ENDO CUT® Q
Endoscopic polypectomy and mucosal resection (EMR) with ENDO CUT® Q
Important information

While Erbe Elektromedizin GmbH has taken the greatest possible care in preparing this brochure and compiling the recommended settings, we cannot completely rule out errors. The information and data contained in the recommended settings cannot be used to justify any claims against Erbe Elektromedizin GmbH. In the event of compelling legal justification for a claim, liability shall be limited to intent and gross negligence.

Although the information on recommended settings, application sites, duration of application and the use of instruments is based on clinical experience, individual centers and physicians also favor settings other than those recommended here. This information is intended only as a guideline and must be evaluated by the surgeon for applicability. Depending on individual circumstances, it may be necessary to deviate from the information provided in this brochure.

Medicine is constantly subject to new developments based on research and clinical experience.

This is another reason why departing from the information provided here may be appropriate.
With the development of new endoscopic resection and hemostasis techniques, the removal of large polyps or other suspicious mucosal lesions is now possible without the need for open surgery.

In endoscopic polypectomy and mucosectomy procedures, Erbe ENDO CUT has established itself as an accepted modality.

The ENDO CUT Q of the Erbe VIO system is a further development of the ENDO CUT offered by the “ERBOTOM ICC” 200 and 350 Model units which have been successfully used for more than 10 years.

This brochure is intended to help users understand the ENDO CUT Q and to use it correctly in their general clinical practice. The brochure targets both endoscopists and the entire endoscopy team.

This brochure was created in close cooperation with experienced endoscopists working at different medical centers. Our particular thanks go to Prof. Schmitt in Neuperlach-Munich and Prof. Schulz in Berlin.
Technolog

Intermittent cutting mode ENDO CUT Q:
cutting cycle yellow, coagulation cycle blue

Cutting cycle with ENDO CUT Q: initial incision phase (yellow/blue),
cutting phase (yellow) and coagulation cycle (blue)

ENDO CUT Q

The fractionated cutting mode ENDO CUT Q is distinguished by alternating
cutting and coagulation cycles (Fig. 1). This facilitates controlled cutting
with safe hemostasis throughout the entire dynamic cutting procedure
while also supporting surgeons in carrying out their work.

Based on more than ten years of experience with ENDO CUT in endoscopy,
voltage regulation in combination with electric arc detection (spark detec-
tion) have proven to be essential features with regard to the quality and
reproducibility of the cutting effect.

ENDO CUT Q is an additional enhancement that ensures safe and effective
removal of large lesions, in particular large polyps.

ENDO CUT Q is a monopolar, high frequency (HF) surgical procedure where
a cutting cycle based on two phases is followed by a coagulation cycle
(Fig. 2):

Cutting cycle
a) Initial incision phase
b) Cutting phase

Coagulation cycle
When cutting with a snare, small arcs (yellow) are created between the snare and the grasped tissue. The coagulation area in this illustration is gray/white. Arrow: direction of traction created by the snare.

Cutting Cycle

a) Initial incision phase
A cutting cycle will always begin with a short initial incision stage of varying duration (Fig. 2). This serves to heat the tissue in the immediate vicinity of the electrosurgical snare endogenously within a few tenths of a second to >100°C, leading to an initial coagulation (hemostasis) of the tissue prior to the actual cutting.

The duration of the initial cutting stage is mainly dependent on the diameter of the snare wire, diameter of the polyp, and the traction of the snare on the tissue it has grasped.

However, the initial cutting stage should be as short as possible to prevent deep coagulation at the base of the polyp. The quicker the cutting phase is arrived at, the more superficial the coagulated area will be. In the following illustrations the cutting cycle is simply depicted as a yellow bar.

b) Cutting phase
The beginning of the cutting phase is indicated by the formation of an electric arc between the tissue and the electrosurgical loop (Fig. 3). The electric arc develops at a high frequency voltage of >200V as soon as the evaporation of tissue fluid results in a small gap between the electrosurgical loop and the tissue that has been gripped.

For a controlled and reproducible cutting result, it is beneficial if the development of the electric arc (spark) is detected automatically. This ensures that the cutting width is reproducible.

The cutting phase in ENDO CUT Q cutting mode is therefore dynamically and automatically regulated using spark detection.

Coagulation Cycle

During the coagulation cycle the tissue is prepared for the next cutting cycle to ensure proper hemostasis prior to the subsequent cut.

The intensity of the coagulation, the so-called coagulation effect, can be modified with ENDO CUT Q with the help of four different settings.

The duration of the coagulation cycle can be finely adjusted using the Expert mode (cf. the chapter “Cutting interval” on page 8). It is important to remember that coagulation is significantly influenced by the effect setting and less by the duration of the coagulation process.

Depending on the chosen setting the coagulated area will increase towards the base of the polyp in the direction of the current flow (Fig. 4).
ENDO CUT Q is a consequential further development of ENDO CUT, a well-known feature of the ICC units.

The Endo Cut Q mode, an optional upgrade, is available for the electrosurgical VIO units, some of which can also be equipped with it retroactively.

A complete system for endoscopic procedures can consist of the following (Fig. 5):
- Electro Surgical Unit (ESU), (Model VIO 200 D)
- Argon Plasma Coagulator (APC), (Model APC 2)
- Endoscopy Irrigation Pump (Model EIP 2)
- Integrated on the VIO Cart

USER INTERFACE

ENDO CUT Q is a cutting mode. This means that on the monitor or the user interface the ENDO CUT Q is displayed in the yellow field (Fig. 6). Normally only the parameter “Effect” is displayed which allows the intensity of the coagulation to be adjusted during cutting.

EXPERT MODE

It is possible to activate the Expert mode to carry out individual adjustments (Fig. 7). If the Expert mode is activated (which should only be carried out by a trained Erbe representative) the parameters “Cutting duration” and “Cutting interval” will also be displayed on the interface and can also be adjusted.

ACTIVATION AND ACTIVATION SIGNALS

ENDO CUT Q is activated by pressing the yellow foot pedal. The user is made aware of the activation by an acoustic signal, the activation signal. As soon as cutting effectively begins, a second acoustic signal will be heard, the cutting signal. The cutting signal serves as an acoustic control for the actual cutting.

The yellow pedal of the foot switch should be pressed down until the polyp or the tissue grasped by the snare has been completely severed.

The cutting stage can be interrupted at any time by ceasing to activate the foot pedal.
In practice

General parameter settings

**EFFECT SETTINGS**

Depending on the size, shape and the location of the polyp it will be necessary to use different coagulation effects to ensure that the polypectomy is carried out with as little loss of blood as possible and with the lowest possible risk of perforation.

The intensity of the coagulation can be adjusted with the help of the parameter “Effect” using four different Effect settings.

**Setting 1**

- With Setting 1 no coagulation is carried out between the individual cutting cycles (Fig. 8).
- This is a purely cutting current.
- Setting 1 is suitable for the resection of polyps in high-risk areas where the walls are particularly thin, because if thermal damage occurs here due to too intense coagulation there is a risk of perforation.

**Setting 2**

- With Setting 2 a very slight coagulation is carried out between the individual cutting cycles (Fig. 9).

**Setting 3**

- With Setting 3 the coagulation between the individual cutting cycles is increased (Fig. 9).

**Setting 4**

- With Setting 4 the coagulation between the individual cutting cycles is maximized. This setting is particularly suitable for applications which require extensive coagulation (Fig. 9).

**CUTTING DURATION**

Depending on the size, shape and location of polyps or other lesions it may be beneficial to vary the duration of cutting.

The extent of the cut is significantly dependent on the duration of cutting and can be adjusted using 4 different settings (only in the Expert mode, cf. page 6 for further details) (Fig. 10).

**Setting 1:**
- With Setting 1 the cutting duration is very brief, which also limits the extent of the cut (Fig. 11). Due to the very small cuts resection is very slow.

**Settings 2–4:**
- With an upscale of the Setting Number the duration of the cut and thereby the speed of the cut increases.
- Settings 2 to 4 have a longer cutting duration each leading to a more extensive cut and therefore to a more rapid resection.
A cutting interval consists of a cutting and a coagulation cycle (Fig. 13). It is defined as the period of time between the beginning of one cutting cycle and the beginning of the next.

Adjustments of the duration of the cutting interval serve to control the fractionated cut. A short cutting interval favors a more rapid cut, longer cutting intervals result in a slower and more controlled resection.

With the help of the parameter “Cutting interval” the duration of the coagulation cycle (in the Expert mode, cf. page 6) can be extended using 10 different settings. Please note that while the cutting interval will influence coagulation, the intensity of the coagulation is decisively influenced by the chosen effect setting (cf. page 7)!

Settings 1–10:
In Setting 1 there is only a very short break between the individual cutting impulses which leads to a rapid cut with limited coagulation (Fig. 13). The higher the setting, the longer the coagulation cycle and therefore the cutting interval (Fig. 14).

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**ENDO CUT Q with cutting interval at Setting 1:**
the coagulation cycle (blue) with the smallest possible cutting interval.

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**ENDO CUT Q with cutting interval at Setting 10:**
maximum duration of a coagulation cycle (blue) with the greatest possible cutting interval.

**CUTTING INTERVAL**

Elevating the polyp above the muscularis propria with the help of the snare prior to ablation.

\(m =\) mucosa, \(sm =\) submucosa, \(mp =\) muscularis propria.

Submucosal (sm) injection. The distance between mucosa (m) and muscularis (mp) is increased after submucosal injection of liquid (blue).

With the submucosal injection the risk of selective thermal heating by the electrosurgical current (black arrows) is reduced.

Positioning the snare. a) Elevating the polyp above the intestinal wall using the snare, b) wrongly positioned snare.

Controlling the amount of tissue grasped prior to carrying out the resection. a) the tissue has been grasped correctly and elevated using the snare in the direction of the arrow, b) in addition to the lesion a part of the intestinal wall was also grasped.
**Operative techniques**

**Preparation for polypectomy procedures and mucosal resection**

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**ELEVATING THE LESION**

An important precondition for a successful and safe polypectomy or mucosal resection is elevation of the lesion (the polyp or mucosa) so that it stands out clearly from the muscularis propria (lifting sign) using the electrosurgical snare (Fig. 15) (or by means of a submucosal injection, see later). By increasing the distance to the muscularis propria the risk of thermal damage or perforation can be decreased. In addition, the fact that the lesion can be elevated (lifting sign) is an important diagnostic indicator (cannot be elevated = indicative of malignity with infiltrative growth).

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**SUBMUCOSAL INJECTION**

Submucosal injection of lesions (for example with a physiological saline solution) offers several benefits. Firstly, this increases the distance between the tissue requiring excision and the muscularis propria (Figs. 16, 17). Due to the excellent electric conductivity and the heat conductance of the injected solution, the electric current applied will be distributed evenly within the saline cushion. This leads to a decrease in current density and to the creation of a thermal insulation layer. The risk of perforation is lessened.

Secondly, the lesion can usually be visualized better and grasped more easily after submucosal injection. This particularly applies to lesions which are located directly behind a fold or are not very elevated.

Furthermore, in addition to the purely mechanical pressure tamponade created by the submucosal injection it is also possible to initiate medicinal prophylaxis against bleeding using vasoconstrictive substances.

It is not imperative to carry out such preparations (as described above) prior to polypectomy procedures or mucosal resections and preparation will differ in different hospitals. The degree and type of preparation will vary depending on the experience and technique of the operating physician and on the clinical findings.

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**PLACING THE ELECTROSURGICAL SNARE**

When positioning the electrosurgical snare it is important to take account of various aspects to avoid complications (bleeding, perforation):

☑ The snare should be placed around the lesion parallel to the intestinal wall, pressing lightly against the wall; the snare should then be closed slowly and lifted up parallel to the intestinal wall (Fig. 18 a).

☑ It is important to avoid one-sided tissue contact of the snare tip to the intestinal wall (Fig. 18 b).

☑ Visual control of the grasped tissue is important: if too much tissue has been grasped (including part of the wall) the snare should be opened and less tissue should be grasped (Fig. 19).

☑ It is important to avoid too much traction on the electrosurgical snare as this will lead to mechanical excision of the lesion without coagulation and therefore increase the risk of bleeding.

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**SPECIFIC FEATURES OF SNARE ELECTRODES**

Single-strand (mono-filament) snares have a smaller area of contact with the tissue compared to multiple-strand (multi-filament, twisted) snares with the same diameter, which results in reduced coagulation.

The diameter of the wire influences the degree of coagulation. A smaller wire diameter will have a lower coagulation effect and a greater cutting effect.

Mono-filament snares are mechanically stiffer than multi-filament snares, which makes grasping the tissue easier.
**PRE-COAGULATION**

To reduce the risk of perforation pre-coagulation with FORCED COAG is recommended when treating stalked polyps or polyps > 10 mm (cf. recommended settings).

**SMALL POLYPS**

Polyps which are smaller than 5 mm may be removed by biopsy forceps. We recommend using the FORCED COAG mode when ablating polyps with hot biopsy forceps; it is also possible to harvest tissue for histological examination at the same time. In this procedure the polyp is grasped with the forceps and clearly elevated from the intestinal wall with a slight traction on the polyp. A coagulated area is created between the distal tip of the hot biopsy forceps and the ablation surface (Fig. 20).

**STALKED POLYPS**

Stalked (pedunculated) polyps between 5 – 15 mm in size (polyp head) can be ablated using either the FORCED COAG mode or ENDO CUT Q (Fig. 21). The polypectomy snare should be positioned close beneath the head of the polyp at a distance from the intestinal wall. As soon as coagulation becomes macroscopically visible at the stalk, the snare should be continually tightened and repositioned (Fig. 22). Too intensive coagulation in the direction of the polyp base increases the risk of perforation of the intestinal wall. Large stalked polyps (> 15 mm) are generally associated with a higher risk of bleeding. During the resection of large stalked polyps with ENDO CUT Q we recommend carrying out bleeding prophylaxis either by submucosal injection, electrosurgical preconditioning, or by clipping. The high-frequency current will also cause the stalk of the polyp to shrink lengthwise (Fig. 23). It is therefore better not to plan the line of resection too close to the intestinal wall. With very large stalked polyps it is often difficult to differentiate between the proximal end of the stalk and the intestinal wall. In these cases we recommend carrying out the resection close to the head of the polyp.

**SESSILE POLYPS**

Submucosal injection is generally recommended when treating sessile polyps in order to ensure that the polyps are sufficiently separated from the intestinal wall. After the polypectomy snare has been properly positioned, the cutting mode ENDO CUT Q can be activated. During the cutting cycle the snare should be slowly tightened and repositioned under slight traction by an assistant. However, if the snare is too tight this could lead to an abrupt severing of the polyp (mechanical severance without sufficient coagulation). After the resection is completed, the resected material can be removed using any one of the commonly employed methods (snare, gripper, net, trap, etc.) – the type of removal will depend on the size of the resected specimen. The resection of large, sessile, broad-based polyps is usually carried out as a partial resection using a piecemeal technique. Different methods, for example using a snare or a cap, are now used (please see the following chapter on EMR). With broad-based polyps it is not always possible to guarantee a complete resection of the polyp. Any polyp tissue at the base of the polyp still present after resectioning can be removed using Argon Plasma Coagulation (APC).
Endoscopic Mucosal Resection (EMR) at the upper margins

**EMR WITH A SNARE**

Prior to EMR with a snare we suggest using APC to mark the area in which there is a suspicion of polyp or carcinoma.

In EMR procedures with or without submucosal injection the lesion can either be removed in one piece "en bloc" (Fig. 24) or using a piecemeal technique.

After placing the snare around the lesion it is important to clearly elevate the lesion from its foundation (lifting sign), either using only the traction of the snare or by means of submucosal injection. This elevation is important diagnostically and as an important precondition for a successful and safe mucosal resection. The snare with the lesion is elevated in the direction of the intestinal lumen, away from the muscularis propria. The cutting process can then be initiated.

**EMR USING A CAP**

In EMR procedures with a cap (Figs. 25 a–d) with or without submucosal injection it may be useful to mark the size and the shape of the lesion using the electrosurgical snare (FORCED COAG mode) or by means of APC (Argon Plasma Coagulation). This will improve orientation, allowing the cap to be placed more precisely on the lesion, which will then be sucked into the cap. After the polyp has been firmly grasped by the snare the cutting process is initiated and the snare is slowly tightened simultaneously.

**EMR WITH NEEDLE INSTRUMENTS**

If the EMR is carried out using an "en bloc" technique (Figs. 26 a–d), it helps if the line of resection is marked using tiny points of coagulation prior to submucosal injection. We recommend using the mode FORCED COAG for such marking with needle instruments or Pulsed APC with an APC probe.

Subsequently, different needle instruments such as needle knives or hook knives together with ENDO CUT Q can be employed for the resection of the mucosa.

The lesion can then be resected either with needle instruments or using an electrosurgical snare.

Due to the higher risk of perforation these EMR techniques (EMR with a cap or a needle instrument) should currently only be carried out in interventional centers by practitioners with sufficient experience.

Recommended settings for ENDO CUT Q for the different surgery techniques please find in the enclosed inset.
Avoiding complications

Complications

The two most common complications after a polypectomy or a mucosal resection are bleeding, which can either be spontaneous (primary) or delayed (secondary), and perforations.

It is important to differentiate between perforations which are due to a mechanical injury to the intestinal wall and those which are created by thermal necrosis.

The following chapter offers hints and pointers on how to use ENDO CUT Q to avoid complications.

INTRAOPERATIVE BLEEDING DUE TO INSUFFICIENT HEMOSTASIS (PRIMARY BLEEDING)

Hemostasis during electrosurgical cutting depends essentially on two factors: on the chosen coagulation effect (effect setting) and on the mechanical traction by the snare on the polyp. If the polyp is constricted too much by the snare, then the polyp will be severed during the first cutting cycle. Because of insufficient coagulation this can lead to bleeding in both cases.

POSTOPERATIVE PERFORATION BY ELECTROSURGICAL CURRENT

If no cutting occurs despite activation of the foot switch, the operating physician should not use the instrument any longer. This could lead to a high energy output and subsequent thermal damage to the intestinal wall. Possible sources of the problem can be wrongly set parameters or defective instruments.

A two-stage or hidden perforation can result from too great an energy output at the base of the polyp, during which a creeping necrotization of the intestinal wall may occur (Fig. 27).

This risk can be reduced by submucosal injection or elevation, particularly of broad-based lesions.

Resections should always be carried out under visual control so that the resection can be cut short if the coagulation effect at the base of the polyp is too great.

COAGULATION OUTSIDE THE DIRECT CUTTING AREA

a) Constriction of the polyp

Too great an elevation of the polyp can result in extreme constriction at the base of the polyp. Such a constriction of tissue can lead to higher current densities which may result in a coagulation and potentially to an incision at some distance from the snare (Fig. 28).

b) Contact between the polyp and the intestinal wall

Contact between the polyp and the intestinal wall can lead to an uncontrolled flowing off the electric current. Together with high current densities at the points of contact this may result in a thermal injury of the intestinal wall (Fig. 29).

c) Unwanted contact of the snare and the intestinal wall

After the resection has been concluded the snare must be completely retracted into the insulated shaft so that if the foot switch is inadvertently activated during the removal of the snare no further coagulation effects will occur.
CONTACT BETWEEN THE SNARE AND THE METAL CLIPS

If metal clips are used for hemostasis it is important to ensure that no electrosurgical current can accidently flow off via the metal clips during resection with the electrosurgical snare (Fig. 30).

DEPRESSING THE FOOT SWITCH

If the pedal of the foot switch is depressed only briefly during resection, there will be no coagulation cycle between the cutting cycles. Only the cutting cycle will be activated. This can also lead to bleeding after resection. The yellow foot pedal must therefore be continually pressed throughout the procedure until the resection is complete.

Defective instruments/accessories

Only connecting cables without any defects should be used. Loose connecting plugs can lead to the creation of arcs at the connecting parts which could negatively affect the control of the operative procedure. The cutting stage might thus be prematurely interrupted, preventing any further cutting.

With polypectomy snares it is important to ensure that the snare can easily be opened via the snare shaft. On no account may defective polypectomy snares be used.

If closure of the snare is no longer possible during the polypectomy procedure, activation of the electrosurgical generator must be immediately terminated, otherwise there is a risk of perforation of the intestinal wall.

FAULTY APPLICATION OF THE PATIENT PLATE

The area of contact between patient plate and skin must always be as large as possible. Any intraoperative lessening of the contact, for example if the patient plate comes off, can lead to thermal injury of the skin.

Improperly placed electrodes or reusable silicon patient plates with a higher impedance can negatively influence the effect of ENDO CUT Q.

We recommend using disposable dispersive electrodes which activate integral patient safety systems in the ESU such as NESSY (Neutral Electrode Safety System), REM, etc.

Note:
For more general information on electrosurgery we recommend the brochure “Basic Principles of Electrosurgery” from Erbe Elektromedizin GmbH.
Recommended settings for ENDO CUT® Q

Polypectomy

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<th>Pre-coagulation</th>
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<th>Forceps biopsy</th>
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<td>Mode</td>
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<td>Effect</td>
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<td>Cutting duration*</td>
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Endoscopic mucosa resection (EMR)

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<td>Flexible APC probe</td>
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* only in the expert mode

Effect Setting 1: cecum, right colon
Effect Setting 2: duodenum, polyps >5 mm
Effect Setting 3: esophagus, stomach, polyps 5–15 mm
Effect Setting 4: rectum, stalked polyps, polyps >15 mm, large tumors
Literature


