

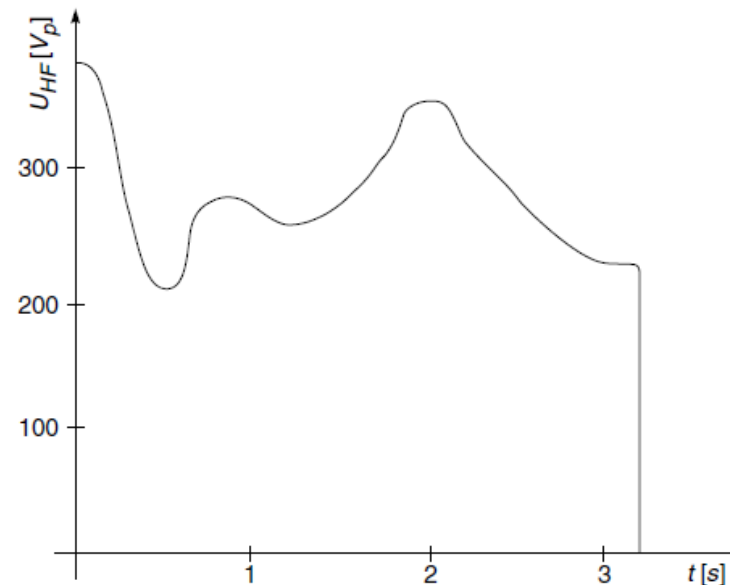
Automated Electro Surgical System

In a conventional electro-surgical unit, there is a considerable fluctuation of the output voltage throughout the 3-s period of the cut. The cause of this undesirable fluctuation is linked to the following factors:

- *Size and Shape of the Cutting Electrode:* The conditions are different for the generator if, for instance, cutting is performed with electrode of large surface area or with a fine needle.
- *Type and Speed of Cut:* The cutting quality is determined by the speed with which the electrode is moved (quick or slow) and by the type of cut (superficial or deep)
- *Different Tissue Properties:* The tissue itself has a strong influence on the quality of the cut. For example, in tissues with a high resistance such as fat, the output voltage is increased whereas in tissues with a low electric resistance, such as nerves and blood vessels, the output voltage may drop significantly.

Voltage Fluctuation in Conventional Machine

The voltage variation can
Cause temperature to vary
Between 600-200 degree C.
At high temperature
carbonisation occurs.
And at low temperatures
cutting will not happen.



► Fig. 27.5 *Cut made with a conventional electro-surgical unit. The incision is uneven with variable coagulation depth along its length due to considerable fluctuation of the voltage secondary to the source resistance of the machine*

Automated Electro Surgical System Contd..

In this machine, the variables—current, tissue resistance, voltage and spark intensity—are registered by means of an inbuilt sensor system and then processed as defined output signals. The automatic control operates on two different criteria:

- *Voltage control*: The selected voltage is controlled and held constant.
- *Spark control*: The selected spark intensity is held constant.

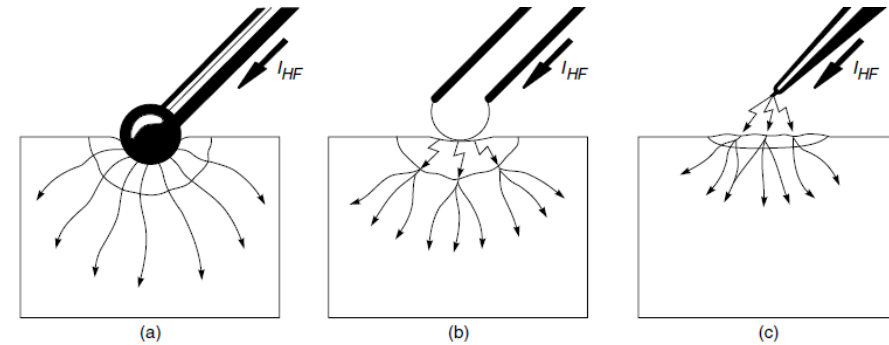
The control of spark intensity is relatively complex because of its non-linear nature. It has been revealed that a number of parameters are directly proportional to the spark intensity and these are used to pre-select and maintain constant these non-linear variables. *The design of the control system ensures that the cutting quality is independent of size and shape of the electrode, the type and speed of the cut and the varying tissue properties.*

Automated Machine provides different coagulation modes

Soft coagulation : In this, no electric arcs are produced between the coagulation electrode and the tissue during the entire coagulation process to prevent the tissue from becoming carbonized. Soft coagulation is recommended in which coagulation electrodes are brought in direct contact with the tissue to be coagulated

Forced Coagulation: This is characterized by the fact that electric arcs are intentionally generated between the coagulation electrode and the tissue in order to obtain deeper coagulation than could be achieved with soft coagulation, particularly when using thinner or smaller electrodes.

– **Spray Coagulation** : In this, electric arcs are deliberately produced between the spray electrode and tissue so that direct contact between electrode and tissue becomes unnecessary. Spray coagulation is used both for



► Fig. 27.7(a) Soft coagulation (b) Forced coagulation (c) Spray coagulation

surface coagulation and haemostasis of vessels not directly accessible to coagulation electrodes, such as those hidden in bone fissures.

Safety Features in Automated Diathermy Machines

The microprocessor-controlled machines provide numerous safety features. These safety features help in reducing the risks in high frequency surgery for both the patient and the users of the machine.

- **Error Detection System, an Error Signalling System and an Error Storage System.** If a certain error arises, it is immediately displayed and the cause of the error can be readily determined.
- **Low Frequency Leakage Current Monitor, High Frequency Leakage Current Monitor, Time Limit Monitoring, Operating Errors and Neutral Electrode Safety System.**
- **Varying Power Delivery to the Electrodes** during the surgical procedure. Machines have a power peak system that delivers a very short power peak at the beginning of electrosurgical cutting to start the cutting arc. Thereafter, average power can be limited to relatively small amounts, which signifies an improvement in protection against unintentional thermal tissue damage.
- **Continuous Monitoring Of Current And Voltage Levels** and making automatic adjustment under the control of a microprocessor provides for a smooth cutting action throughout the procedure.

Electro Surgery Techniques

There are basically two types of electro-surgical techniques: The Mono-Polar And The Bi-Polar Technique.

Mono-polar Technique: In the monopolar technique the current flows from the active electrode through the patient to the neutral electrode (patient plate) from which it returns to the generator. The cutting or coagulating effect depends on the contact area between the mono-polar active electrode and the tissue, which is very small compared with the contact area between the patient plate and patient's skin.

Bi-polar Technique: In this technique, two electrodes are used. The current in this case flows through the tissue between the tips of the two electrodes and returns to the generator without passage through the patient. The bipolar surgery is not only safer than monopolar but is also more precise since the current only flows locally at the specific site where it is actually required for heat generation. In addition, the risk of inadvertent burning of the patient at the patient plate is very low. Hence Bipolar electrodes are becoming a choice wherever possible

