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Short Communication

Ultracision Harmonic Scalpel: A Boon for Oral and Maxillofacial Surgeons

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ABSTRACT

Harmonic scalpel is an ultrasonic based surgical instrument which has two synchronized functions of cutting and coagulation. With its basis in ultrasonic energy, its two main advantages are effective hemostasis and less extensive tissue damage with better visibility than diathermy or laser.
It has a potential role in oral and maxillofacial surgery owing to its advantages. A note on the advantages and uses has been presented.

Keywords: Ultrasonic; Harmonic; UHS; Ultracision; Scalpel.

INTRODUCTION

'Ultracision' encompasses the application of an electrical current across a series of coupled pairs of negatively charged, ferroelectric, ceramic, disc-shaped crystals in a transducer to produce a balanced sinusoidal (or harmonic) ultrasonic wave form of high electro-acoustic efficiency. By coupling a metallic rod to this device, the wave motion is converted into high-frequency mechanical motion at the tip of a blade located at the end of the rod. The blade is then able to cut and coagulate tissue simultaneously in a precise and controlled manner. [1]

The Ultracision Harmonic Scalpel (UHS) is a surgical instrument which uses ultrasound technology to simultaneously cut and coagulate.

Apparatus

The UHS System consists of a portable generator, double pedal, linking cable and a handpiece consisting of both the transducer and harmonic scalpel blade (Fig.1).

The scalpel blade uses the inside curve to cut and dissect, and the outer blunt edge or flat side to coagulate. Both blades are connected to rods, which are 32 cm long. Selection of blade is in accordance with the surgeon's preference for the procedure being done. [2]

The generator provides electricity which is transformed into mechanical energy via a system of piezoelectric crystals. Five power levels are available for the apparatus. At level one, the instrument tip vibrates longitudinally with amplitude of 50 µm, and is used to cut tissue slowly and coagulate collaterally. At level five, the effect is almost a pure cut with minimal coagulation. [3]

The heat produced is directly proportional to the power level and length of time. The effect of the harmonic scalpel on the tissues varies with the energy level, tissue tension and type of terminal. With

higher energy, faster cutting is achieved with less hemostasis. With a lower power level, hemostasis is more intense, but the cutting is slower. Higher the tension on the tissues, the quicker the speed during cutting. [4]

Fig.1: UHS System (*Source: Ultracision Harmonic Scalpel, Generator 300 System Service Manual*)

Mechanism of action

Ultrasonic Harmonic Scalpel

⇩

Electrical energy is converted to mechanical energy: ULTRASONIC energy at frequency of 55.5 kHz

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Causes vibration of the handset

⇩

1.Coaptation 2. Coagulation 3. Cutting 4. Cavitation

⇩ ⇩

Temperature <63°C: Fragmentation of proteins

⇩

Breakage of tertiary hydrogen bonds

⇩

Formation of viscous collagen

⇩

Tissue dissection & Sealing of small vessels

Temperature >63°C: Protein denaturation

⇩

Formation of sticky coagulum

⇩

main vessel occlusion

Thermal injury zone with the harmonic scalpel extends to a depth of 50-150µm, which appreciably reduces mucosal damage and perforation of vessels.

Advantages

The harmonic scalpel has increasingly gained popularity in most surgical fields as ultrasonic dissection allows simultaneous cutting and coagulation. It uses relatively low levels of energy, and blood loss is minimal.

1. Reduction in intraoperative blood loss,
2. Reduction in operating time (avoiding ligatures or electric coagulation for hemostasis),
3. Reduced drainage,
4. Lesser seroma formation,

5. Decreased postoperative pain (minimum eschar formation and tissue dessication)
6. Better wound healing when compared with the standard technique using surgical diathermy.

Uses

The use of the Harmonic scalpel in maxillofacial surgery is relatively new. However, due to its advantages over diathermy, it is gaining popularity in various surgical procedures some of which are listed below.

1. Tonsillectomy,
2. Thyroidectomy,
3. Glossectomy,
4. Superficial parotidectomy,
5. Submandibular gland resection,
6. Surgical treatment of rhinophyma,
7. Rhytidectomy,
8. Resection of oral cavity tumors,
9. Neck dissections,
10. Vascular lesions,
11. Resection of carotid body tumors,
12. Sphincter pharyngoplasty. [5]
13. Elevation of pectoralis major myocutaneous flap, [6] latissimus dorsi flap, [7] radial forearm free flap, serratus free flap and fibula free flap.
14. Obstetrics and Gynecology.

CONCLUSION

Harmonic scalpel is a promising tool whose use in maxillofacial surgery can be used to benefit both the surgeon as well as the patient.

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