).



**Image 3, 4 and 5**

Magnification endoscopy showing areas of ESCN and abnormal IPCL configuration. These images are obtained using the MagniView endoscope (EG-2990Zi).



**How do you use i-scan and i-scan OE in your clinical practice?**

*"I use systematically advanced imaging techniques such as i-scan and i-scan OE in the work-up of patients with suspicion of Barrett's associated neoplasia to help in the detection of small subtle lesions."*

**Professor Dr. Raf Bisschops**  
UZ Leuven, Belgium

## Diagnosis of a Barrett's oesophagus with i-scan, i-scan OE and MagniView

**Patient history**

A 57 year old male patient with history of reflux disease was referred after surveillance endoscopy with random biopsies detected high grade dysplasia.

**Endoscopic findings**

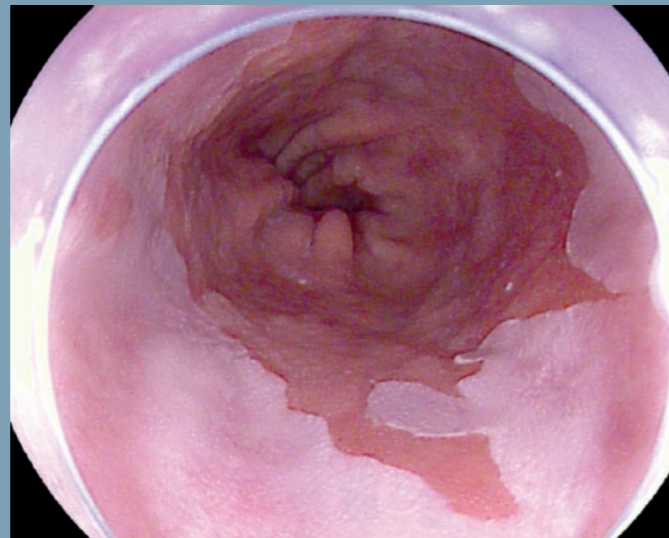
A C2M5 Barrett segment was found. At the top of the circumferential extend a discrete type II B lesions was found. i-scan 3 (OE) mode allowed to assess the mucosal and vascular architecture. In this case the MagniView was used to acquire magnifying endoscopy images. Optical zoom endoscopy with i-scan 3 (OE) showed an irregular mucosal and vascular pattern suggestive of neoplastic changes.

**Patient outcome and follow-up**

The patient was scheduled for endoscopic mucosal resection of this discrete lesion to obtain a proper histological staging of the neoplasia. If pathology results show good prognostic factors such as limited to the mucosa, without lymphovascular invasion and well to moderately differentiated neoplasia, the patient will subsequently be scheduled for additional ablation therapy of the Barrett.

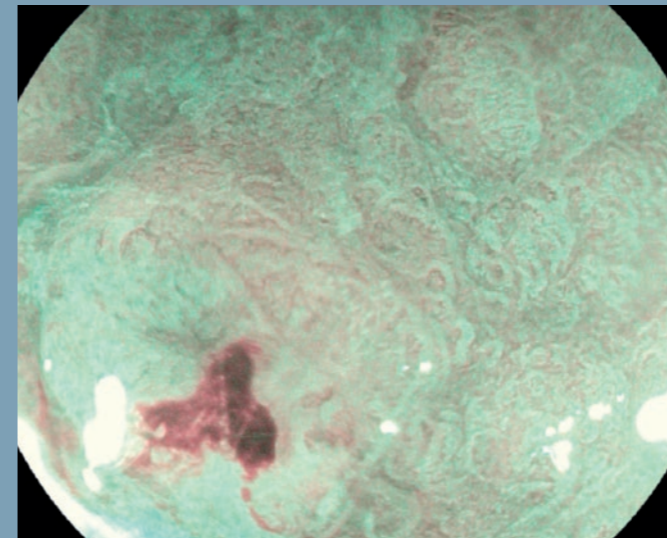
**Summary**

Patients with a suspicion of Barrett's related dysplasia require a thorough endoscopic work-up to detect small superficial lesions. Adequate histological staging is required to select appropriate patients for endoluminal therapy.



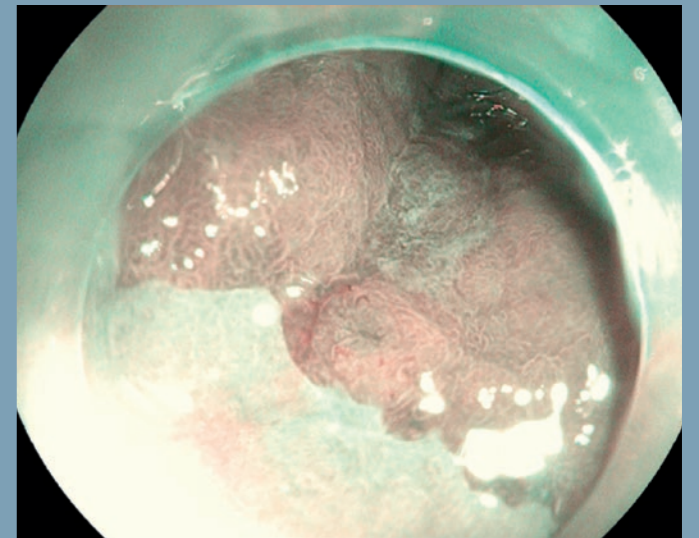
**Image 1**

i-scan 1 (SE) showed a C2M5 Barrett segment.



**Image 2 and 3**

This image is obtained using i-scan 3 (OE) together with an optical zoom gastroscope, MagniView (EG-2990Zi).







**How do you use i-scan and i-scan OE in your clinical practice?**

*"i-scan OE combines the versatility and flexibility of i-scan with even sharper and crisper pictures. While i-scan 1 (SE) is my standard setting during every procedure, because it gives you the extra bit of contrast and detail to detect even very subtle changes of the mucosa, i-scan 3 (OE) offers an extremely sharp view of the surface pattern, for example in Barrett's oesophagus.. Combine it with the capabilities of the optical zoom endoscopes and you get the ultimate diagnostic tool in both lower and upper GI tract."*

**Dr. Michael Häfner**  
Elisabethinen Krankenhaus Wien, Austria

## Diagnosis of an oesophageal squamous cell cancer with i-scan, i-scan OE and MagniView

**Patient history**

A 60 year old male patient is referred for gastroscopy because of recurrent dysphagia.

**Endoscopic findings**

The initial endoscopic white light picture seemed to be compatible with eosinophilic esophagitis (ring structures, stricture at 25 cm). However, upon closer inspection with i-scan 1 (SE) and i-scan 2 (TE) suspicious flat lesions could be detected. i-scan 3 (OE) in combination with optical zoom endoscopy clearly visualized pathological intrapapillary capillary loops (IPCL). By using this method we could identify the changes as IPCL type V1 with dilatation and irregularity, compatible with mucosal squamous cell can-

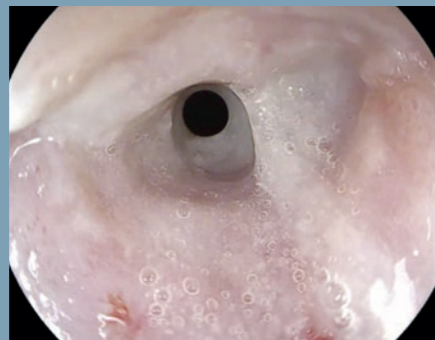
cer. Using Lugol's staining the full extension of the lesion could be shown.

**Patient outcome and follow-up**

Biopsies were taken and confirmed the diagnosis of esophageal squamous cell cancer. The patient was sent to surgery, due to a widespread and circumferential tumor.

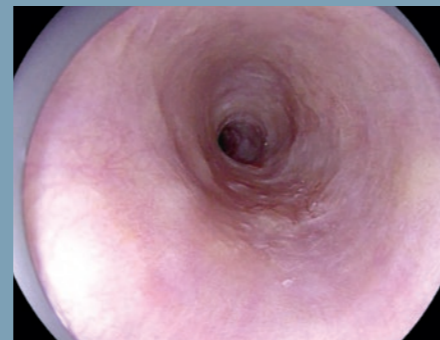
**Summary**

i-scan OE in combination with optical zoom endoscopy clearly allowed visualization of the pathological intrapapillary capillary loops (IPCL) supporting an accurate diagnosis.



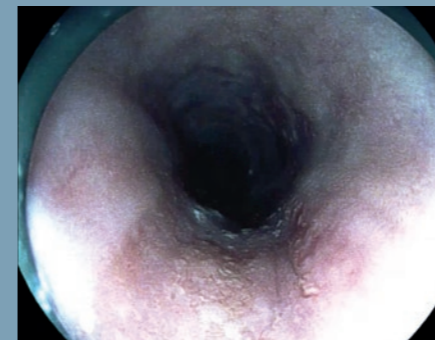
**Image 1**

White light picture showing ring-like structures, initially interpreted to be compatible with eosinophilic esophagitis.



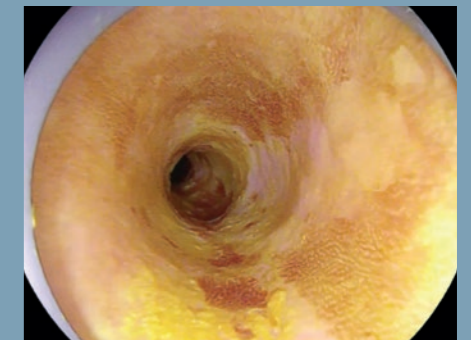
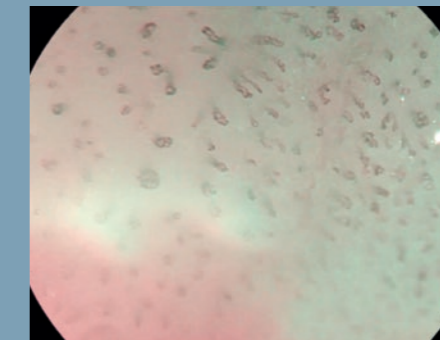
**Image 2 and 3**

i-scan 1 (SE) and i-scan 2 (TE) clearly show a flat lesion in the mid esophagus.



**Image 4**

i-scan 3 (OE) combined with optical zoom allows for the detection of dilated and irregular intrapapillary capillary loops (IPCL), compatible with mucosal squamous cell cancer. This image is obtained using the MagniView gastroscope (EG-2990Zi).



**Image 5**

Staining with Lugol's shows the full extension of the squamous cell cancer.



**How do you use i-scan and i-scan OE in your clinical practice?**

*"In my own practice I rely on i-scan 1 (SE) as my default initial mode for interrogating the upper GI tract. This has superseded the white light mode for me and helps me to assess and detect early cancers. The depth and image resolution is excellent at defining mucosal patterns that when disordered or irregular lead one to suspect neoplasia. My own preference is then to switch to i-scan 2 (TE) to better characterize the lesion in terms of borders but also it allows one to interpret vascularity in great detail. Coupled with the magnification range of endoscopes I have used this mode with much success, for example in patients with early squamous cell cancer of the esophagus. With the combination of conventional chromoendoscopy and agents such as acetic acid it can provide very accurate delineation of flat lesions. Over the past six months I have been using the new optical enhancements that PENTAX Medical have developed beyond the conventional i-scan modes described above. The filtering technology here provides a very distinct and lighter image of the vascularity and mucosal pit patterns that become disordered in early cancer and coupled with i-scan 1 (SE) have in my practice become the two most commonly used enhanced imaging modalities that I use."*

**Dr. Rehan Haidry**  
University College Hospital London, UK

## Detection and resection of an early neoplastic lesion in a Barrett's oesophagus with i-scan, i-scan OE and MagniView

**Patient history**

A 77 year old man with long standing symptoms of acid reflux was under a Barrett's surveillance programme. He has a history of type 2 diabetes and ischaemic heart disease with previous coronary surgery. At upper endoscopy a lesion was found arising from the Barrett's mucosa that was assessed with enhanced imaging and he underwent endoscopic resection.

**Endoscopic findings**

Barrett's oesophagus is the precursor lesion to oesophageal adenocarcinoma and early detection of neoplasia is essential to target therapy at an early stage. The images below show a patient undergoing surveillance for BE and de-

tection of neoplasia with i-scan imaging and optical enhancement.

**Patient outcome and follow-up**

The patient had an early lesion for which he underwent endoscopic resection. The specimen demonstrated intramucosal carcinoma with moderate differentiation, no lympho-vascular penetration and an r0 resection. There was no submucosal invasion. He returned 8 weeks later and had RFA of the residual metaplastic Barrett's mucosa.

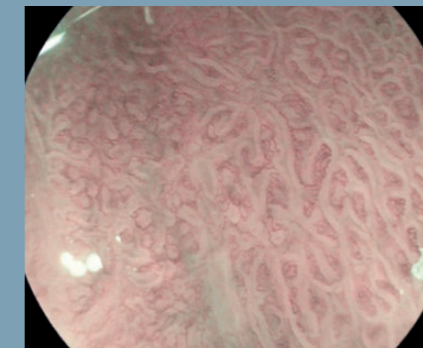
**Summary**

The case highlights that i-scan 3 (OE) in combination with optical zoom endoscopy helped to visualize an early neoplastic lesion arising from the Barrett's mucosa.



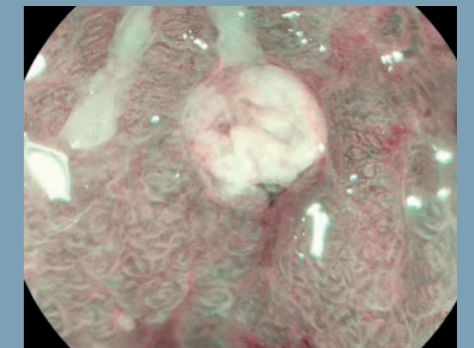
**Image 1**

A patient undergoing assessment for Barrett's oesophagus with an early neoplastic lesion as seen with i-scan 3 (OE).



**Image 2 and 3**

Abnormal mucosal architecture and vasculature with magnification endoscopy and i-scan 3 (OE) in a patient with Barrett's neoplasia. These images were obtained using the MagniView gastroscope (EG-2990Zi).







**How do you use i-scan and i-scan OE in your clinical practice?**

*"The PENTAX Medical High-Definition White Light (HD WL) image is a major advance but when I switch i-scan 1 (SE) on then the image becomes sharper and crisper without losing any other attribute so I don't see any reason why i-scan 1 (SE) should not be left on at all times. Once I find a subtle abnormality or any obvious lesion then I switch on i-scan 2 (TE) and that really highlights the lesion from the surrounding normal mucosa. Once the presence of neoplasia is confirmed then I switch on i-scan 3 (OE) to fine evaluate the surface and vessel patterns of the lesion (to differentiate neoplastic from non-neoplastic lesion) and identify the exact margins of the lesion. The recent addition of i-scan OE to the PENTAX Medical family has been a major step forward in evaluation and characterization of gastrointestinal neoplasia."*

**Professor Dr. Pradeep Bhandari**  
 Queen Alexandra Hospital, Portsmouth, UK

## Assessment of a gastric lesion using i-scan and i-scan OE

**Patient history**

A 67 year old female was being investigated for iron deficiency anaemia. There was no family history of gastric cancer. CT pneumocolon was normal. Patient was booked for Gastroscopy and Colonoscopy.

**Endoscopic findings**

HD WL gastroscopy revealed a slightly elevated area in the gastric antrum but its significance was not clear.

i-scan 1 (SE) enhanced the surface pattern making it very easy to appreciate a 10 mm Ila lesion.

i-scan 2 (TE) accentuated the vascular pattern which appeared to be different

from surrounding and neoplastic in nature.

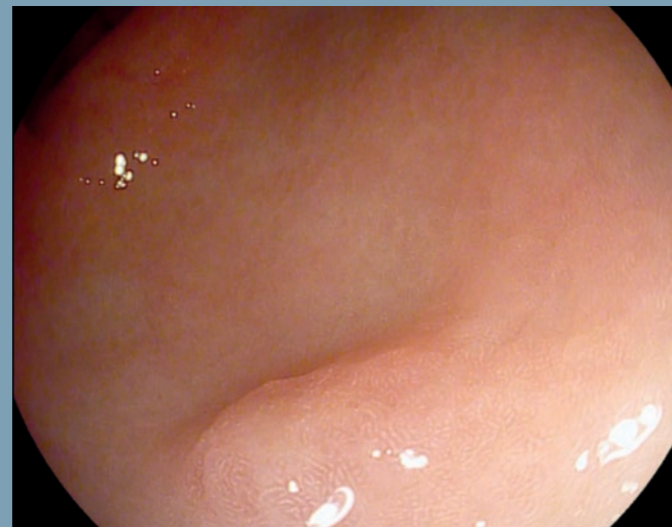
i-scan 3 (OE) showed an increased vascularity of this lesion and tubular pit pattern confirming the suspicion of gastric adenoma. i-scan 3 (OE) is very effective in delineating the margins of neoplastic lesion and evaluating the details of the surface pattern.

**Patient outcome**

Patient underwent endoscopic submucosal dissection and the gastric lesion was removed en bloc. The histology confirmed a gastric adenoma with low grade dysplasia. The patient has had no recurrence on follow up.

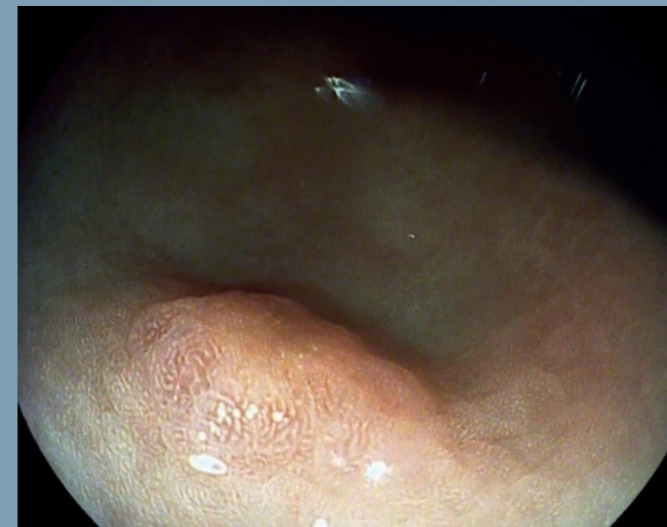
**Summary**

i-scan and i-scan OE were used to accentuate a subtle gastric antral lesion through surface and vessel pattern enhancement. Early gastric dysplastic lesions are easily missed and the use of this technology is valuable in improving inspection of the gastric mucosa during diagnostic gastroscopy and surveillance.



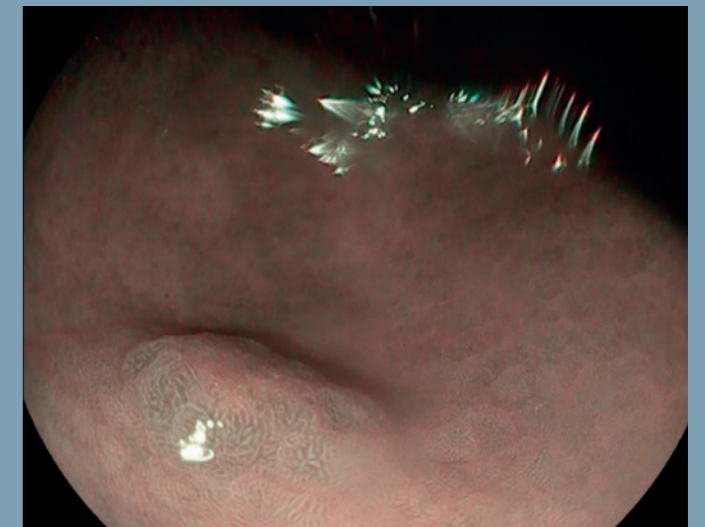
**Image 1**

i-scan 1 (SE) enhanced the surface pattern making it very easy to appreciate a 10 mm Ila lesion.



**Image 2**

i-scan 2 (TE) accentuated the vascular pattern which appeared to be different from surrounding and neoplastic in nature.



**Image 3**

i-scan 3 (OE) showed an increased vascularity of this lesion and tubular pit pattern confirming the suspicion of gastric adenoma.

# Diagnosis of a Gastrointestinal Stromal Tumor (GIST) with i-scan and i-scan OE



## How do you use i-scan and i-scan OE in your clinical practice?

*"I usually use as default i-scan 1 (SE) as a detection mode and I usually turn on i-scan 3 (OE) when I want to better visualize the mucosal and vascular pattern. I find it particularly useful in Barrett's oesophagus to diagnose high grade dysplasia area, for rectal and colonic polyp to decide between ESD or piece meal EMR when i-scan 3 (OE) shows aspect of carcinoma in situ or limited to sm1"*

**Dr. Marc Giovannini**  
 Institut Paoli-Calmettes, Marseille, France

## Patient history

A 56 year old male went for an endoscopy with suspicious of a gastric sub-mucosal lesion and a duodenal stenosis.

## Endoscopic findings

A sub-mucosal tumour was visualized in the gastric fundus curvature. The tumour has around 25 mm of diameter. The endoscopic ultrasound examination confirms the endoscopic findings. The elastography confirms the hardness of the tumor but not much enhancement is shown with the sonovue which possibly indicates a GIST with a low level of malignancy. Two biopsies were taken with a 19 gauge needle.

## Patient outcome and follow-up

Considering the location in the stomach, the size of the tumor of around 25mm and the low number of mitoses, all indicate a low risk of metastatic evolution according to the MIETTINEN classification.

The next step in terms of therapy will be to perform an endoscopic resection of the GIST using the STER technique (Submucosal Tunnelling Endoscopic Resection).

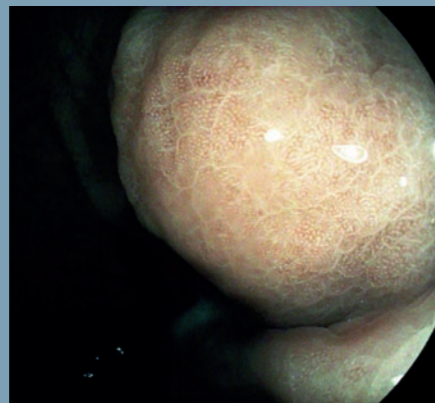
## Summary

i-scan 3 (OE) and i-scan 2 (TE) showed a submucosal mass with normal mucosa a little bit adenomatous. i-scan could eliminate the hypothesis of a mucosal lesion and EUS confirmed the GIST diagnosis.



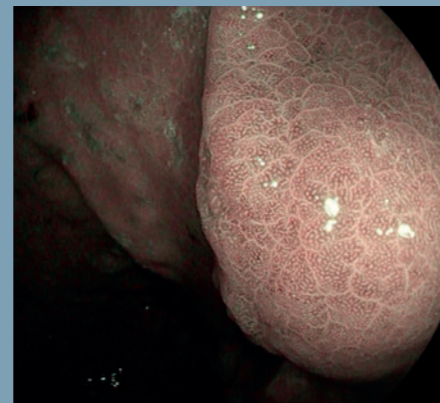
**Image 1**

i-scan 1 (SE) shows a submucosal mass with a normal mucosa.



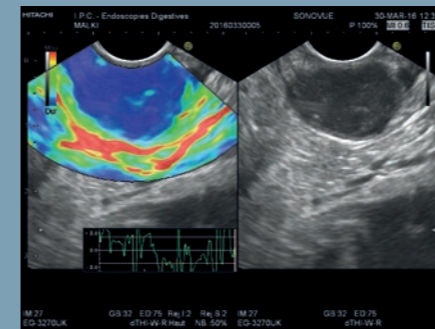
**Image 2**

i-scan 2 (TE) shows a submucosal mass with a normal mucosa a little bit adenomatous.



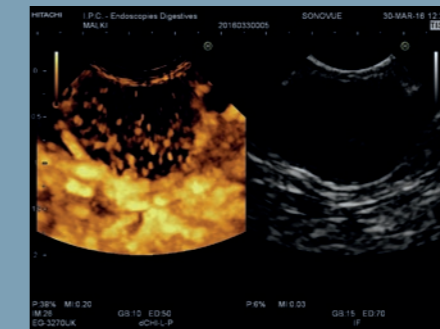
**Image 3**

i-scan 3 (OE) shows a submucosal mass with a normal mucosa a little bit adenomatous.



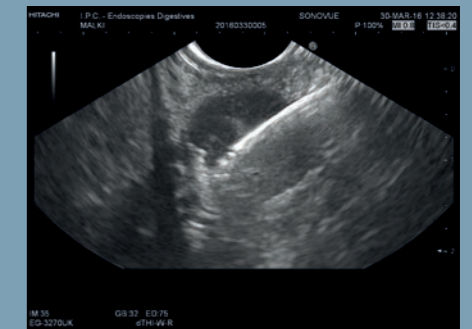
**Image 4**

The real-time tissue elastography confirms the hardness of the tumor...



**Image 5**

...but not much enhancement is shown with the dynamic contrast harmonic imaging examination.



**Image 6**

Two biopsies were taken with an 19 gauge needle. The puncture material show a proliferation of fusiform cells which indicate a GIST as the most likely diagnosis.





**How do you use i-scan and i-scan OE in your clinical practice?**

*"I think that i-scan OE represents a further step forward in the diagnostic capabilities of endoscopy. With the i-scan system we can see the mucosa and the lesions with different visualizations that allows to collect different information, specific for each enhance. We can choose the most suitable i-scan function depending on: anatomical site, pathology or just according to the way the endoscopist feels more confident to be able to make the diagnosis. After my first experience with i-scan OE I feel that it allows to better study the pit pattern of healthy mucosa and of lesions.*

*The other 2 important aspects that I want to underline are:*

- *i-scan 3 (OE) should allow to use the existing classifications already accepted in the literature based on Optical Enhancement making the data resulting from the use of PENTAX Medical endoscopes more comparable.*
- *i-scan 1 (SE) and i-scan 2 (TE), in addition to the diagnostic capability demonstrated in the literature, allows also to perform an enhanced observation also in difficult conditions like bleeding, bile or fecal residue, when it's not possible to use an optical system."*

**Dr. Federico Buffoli**  
 Ospedale di Cremona, Italy

## Analysis of a ECL cell micronodular hyperplasia using i-scan and i-scan OE

**Patient history**

A 54 year old female with GORD under continuous PPI treatment for the last 4 years Hypergastrinemia (X4) and increase in Chromogranin A levels (X5) were registered. Undergoing upper GI examination for symptoms persistence.

**Endoscopic findings**

Different 4-5 mm cystic fundic gland polyps were observed. i-scan 1 (SE) revealed a 2-3 mm nodular area in the fundus. This area presented a whitish colour and a different pit-pattern from the surrounding mucosa. With i-scan 2 (TE) and i-scan 3 (OE) the lesion became more evident from the surrounding mucosa.

**Patient outcome and follow-up**

Biopsies taken from the antrum and gastric body as per protocol revealed no evidence of atrophic gastritis. 3 cystic fundic gland polyps were removed as well. Targeted biopsy on the nodular area revealed an ECL cell micronodular hyperplasia. PPI were switched to Ranitidine with partial reduction of gastrin and chromogranin A serum levels. However reflux symptoms worsened. The subject is under clinical and laboratory test follow up.

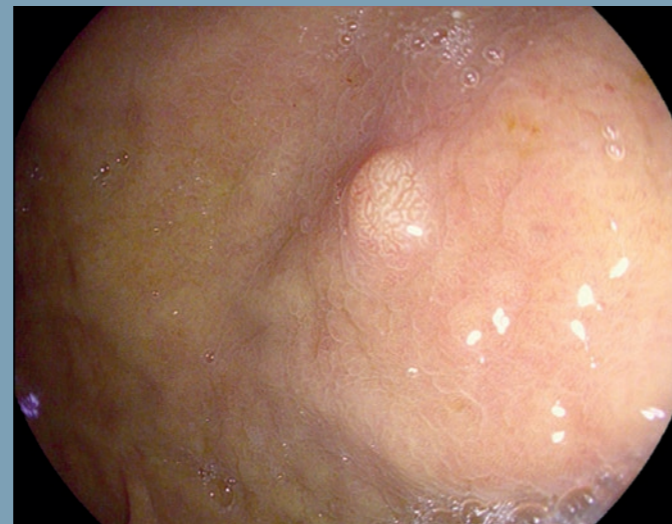
**Discussion**

Several case reports of ECL hyperplasia without atrophic gastritis are present in literature, especially in patients under PPI treatment. Therefore, especially in the presence of cystic fundic gland polyps, an accurate evaluation of the whole

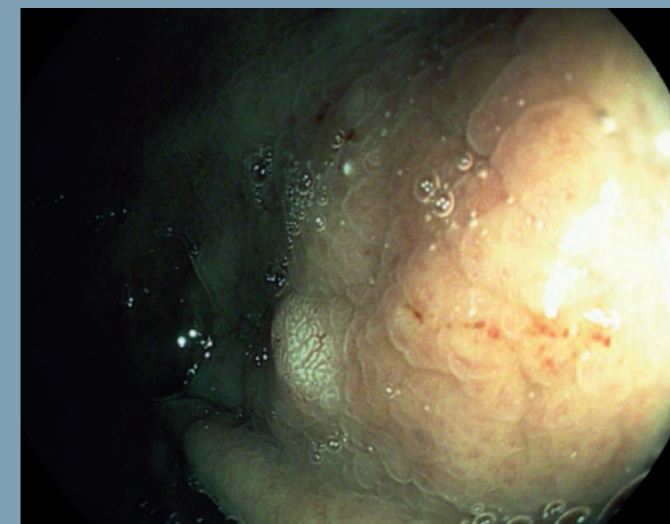
mucosa has to be carried out. (Aliment Pharmacol Ther 2014; 39: 1071-1084). HD endoscopy coupled with optical and digital chromo-endoscopy allow to detect and evaluate even very small lesions. Endoscopes equipped with both optical and digital chromo-endoscopy would be useful in the stomach to help detection of small lesions.

**Summary**

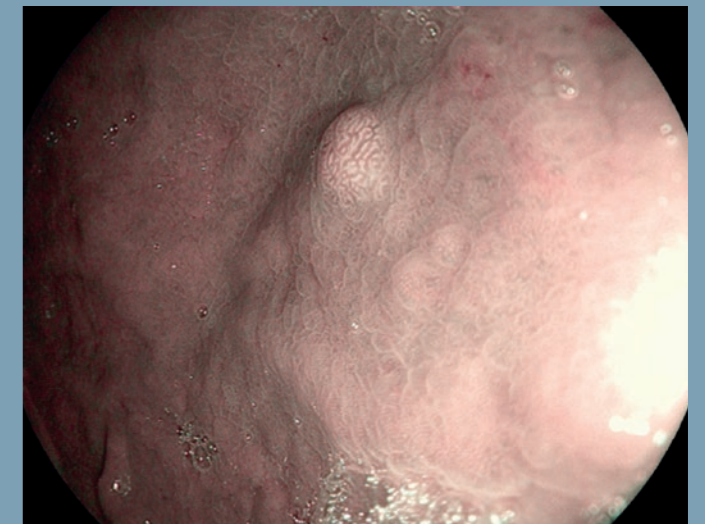
HD endoscopy coupled with optical and digital chromoendoscopy is useful to study the mucosa of the stomach highlighting even small mucosal alterations.



**Image 1**  
 2-3 nodular lesion of the gastric fundus with i-scan 1 (SE).



**Image 2 and 3**  
 With i-scan 2 (TE) and i-scan 3 (OE) the lesion became more evident from the surrounding mucosa.





**How do you use i-scan and i-scan OE in your clinical practice?**

*"In my own practice I rely on i-scan 1 (SE) as my default initial mode for interrogating the upper GI tract. This has superseded the white light mode for me and helps me to assess and detect early cancers. The depth and image resolution is excellent at defining mucosal patterns that when disordered or irregular lead one to suspect neoplasia. My own preference is then to switch to i-scan 2 (TE) to better characterize the lesion in terms of borders but also it allows one to interpret vascularity in great detail. Coupled with the magnification range of endoscopes I have used this mode with much success, for example in patients with early squamous cell cancer of the esophagus. With the combination of conventional chromoendoscopy and agents such as acetic acid it can provide very accurate delineation of flat lesions. Over the past six months I have been using the new optical enhancements that PENTAX Medical have developed beyond the conventional i-scan modes described above. The filtering technology here provides a very distinct and lighter image of the vascularity and mucosal pit patterns that become disordered in early cancer and coupled with i-scan 1 (SE) have in my practice become the two most commonly used enhanced imaging modalities that I use."*

**Dr. Rehan Haidry**  
 University College Hospital London, UK

## Diagnosis of an hyperplastic polyp in the prepyloric area with i-scan and i-scan OE

**Patient history**

A patient was referred for upper endoscopy due to symptomatic iron deficiency anaemia and positive faecal occult blood. Colonoscopy was normal and the patient was then investigated with upper endoscopy and a capsule endoscopy. The latter was normal.

**Endoscopic findings**

At endoscopy, it was found a hyperplastic polyp at the pre-pyloric area with areas of inflammation but typical features in keeping with a hyperplastic lesion as demonstrated with enhanced imaging with i-scan followed by optical enhancement with OE 1 and OE 2.

**Patient outcome and follow-up**

The patient was reassured that this was a benign finding and endoscopic resection was carried out as a day case. The lesion showed to be hyperplastic and no further follow-up was required.

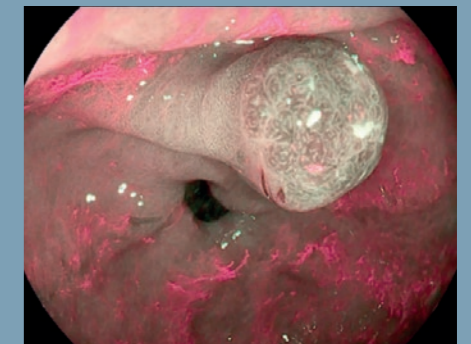
**Summary**

The case shows how i-scan and i-scan OE help to assess the mucosal and vascular pattern and support the diagnostic of an hyperplastic polyp.



**Image 1**

Hyperplastic polyp as seen with i-scan 1 (SE).



**Image 2 and 3**

Pre-pyloric gastric lesion seen with OE 1 and OE 2 in keeping with a hyperplastic polyp.





**How do you use i-scan and i-scan OE in your clinical practice?**

*"In IBD, one can expect also to use the i-scan 3 (OE), especially to predict microscopic inflammation. This concept and assessment is very important for our patients, because mucosal healing is associated with less steroid use, less hospitalization and less surgery for patients. I suspect that the i-scan 3 (OE) technology will be very helpful for the assessment of mucosal healing in patients with inflammatory bowel diseases. In this way, it will help to guide whether medical therapy should be advanced for patients with active mucosal disease or whether medical therapy can be decreased for those who demonstrate good mucosal healing."*

**Prof. Dr. Helmut Neumann**  
University Hospital Erlangen, Germany

## Diagnosis of Crohn's disease with i-scan and i-scan OE

**Patient history**

A 31-year old patient was admitted because of persistent abdominal pain in the lower right abdomen. Physical examination was unremarkable but laboratory investigations showed a mild anemia with hemoglobin of 10 g/dL (reference value 12-16 g/dL) and a C-reactive protein of 7 mg/L (reference value < 5 mg/L). Esophago-gastro-duodenoscopy was normal.

**Endoscopic findings**

High-Definition white light imaging with i-scan 1 (SE) showed multiple, up to a 3mm in size, fibrinous erosions in the terminal ileum surrounded by normal appearing mucosa. Analysis of the remaining colon revealed no additional lesions.

High-Definition imaging with digital chromoendoscopy technique i-scan 2 (TE) strongly highlighted the borders of the lesions.

High-Definition imaging with latest optical chromoendoscopy technique i-scan 3 (OE) clearly showed an inflammatory appearance of the lesion surrounded by non-inflamed mucosa. Of note, i-scan 3 (OE) highlights the vascular pattern morphology.

**Patient outcome and follow-up**

Biopsies from the terminal ileum and colon were obtained and placed in separate jars. Histopathological analysis revealed diagnosis of Crohn's disease.

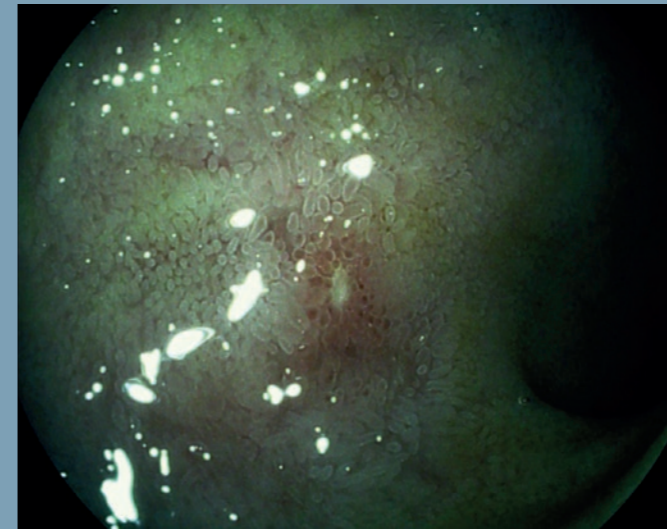
**Summary**

The case highlights the importance of advanced endoscopic imaging techniques for detection of subtle mucosal lesions in the luminal gastrointestinal tract and the potential of the newly introduced Optical Enhancement technology for characterization of inflammatory lesions in patients with inflammatory.



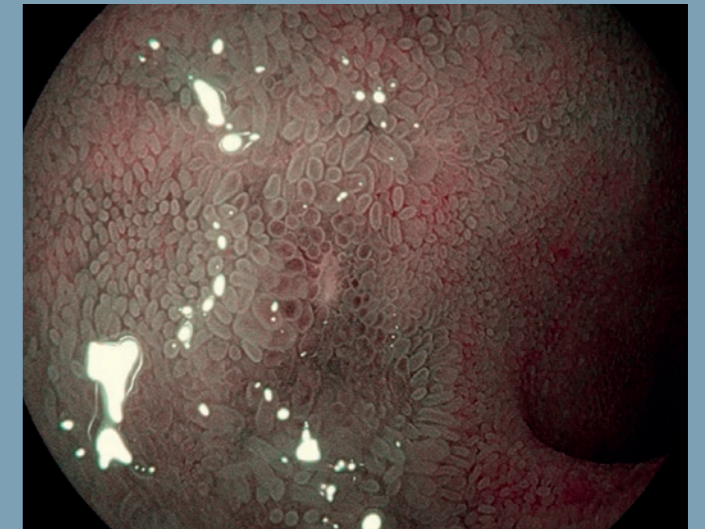
**Image 1**

i-scan 1 (SE) showed multiple, up to a 3 mm in size, fibrinous erosions in the terminal ileum surrounded by normal appearing mucosa.



**Image 2**

i-scan 2 (TE) strongly highlighted the borders of the lesions.



**Image 3**

i-scan 3 (OE) clearly showed an inflammatory appearance of the lesion surrounded by non-inflamed mucosa.





**How do you use i-scan and i-scan OE in your clinical practice?**

*"I usually use the i-scan 1 (SE) at the beginning of all my endoscopic studies. It brings the characteristics of the white light endoscopy with more resolution of the surface which is better to identify lesions. Once I identify a lesion I turn to i-scan 2 (TE) to characterize the vascularity. The new EPK-i7010 with the i-scan OE gives the best features of mucosal pattern and vascularity with the same tool. In Barrett's oesophagus the new EPK-i7010 gives the chance to discriminate in the best way the suspicious areas for dysplasia. This allows to take less biopsies in the protocol with better results of getting the dysplastic Barrett's and identifying the intramucosal neoplasia."*

**Dr. José Miguel Esteban**  
Hospital Clínico San Carlos, Spain

## Determining the lateral extension and characterizing an ampullary lesion with i-scan and i-scan OE

**Patient history**

A 60 year old male was referred with abnormal liver function tests and extra-hepatic biliary duct dilation on abdominal ultrasound. The MRCP demonstrated moderate dilation of the common bile duct to the level of the papilla, as well as a nodular filling defect within the lumen of the distal portion of the duct, adjacent to the ampulla. EUS was performed and showed an ampulloma with extension of growth into the distal bile duct. Endoscopy with a High-Definition duodenoscope was performed in order to characterize the lesion and for sampling.

**Endoscopic findings**

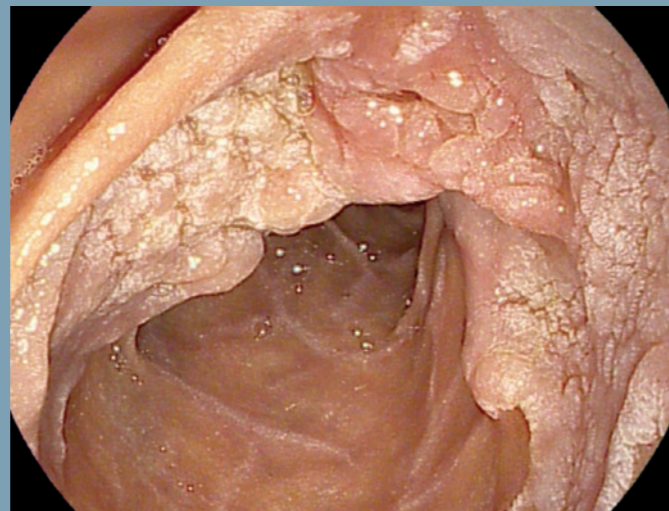
Imaging with i-scan 1 (SE) mode revealed a lesion with abnormal irregular mucosal architecture greater than 4 cm. These features were even more prominent in the central portion of the lesion which included the papilla. Visualization of the lesion with i-scan 2 (TE) demonstrated a central area of increased vascularity and abnormal microvascular pattern. Inspection with i-scan 3 (OE) confirmed the lateral margins of the lesion to extend beyond those determined by white light endoscopy.

**Patient outcome and follow-up**

Based on endoscopic and endosonographic findings, endoscopic resection was not feasible and the patient was then referred for surgery.

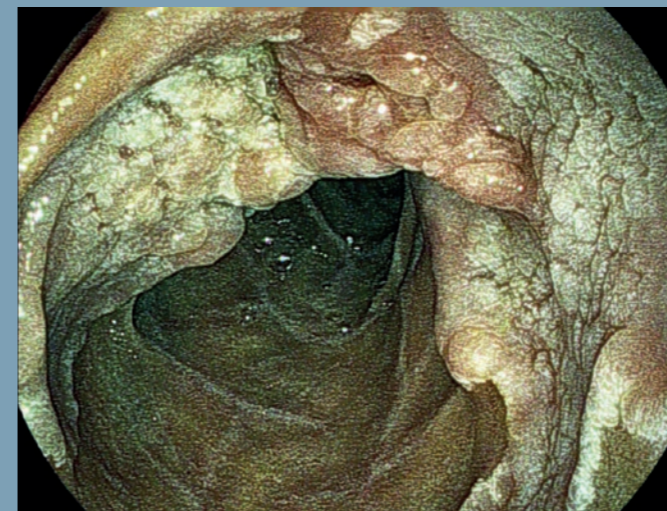
**Summary**

In this patient with an ampullary laterally spreading granular tumour, i-scan imaging was used to characterize the grade of the lesion and to determine the true lateral margins. This assisted in determining the appropriate method of treatment.



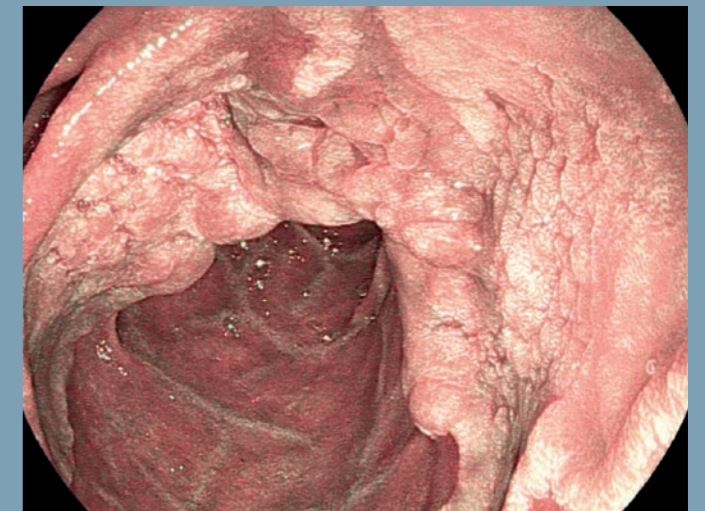
**Image 1**

i-scan 1 (SE) revealed a lesion with abnormal irregular mucosal architecture greater than 4 cm.



**Image 2**

i-scan 2 (TE) demonstrated a central area of increased vascularity and abnormal microvascular pattern.



**Image 3**

i-scan 3 (OE) confirmed the lateral margins of the lesion to extend beyond those determined by white light endoscopy.





**How do you use i-scan and i-scan OE in your clinical practice?**

*"I think that i-scan OE represents a further step forward in the diagnostic capabilities of endoscopy. With the i-scan system we can see the mucosa and the lesions with different visualizations that allows to collect different information, specific for each enhance. We can choose the most suitable i-scan function depending on: anatomical site, pathology or just according to the way the endoscopist feels more confident to be able to make the diagnosis. After my first experience with i-scan OE I feel that it allows to better study the pit pattern of healthy mucosa and of lesions.*

*The other 2 important aspects that I want to underline are:*

- i-scan 3 (OE) should allow to use the existing classifications already accepted in the literature based on Optical Enhancement making the data resulting from the use of PENTAX Medical endoscopes more comparable.*
- i-scan 1 (SE) and i-scan 2 (TE), in addition to the diagnostic capability demonstrated in the literature, allows also to perform an enhanced observation also in difficult conditions like bleeding, bile or fecal residue, when it's not possible to use an optical system."*

**Dr. Federico Buffoli**  
 Ospedale di Cremona, Italy

## Analysis of a diminutive colonic polyp using i-scan and i-scan OE

**Patient history**

A 56 year old female with a positive faecal occult blood test underwent screening colonoscopy as part of national colorectal cancer control program.

**Endoscopic findings**

With i-scan 1 (SE), a 3-4 mm diminutive polyp was detected in the ascending colon. i-scan 2 (TE) pointed out an elongated pit-pattern at the edges of the lesion typical of adenomatous lesion, i-scan 3 (OE) highlighted the vascular pattern around the papillary pits allowing a presumptive diagnosis of adenomatous lesion.

**Patient outcome and follow-up**

The lesion was resected by means of cold snaring and retrieved for histological assessment. Definite histological diagnosis was low grade dysplasia tubular adenoma. Follow-up examination was scheduled according to ESGE guidelines.

**Discussion**

Recently the "resect and discard" strategy has been proposed for diminutive polyps. Meanwhile for recto-sigmoid hyperplastic polyps the "leaving-in" strategy is considered. High-Definition endoscopy coupled with digital and optical chromoendoscopy has shown high sensibility and sensitivity in the prediction of diminutive polyp histology –

so called optical biopsy – (agreement > 90%; N.P.V. >90%) (Gastrointest Endosc 2015; 81:502-16.). The opportunity to have on the same endoscope both optical and digital chromoendoscopy increases the diagnostic yield allowing to safely apply such strategies.

**Summary**

HD endoscopy coupled with optical and digital i-scan is a helpful tool for the study of diminutive polyp features enhancing polyp vascular-pattern and pit-pattern.



**Image 1**  
 Diminutive lesion observed with i-scan 1 (SE).



**Image 2**  
 Evaluation of pit-pattern with i-scan 2 (TE).



**Image 3**  
 Evaluation of pit and vascular pattern with i-scan 3 (OE).



**How do you use i-scan and i-scan OE in your clinical practice?**

*"In order to implement Optical Enhancement (OE) in routine clinical practice, the endoscopist must firstly understand the rationale of this new technology.*

*What is the additional value?*

*HD imaging remains key. Besides this, contrast enhancement using i-scan OE, which is an image pre-processing technology, highlights the epithelial mucosal surface pattern and especially the vascular pattern into detail. i-scan OE facilitates detection and in-vivo diagnosis of lower gastrointestinal tract pathology enabling targeted endotherapy."*

**Dr. Silvia Sanduleanu,**  
Maastricht University Medical Center+, The Netherlands

## Surveillance endoscopy in a patient with familial adenomatous polyposis with i-scan and i-scan OE

**Patient history**

A 70 year old male participated in the national fecal immunochemical test (FIT)-based CRC screening program. His previous history included a prostate carcinoma for which he received curative radiotherapy.

**Endoscopic findings**

During withdrawal, careful inspection using a High-Definition PENTAX Medical colonoscope showed a laterally spreading tumor of homogeneous granular type in the ascending colon. The lesion diameter was 15 mm. Subsequent examination using contrast enhancement (i-scan 2 (TE) and i-scan 3 (OE)) allowed to better delineate the borders of the lesion and to examine the epithelial sur-

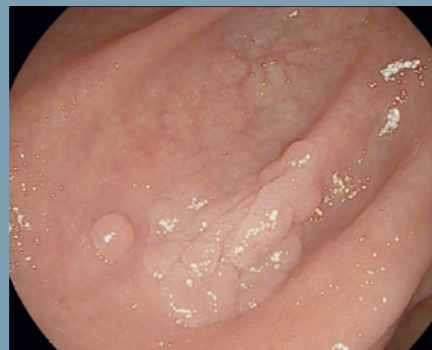
face pit-pattern and vascular pattern into detail. Clearly, the lesion shows a Kudo type 3L pit pattern (without areas of non-invasive pit-pattern) and a regular vascular pattern, indicating a tubular adenoma with low-grade dysplasia. The lesion was resected en-bloc by endoscopic mucosal resection (EMR).

**Patient outcome and follow-up**

According to the current post-polypectomy surveillance guidelines this patient will receive follow-up colonoscopy after three years.

**Summary**

Stepwise examination using Optical Enhancement (i-scan 3 (OE)) and contrast enhancement (i-scan 2 (TE)) help to better demarcate the borders of the lesion and visualize the epithelial surface pit-pattern and vascular pattern into detail. There were no signs of submucosal (SM) invasion, supporting EMR as the therapy of choice. Comprehensive stepwise examination with both optical enhancement and contrast enhancement image modalities assist clinical decision on the best therapeutic plan.



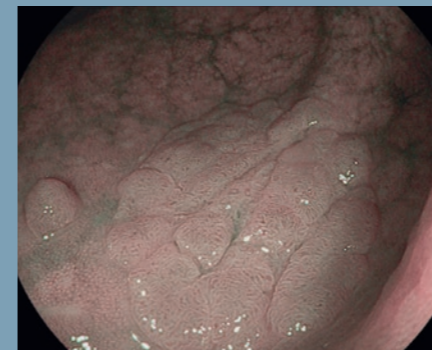
**Image 1**

A slight change of the epithelial mucosal surface is observed with i-scan 1 (SE), which triggers further examination.



**Image 2**

The borders of the lesion are delineated from the surrounding mucosa neoplasm with i-scan 2 (TE).



**Image 3**

Combined inspection of the epithelial surface pit-pattern and vascular pattern shows a non-invasive neoplasm using i-scan 2 (TE) and i-scan 3 (OE).



**Image 4 and 5**

The lesion was resected using en-bloc EMR. The patient was recommended to undergo surveillance colonoscopy after three years.



## Analysis of a rectal polyp with i-scan, i-scan OE and MagniView



### How do you use i-scan and i-scan OE in your clinical practice?

*"Several studies have shown that digital-based chromoendoscopy is accurate in predicting the histology of polyps of the colon and rectum. The i-scan 1 (SE) is my favorite mode in order to obtain the sharpest image. In 2013, we observed good interobserver agreement among endoscopists in the evaluation of neoplastic and non-neoplastic lesions visualized with the PENTAX Medical i-scan technique but a poor agreement in the evaluation of pit-pattern and margins. The recent addition of i-scan 3 (OE) is useful as it really helps me to better assess the vascular and pit patterns of the lesion and accurately identify its margins."*

**Dr. Cristina Trovato**  
European Institute of Oncology, Milan, Italy

### Patient history

A 58 year old patient underwent colonoscopy for positive fecal occult blood test. At HD+ white light endoscopy, on the back / left side wall, close to the anorectal junction, a polypoid lesion of 12 mm of diameter was observed. According to the Paris Classification, it was classified as subtype 0-Is. The lesion was spontaneously bleeding.

### Endoscopic findings

Analysis of the surface microarchitecture and the network of superficial capillaries were performed using i-scan 3 (OE) and an optical zoom scope (EC-3890Zi). Tubulogyrus pattern-presence of tubules, either linear or convoluted, is easily recognized. In retroflexion an area of the

lesion showing a "non-structural" pattern devoid of pits and disrupted vessels was better detected. Using optical magnification capillary network was irregular in shape, size and arrangement, suggesting the presence of submucosal cancer.

### Patient outcome and follow-up

In order to obtain accurate local assessment endo ultrasonography (EUS) was performed. A small tumor located within the mucosa and superficial submucosal layers was assessed (uT1). No suspicious lymph node was detected (uN0).

Then the lesion was resected en-bloc using inject and cut endoscopic mucosal resection technique. The resection site showed complete resection.

Pathology specimen revealed undifferentiated adenocarcinoma with submucosal invasion depth of 500 μm as suggested by optical diagnosis.

### Summary

i-scan Optical Enhancement and MagniView endoscope is a valid tool for real-time endoscopic diagnosis of superficial submucosal invasive cancer of the rectum.



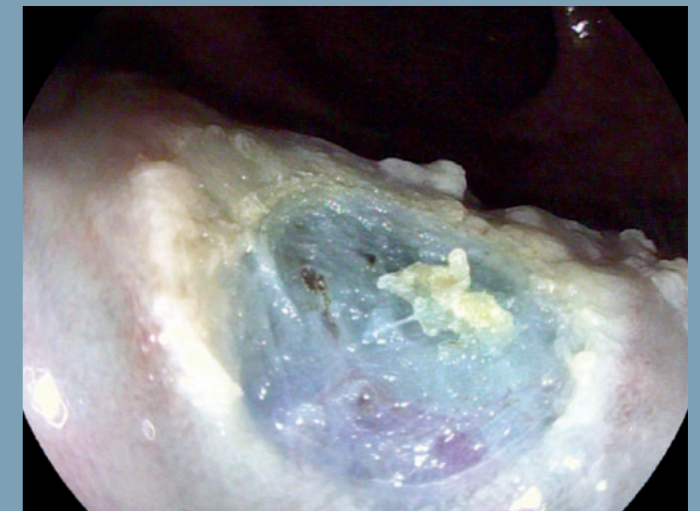
**Image 1**

i-scan 1 (SE) revealed a lesion with abnormal irregular mucosal architecture greater than 4 cm.



**Image 2**

i-scan 3 (OE) demonstrated a central area of increased vascularity and abnormal microvascular pattern.



**Image 3**

The lesion was resected en-bloc using inject and cut endoscopic mucosal resection technique. The resection site showed complete resection.



**How do you use i-scan and i-scan OE in your clinical practice?**

*"i-scan 3 (OE) combines the versatility and flexibility of i-scan with ever sharper and crisper pictures. While i-scan 1 (SE) is my standard setting during every procedure because it gives you the extra bit of contrast and detail to detect even very subtle changes of the mucosa, i-scan 3 (OE) offers an extremely sharp view of the surface pattern for example in Barrett's oesophagus. Combine it with the capabilities of the optical zoom endoscopes and you get the ultimate diagnostic tool in both lower and upper GI tract."*

**Dr. Michael Häfner**  
Elisabethinen Krankenhaus Wien, Austria

## Detection of a serrated polyp with i-scan and i-scan OE

**Patient history**

A 55 year old female patient was referred for polypectomy at our unit because of a larger polyp in the right colon.

**Endoscopic findings**

A colonoscopy was performed using HD+ technology and i-scan 1 (SE) for improved detection of especially flat lesions. Two additional serrated polyps were found and resected, one in the cecum, the other one in the descending colon. The latter one (image 1) was completely flat (Paris Ib) and could be detected because of the typical mucus cap. Using i-scan 2 (TE) and i-scan 3 (OE) the margins of the lesion could

be detected easily. i-scan 3 (OE) clearly showed another typical feature of serrated polyps, blurred vessel.

**Patient outcome and follow-up**

The serrated polyp was resected after submucosal injection with saline and indigo carmine.

**Summary**

This cases highlights how i-scan 1 (SE) can support the detection of a flat lesion and how i-scan 2 (TE) and i-scan 3 (OE) can support the demarcation and characterization of the lesion, guiding therapy.



**Image 1**

i-scan 1 (SE) highlights a completely flat lesion (Paris Ib) which could be detected because of the typical mucus cap.



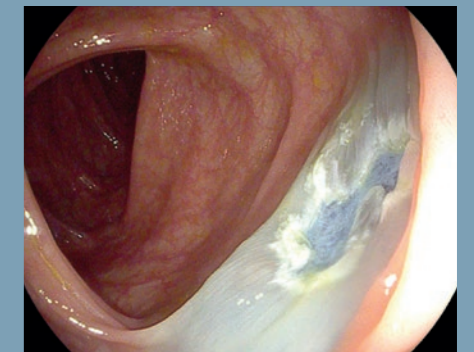
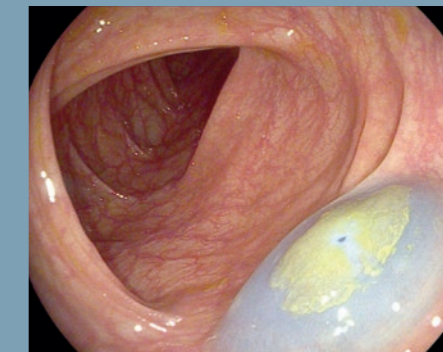
**Image 2**

Using i-scan 2 (TE) and i-scan 3 (OE) the margins of the lesion could be detected easily.



**Image 3**

i-scan 3 (OE) clearly showed another typical feature of serrated polyps, the blurred vessels.



**Image 4 and 5**

The serrated polyp was resected after submucosal injection with saline and indigo carmine.





**How do you use i-scan and i-scan OE in your clinical practice?**

*"In order to implement Optical Enhancement (OE) in routine clinical practice, the endoscopist must firstly understand the rationale of this new technology.*

*What is the additional value?*

*HD imaging remains key. Besides this, contrast enhancement using i-scan OE, which is an image pre-processing technology, highlights the epithelial mucosal surface pattern and especially the vascular pattern into detail. i-scan OE facilitates detection and in-vivo diagnosis of lower gastrointestinal tract pathology enabling targeted endotherapy."*

**Dr. Silvia Sanduleanu,**  
Maastricht University Medical Center+, The Netherlands

## Surveillance endoscopy in a patient with familial adenomatous polyposis with i-scan and i-scan OE

**Patient history**

A 70 year old male participated in the national fecal immunochemical test (FIT)-based CRC screening program. Besides previous cholecystectomy, his medical history was uneventful.

**Endoscopic findings**

During withdrawal, a subtle appearing (flat elevated, Paris IIa) lesion, 8 mm in size was detected in the descending colon (Figures). Furthermore, three sessile lesions were identified with a diameter of 6, 10 and 12 mm in the descending colon, sigmoid colon and rectum. Examination using contrast enhancement (i-scan 2 (TE) and i-scan 3 (OE)) clarifies the borders of the lesion and allows to examine the epithelial surface pit-pat-

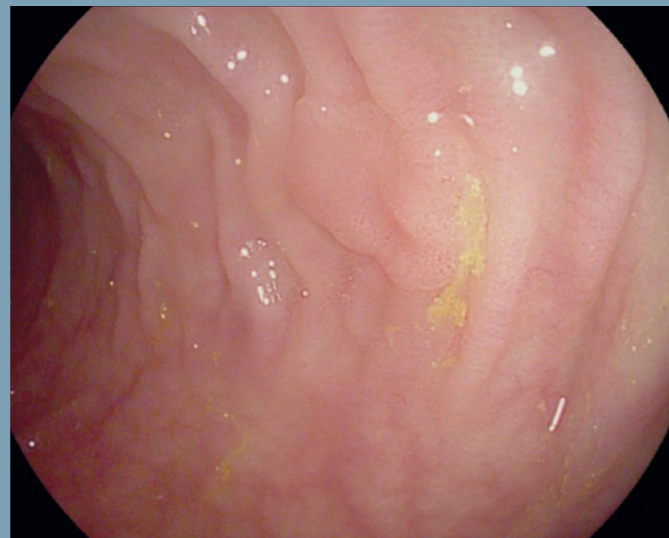
tern and vascular pattern into detail. The lesion shows a Kudo type 3L pit pattern. No areas of non-invasive pit-pattern were seen, indicating a tubular adenoma with low-grade dysplasia. The lesion was resected en-bloc by endoscopic mucosal resection (EMR).

**Patient outcome and follow-up**

According to the current post-polypectomy surveillance guidelines this patient will receive follow-up colonoscopy after three years.

**Summary**

Careful examination using optical enhancement (i-scan 3 (OE)) and contrast enhancement (i-scan 2 (TE)) objectifies the borders of the lesion and better visualizes the epithelial surface pit-pattern and vascular pattern. No signs of submucosal (SM) invasion were found, supporting EMR as the preferred therapy. Systematic examination using both optical enhancement and contrast enhancement image modalities helps the endoscopist to decide the best therapeutic approach.



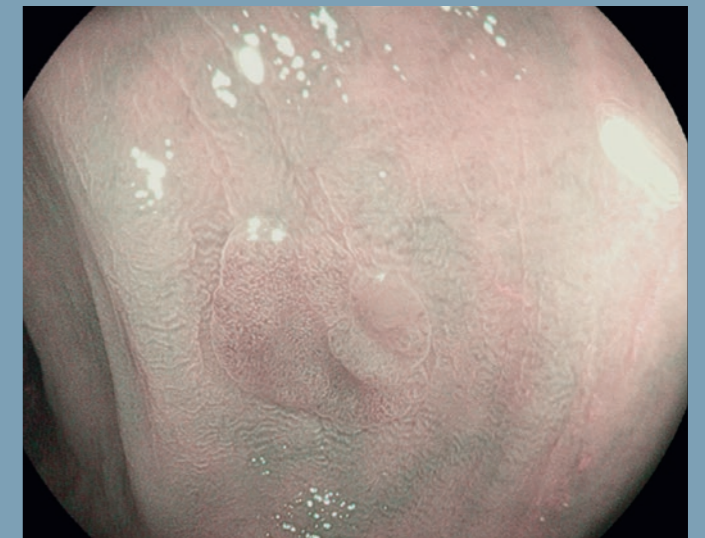
**Image 1**

A subtle change of the epithelial mucosal surface is observed with i-scan 1 (SE).



**Image 2**

The borders of the lesion are clearly delineated from the surrounding mucosa. Combined inspection of the epithelial surface pit-pattern and vascular pit-pattern shows a non-invasive neoplasm with i-scan 2 (TE) and i-scan 3 (OE). En-bloc EMR was performed.



**Image 3**





**How do you use i-scan and i-scan OE in your clinical practice?**

"I think that i-scan OE represents a further step forward in the diagnostic capabilities of endoscopy. With the i-scan system we can see the mucosa and the lesions with different visualizations that allows to collect different information, specific for each enhance. We can choose the most suitable i-scan function depending on: anatomical site, pathology or just according to the way the endoscopist feels more confident to be able to make the diagnosis. After my first experience with i-scan OE I feel that it allows to better study the pit pattern of healthy mucosa and of lesions.

The other 2 important aspects that I want to underline are:

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- i-scan 1 (SE) and i-scan 2 (TE), in addition to the diagnostic capability demonstrated in the literature, allows also to perform an enhanced observation also in difficult conditions like bleeding, bile or fecal residue, when it's not possible to use an optical system."

**Dr. Federico Buffoli**  
Ospedale di Cremona, Italy

## Analysis of pit and vascular pattern of a superficial invasive colonic lesion using i-scan

**Patient history**

A 61 year old female underwent screening colonoscopy after positive faecal occult blood test. Both examinations were performed in the settings of national colorectal cancer control program.

**Endoscopic findings**

In the sigmoid colon a 40 mm non polypoid lesion with central depression was detected with i-scan 1 (SE). Pit-pattern evaluation with i-scan 2 (TE) highlighted complete loss of pits architecture. i-scan 3 (OE) showed a high density of vascular pattern with irregular, thickened and blind ending capillary vessels. Evaluation of the central depressed area pointed out a loose vascular area.

Endoscopic features were strongly suspicious for a deep submucosal invasive cancer (>Sm1).

**Patient outcome and follow-up**

The patient underwent surgical resection. Hystological diagnosis of the surgical specimen was well differentiated Sm3 invasive cancer (pT1N0M0). No further treatment was adopted.

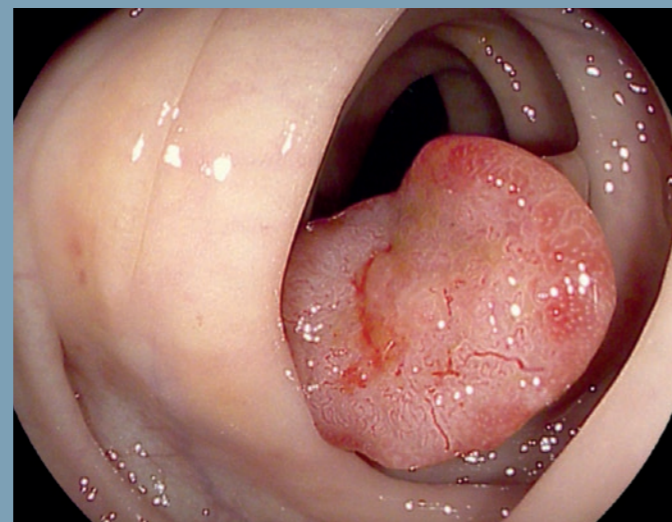
**Discussion**

HD endoscopy with optical enhance is used to predict SM-d carcinomas in colorectal tumors (Gastrointest Endosc 2013; 78:625-32). Furthermore, i-scan 1 (SE), i-scan 2 (TE) and i-scan 3 (OE) allow to study pit and vascular pattern of the lesion providing

useful information on the presumptive level of invasion. Understanding the level of invasion is fundamental to decide whether or not a lesion may be endoscopically resected.

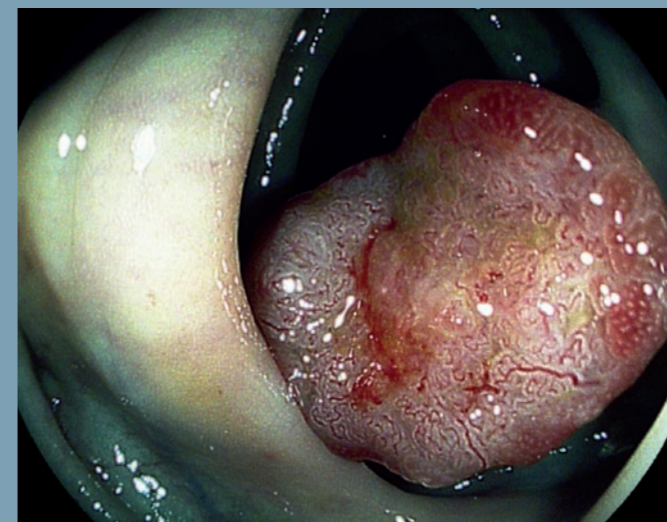
**Summary**

HD endoscopy coupled with optical and digital i-scan is a useful tool for the detection of colonic lesions. Moreover they play a pivotal role in the evaluation of pit-pattern and vascular pattern.



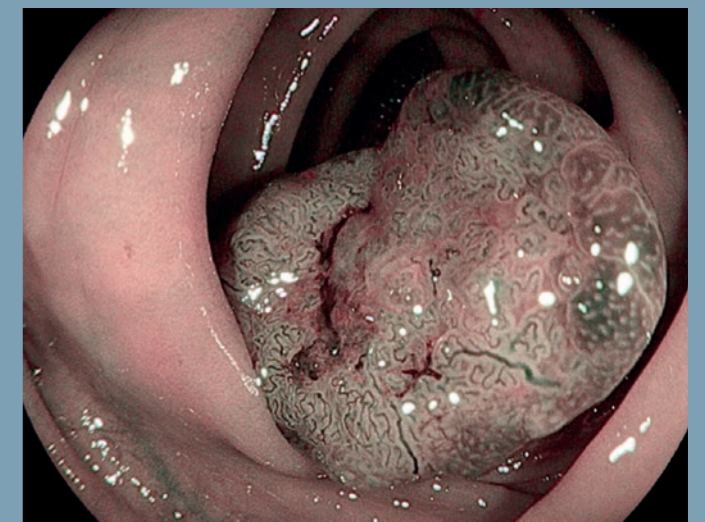
**Image 1**

A 40 mm non polypoid lesion with central depression with i-scan 1 (SE).



**Image 2**

Complete loss of pits architecture with i-scan 2 (TE).



**Image 3**

Marked distortion, irregular enlargement and blind ending of the capillary vessels with i-scan 3 (OE).



# i-scan Certification

## Knowledge is power

The i-scan certification has the aim to empower the clinical team to fully utilize i-scan in routine practice, fully leveraging on its proven benefits. With every OPTIVISTA EPK-i7010 video processor installation, your clinical team gets access to a comprehensive i-scan training platform, comprising self-training modules on i-scan classifications, tutorial videos and webinars. All this new content is available in the private membership section of the i-scan website. This platform stores a record of your progress and automatically informs you when new learning content is available.

After completion of the i-scan online training module, an i-scan certification will be issued by the i-scan task force to attest your i-scan knowledge.



### Exchange and expand your knowledge on i-scan by visiting the i-scan website

- Available in English, German, French, Spanish, Italian and Russian
- Extensive case video library
- Available archive of i-scan scientific studies
- Private membership for exclusive training access

[www.i-scanimaging.com](http://www.i-scanimaging.com)



# i-scan, technology with proven results

## UGI: i-scan

	N	Major findings/conclusions
Sehgal <i>et al</i> , 2014		A novel endoscopic classification system using i-scan improves dysplasia detection in Barrett's oesophagus
Hoffman <i>et al</i> , 2014	95	I-scan or acetic acid-guided biopsies have a significant higher diagnostic yield for identifying SCE, with significantly fewer biopsies, as compared to a protocol of random biopsies. Acetic acid and i-scan showed comparable results diagnosing SCE in our study.
Cammarota <i>et al</i> , 2013	115	Image-enhancing endoscopic technology allows a clear visualization of villous patterns in the duodenum. By switching from the standard to the i-scan view, it is possible to optimize the accuracy of endoscopy in recognizing villous alteration in subjects undergoing endoscopic evaluation.
Kang <i>et al</i> , 2013	514	Compared to WL endoscopy, applying i-scan in daily practice can improve the diagnostic yield of reflux esophagitis by detecting more minimal changes in the squamo-columnar junction of the esophagus and can improve the interobserver agreement of the modified Los Angeles classification.
Kim <i>et al</i> , 2011	156	The use of i-scan endoscopy significantly improves the identification of minimal change in the Gastroesophageal Reflux Disease and helps to identify more precisely the type of minimal change
Hoffman <i>et al</i> , 2009	50	Lugol's solution in conjunction with HD+ endoscopy significantly improves the identification of patients with esophagitis and reduces misclassification. The i-scan filter and chromoendoscopy help to identify reflux-associated lesions

## IBD: i-scan

Iaccucci <i>et al</i> , 2015	78	The subtle histological abnormalities underlying the apparently healed mucosa in ulcerative colitis could be detected using high definition colonoscopy and the refined ECAP histology scoring system. These techniques detect residual abnormalities in the majority of patients with seemingly complete mucosal healing by conventional Mayo criteria
Iaccucci <i>et al</i> , 2013	45	High definition i-scan offers the potential to better characterize the mucosa in patients with UC and may provide information about both inflammation and mucosal healing.
Neumann <i>et al</i> , 2010	50	i-scan colonoscopy significantly improves the diagnosis of severity and extent of mucosal inflammation in patients with IBD. Therefore, i-scan may be of additional value for determining the grade of inflammation in patients with quiescent IBD.

## LGI: i-scan in detection

Bisschops <i>et al</i> , 2016	60	i-scan Detects More Polyps in Lynch Syndrome (HNPCC) Patients
Kim <i>et al</i> , 2016	501	Colonoscopy using HD i-scan had a significantly higher detection rate of colorectal polyps, including neoplastic polyps, because of improved sensitivity for detecting non-protruding lesions.
Bowman <i>et al</i> , 2015	1,936	i-scan detects more adenomas and advanced polyps compared to high definition white light endoscopy
Neurath <i>et al</i> , 2013	300	i-scan improves the detection of right sided colon adenomas in comparison to high-definition white light endoscopy
Testoni <i>et al</i> , 2013	542	Nonexpert endoscopists had a similar detection rate of mucosal lesions compared to expert endoscopists when using i-scan; when using standard WLE experts detected more lesions than nonexperts
Testoni <i>et al</i> , 2012	1,101	Compared to standard white light colonoscopy, i-scan detects more polyps, specifically flat and small polyps (<10 mm)
Hoffman <i>et al</i> , 2010	69	i-scan can detect and identify small adenomatous polyps as well as standard chromoendoscopy in the distal 30 cm of the colon
Hoffman <i>et al</i> , 2010	220	i-scan detects more colorectal neoplasia compared to standard video endoscopy; i-scan can accurately predict polyp histology

# Studies on i-scan OE

## LGI: i-scan *in vivo* characterization

	N	Major findings/conclusions
Rath <i>et al</i> , 2015	224	High-definition endoscopy in combination with digital chromoendoscopy allowed real-time <i>in vivo</i> prediction of distal colorectal polyp histology and is accurate enough to leave distal colorectal polyps in place without resection or to resect and discard them without pathologic assessment. This approach has the potential to reduce costs and risks associated with the redundant removal of diminutive colorectal polyps.
Guo <i>et al</i> , 2015	Meta-analysis	Endoscopic diagnosis with i-scan has accurate optical diagnostic performance to differentiate neoplastic from non-neoplastic polyps with an area under the HSROC curve exceeding 0.90. Both the sensitivity and specificity for diagnosing colonic polyps are over 90%.
Basford <i>et al</i> , 2014	84	A single endoscopist was able to predict histology of small polyps (<10 mm) with high accuracy using both HDWLE and i-scan; there was no difference in prediction between i-scan and HDWLE (both met ASGE performance thresholds)
Basford <i>et al</i> , 2013	145	1) Even in expert hands there is a significant learning curve when using a new technology for the <i>in-vivo</i> characterization of small colonic polyps. 2) The PIVI threshold for a 'resect and discard' policy may require a longer training period than for a 'do not resect' policy 3) These results should help define standards of training in clinical practice for <i>in-vivo</i> characterization of small colonic polyps.
Pigo <i>et al</i> , 2013	78	HDWL i-scan technology helps for characterization of polyps of the colon with good accuracy even if it cannot replace, at the moment, the histopathological examination. Reproducibility among operators is supported by a moderate substantial interobserver and intraobserver agreement.
Hong <i>et al</i> , 2012	389	i-scan did not detect more polyps or adenomas compared to HDWLE; i-scan in mode 2 better predicted polyp histology than HDWLE
Lee <i>et al</i> , 2011	142	i-scan and narrow band imaging (NBI) have similar efficacy in predicting histology of diminutive polyps compared to high definition white light colonoscopy (both superior to HDWLE)
Hoffman <i>et al</i> , 2010	220	i-scan detects more colorectal neoplasia compared to standard video endoscopy; i-scan can accurately predict polyp histology

## i-scan: a fast learning curve

	N	Major findings/conclusions
Neumann <i>et al</i> , 2016	298 images	Accurate interpretation of i-scan images for prediction of advanced colorectal neoplasia can successfully be performed even by nonexpert endoscopists with a high overall accuracy and excellent interobserver agreements
Masci <i>et al</i> , 2013	400 images	We observed good interobserver agreement in the evaluation of neoplastic and non-neoplastic lesions and poor agreement in the evaluation of pit-pattern and margins. Adequate training is required in order to interpret images acquired with the i-scan technique
Bowens <i>et al</i> , 2013	550 images	Eleven endoscopists without previous experience on optical diagnosis evaluated a total of 550 images (396 adenomatous, 154 non-adenomatous). After a single training session, endoscopists with varying levels of experience can already provide optical diagnosis with an accuracy of 84.0%.
Neumann <i>et al</i> , 2013	110 images	Accurate interpretation of CVC images for prediction of hyperplastic and adenomatous colorectal lesions follows a learning curve but can be learned rapidly.
Wang <i>et al</i> , 2012	45 images	Computer-generated enhancements are satisfactory in predicting the histology of small colon polyps without the need for magnification. This advantage is mostly related to the pit pattern enhancement

## Preliminary data on i-scan OE

	Published studies
Mönkemüller <i>et al</i> , 2013	Present and future perspectives of virtual chromoendoscopy with i-scan and optical enhancement technology. Digestive Endoscopy 2013; 26.
Koike <i>et al</i> , 2013	Evaluation of a new image-enhanced endoscopic technology using band-limited light for detection of esophageal squamous cell carcinoma. Digestive Endoscopy 2013

## DDW (Digestive Disease Week) 2016 abstracts

### UGI

	N	Major findings/conclusions
Robles-Medrandá <i>et al</i>	57 patients	OE system™+Magniview™ scopes can detect minimal esophageal lesions (MEL) and predict gastroesophageal reflux disease (GERD) with a high sensitivity and accuracy. The presence of MEL has a high grade of correlation with histology inflammation
Neumann <i>et al</i>	100 areas	The newly introduced OE technology significantly improves diagnosis of GERD compared to high-definition whitelight endoscopy. The results should now be confirmed in a multicenter trial.

### IBD

Iaccuci <i>et al</i>	34 patients	The new OE-i-scan with magnification may accurately reflect histologic abnormalities demonstrated by ECAP histology score which incorporates the full spectrum of acute and chronic histologic abnormalities. This demonstrates that with advanced CE technology, endoscopic assessment of ulcerative colitis is starting to approximate histology.
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### LGI

Iaccuci <i>et al</i>	57 patients	Use of i-scan OE to evaluate accuracy and inter-observer agreement in polyp characterization. Gastroenterologists and physicians without prior experience in novel i-scan OE magnification colonoscopy can achieve significant improvements in predicting polyp histology after a brief training session using videos. Both NICE and ICE polyp classification performed equivalently.
Neumann <i>et al</i>		Developed and validated for the first time a simple and effective classification system for differentiating hyperplastic and adenomatous colorectal lesions by using the newly introduced OE-technology during real-time colonoscopy. These findings need to be evaluated in future prospective, controlled, and blinded clinical trials.

To consult these and other studies please visit [www.i-scanimaging.com](http://www.i-scanimaging.com)



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