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Coblation an overview

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Abstract:

The term coblation is derived from “Controlled ablation”. This procedure involves non-heat driven process of soft tissue dissolution using bipolar radiofrequency energy under a conductive medium like normal saline. When current from radiofrequency probe pass through saline medium it breaks saline into sodium and chloride ions. These highly energized ions form a plasma field which is sufficiently strong to break organic molecular bonds within soft tissue causing its dissolution. This article attempts to provide a broad overview of the technology and its uses in the field of otolaryngology.

Introduction:

Coblation (Controlled ablation) was first discovered by Hira V. Thapliyal and Philip E. Eggers. This was actually a fortuitous discovery in their quest for unblocking coronary arteries using electrosurgical energy. In order to market this emerging technology these two started an upstart company ArthroCare. Coblation wands were exhibited in arthroscopy trade show during 1996. Initially coblation technology was used in arthroscopic surgeries immensely benefiting injured athelets.

Technology overview:

Coblation technology is based on non heat driven process of soft tissue dissolution which makes use of bipolar radio frequency energy [1]. This energy is made to flow through a conductive medium like normal saline. When current from radiofrequency probe passes through saline medium it breaks saline into sodium and chloride ions. These highly energized ions form a plasma field strong enough to break organic molecular bonds within soft tissue causing its dissolution. Since 1950's high frequency electrosurgical apparatus have been in use. In conventional high frequency apparatus heat is made use of to cause tissue ablation and coagulation. The heat generated happens to be a double edged weapon causing collateral damage to normal tissues. Coblation is acutally a benefical offshoot of high frequency radio frequency energy. The excellent conductivity of saline is made use of in this technology. This conductivity is responsible for high energy plasma generation.

Stages of plasma generation:

First stage – (Vapour gas piston formation):

This is characterised by transition from bubble to film boiling. This decreases heat emission and causes increase in surface temperature.

Second stage – Stage of vapour film pulsation:

Tissue ablation occurs during this stage.

Third stage – Reduction of amplitude of current across the electrodes.

Fourth stage : Dissipation of electron energy at the metal electrod surface

Fifth stage (stage of thermal dissipation of energy): This stage is essentially due to recombination of plasma ions, active atoms and molecules.

These stages explain why coblation is effective if applied intermittently. This ensures constant presence of stage of vapour film pulsation which is important for tissue ablation.

Effect of plasma on tissue:

The effect of plasma on tissue is purely chemical and not thermal. Plasma generates H and OH ions. It is these ions that make plasma destructive. OH radical causes protein degradation. When coblation is being used to perform surgery the interface between plasma and dissected tissue acts as a gate for charged particles.

In nutshell coblation causes low temperature molecular disintegration. This causes volumetric removal of tissue with minimal damage to adjacent tissue [2]. (Collateral damage is low).

Differences between coblation and conventional electro surgical devices

	Coblation Devices	Conventional Electro surgical Devices
Temperatures	40 ° C – 70 ° C	400 ° C – 600 ° C
Thermal penetration	Minimal	Deep
Effects on Target tissue	Gentle removal / Dissolution	Rapid heating, charring, burning and cutting
Effects on surrounding tissue	Minimal dissolution	Inadvertant charring / burning

Components of Coblation system:

1. RF generator

2. Foot pedal control

3. Irrigation system

4. Wand

Figure showing various components of coblator

RF generator:

This generator generates RF signals. It is controlled by microprocessor. This generator is capable of adjusting the settings as per the type of wand inserted. It automatically senses the type of the wand and adjusts settings accordingly. Manual override of the preset settings is also possible. Two settings are set i.e. coblation and cauterization. For a tonsil wand the recommended settings would be :

Coblation – 7 (plasma setting)

Cauterization – 3 (Non plasma setting)

Similarly the foot pedal has two color coded pedals. Yellow one is for coblation and the blue one is for RF cautery. This device also emits different sounds when these pedals are pressed indicating to the surgeon which mode is getting activated.

Even though coblation is a type of electro surgical procedure, it does not require current flow through the tissue to act. Only a small amount of current passes through the tissue during coblation. Tissue ablation is made possible by the chemical etching effect of plasma generated by wand. The thickenss of plasma is only 100-200 μm thick around the active electrode.

Otolaryngological surgeries where coblation technology has been found tobe useful include:

1. Adenotonsillectomy

2. Tongue base reduction

3. Tongue channeling

4. Uvulo palato pharyngoplasty

5. Cordectomy

6. Removal of benign lesions of larynx including papilloma

7. Kashima's procedure for bilateral abductor paralysis

8. Turbinate reduction

9. Nasal polypectomy

There are different types of wands [3] available to perform coblation procedure optimally.

Tonsil and adenoid wand is the commonly used wand for all oropharyngeal surgeries. This wand will have to be bent slightly to reach the adenoid.

Laryngeal wand is of two types. Normal laryngeal wand which is used for ablating laryngeal mass lesions. Mini laryngeal wand is used to remove small polyps from vocal folds. The main advantage of mini laryngeal wand is its ability to reach up to the subglottic area.

Nasal wand and nasal tunelling wands are commonly used for turbinate reduction.

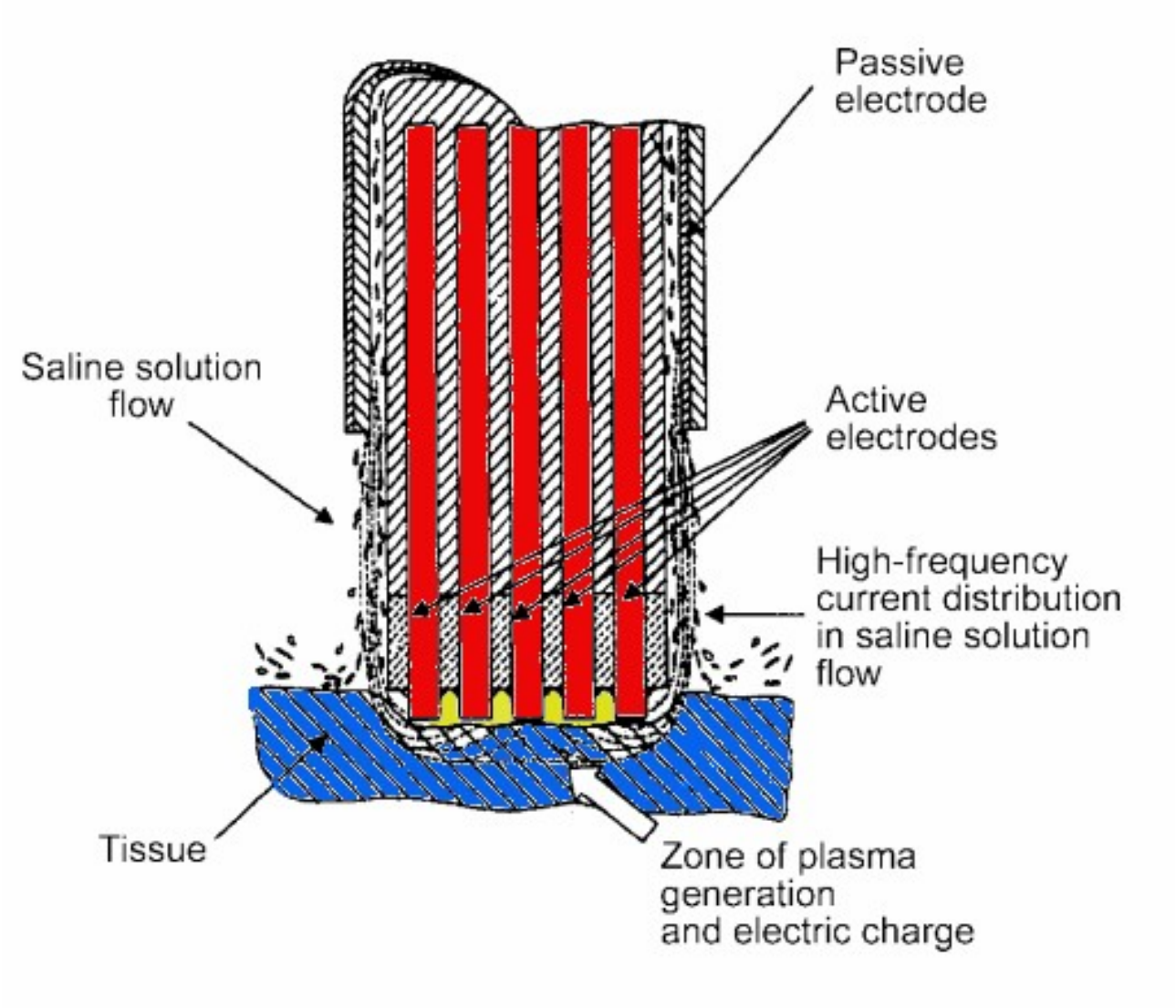
Seperate tunelling wands are available for tongue base reduction.

Equipment specification:

1. Modes of operation – Dissection, ablation, and coagulation

2. Operating frequency – 100 khz

3. Power consumption – 110/240 v, 50/60 Khz



Diagramatic representation of coblation wand

Coblation wand has two electrodes i.e. Base electrode and active electrode. These electrodes are separated by ceramic. Saline flows between these two electrodes. Current generated flows between these two electodes via the saline medium. Saline gets broken down into ions thereby forming active plasma which ablates tissue.

Efficiency of ablation can be improved by:

1. Intermittent application of ablation mode

2. Copious irrigation of normal saline

3. By using cold saline plasma generated becomes more efficient in ablating tissue. Cold saline can be prepared by placing the saline pack in a refrigerator over night.

Coblation is a smokelessa procedure. If smoke is seen to be generated during the procedure it indicates the presence of ablated tissue in the wand between the electrodes. Hence a smoking wand should be flushed using a syringe to remove soft tissue ablated particles between the electrodes.

The generated frequency from coblator should atleast be 200 kHz since frequencies lower than 100 kHz can cause neuromuscular excitation when the wand accidentally comes into contact with neuromuscular tissue.

Conclusion:

Author wishes to conclue that coblation is a promising technology in otolaryngology. Of course as with any other technology it has the cost factor built into it. The cost of wand which is meant for single use is rather high. This equipment is very useful for ablating laryngeal lesions. As far as adenotonsillectomy is concerned it adds to the cost of the surgical procedure. Performing tonsillectomy using coblation helps the surgeon to cross the learning curve rather easily. This technology has a learning curve to surmount. After getting over the curve a surgeon can efficiently handle laryngeal lesions and obstructive sleep apnoea with ease.

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