

Chemical Ablation of the Tissue in ENT Surgery

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Various interventions require tissue ablation in ENT surgery. This can be achieved using a multitude of methods, but the tendency today is to use minimally invasive methods. The development of new technologies has allowed us to consider the use of coblation for tissue ablation, which is based on a chemical reaction, instead of a thermal or mechanical ablation. The technology proved to be extremely used in the field of ENT. Its indications range from functional surgery to benign or even malignant tumors and it can be used in the nose, pharynx and larynx, with probes of different length and angulation. This minimally invasive method of tissue ablation associates less scarring, a faster recovery and a lower postoperative discomfort. Although the time required for the intervention may be somewhat longer, the overall results are superior to the classical methods, considering it provides instant hemostasis as well. We consider it to be a reliable method, fit for a wide range of indications.

Keywords: coblation, tissue ablation, minimally invasive

Tissue ablation is one of the most common procedures in ENT practice. It may refer to the functional volumetric reduction of turbinates, adenoidectomy, tonsillectomy or benign or malignant tumor ablation, but the principle remains. The classical cold instruments implied a certain degree of hemorrhage, even in experienced hands, and the use of thermal devices for hemostasis associated scarring, edema and pain [1].

The last decades signified a revolution in the field of surgical technologies. New minimally invasive instruments became available, allowing the surgeon the one best fitted for every intervention. The goal is to obtain an instrument that provides efficient tissue ablation, with instant hemostasis and minimal damage on the surrounding tissue. One of the most promising technologies proved to be coblation [2].

The technology was developed by ArthroCare Company and was first designed for other specialties, such as gynecology, urology and orthopedics. Only lately did the manufacturer develop coblation wands that are suitable for ENT. It soon started to be widely used, due to its obvious advantages of providing simultaneous ablation and hemostasis at low temperatures [3].

The first interventions included adenoidectomy and tonsillectomy, with studies aiming to assess the advantages of the method [4,5]. Overall, it was considered to be a reliable and superior method, taking into account the degree of hemorrhage, the postoperative pain and the recovery time [6-8]. Another intervention where the technology proved efficient was the turbinectomy, during functional interventions [9]. The time for recovery was much shorter, with no need for nasal packing and a better wound healing.

Showing such promising results, the indications widened. Coblation was successfully used for tumor ablation, including nasopharyngeal fibromas [10] or laryngeal papillomatosis [11]. For nasopharyngeal

fibromas, which are tumors that may cause massive bleedings, the advantage of simultaneous hemostasis proved significant, allowing endoscopic resections of the tumor with good long-term results. The clean view allows the surgeon to completely remove the tumor, with a lower risk of recurrence. As far the use of coblation for laryngeal papillomatosis is concerned, the opinions are still controversial. It has the clear advantage of producing minimal damage to the surrounding tissue compared to laser, but the time required for the intervention is significantly higher. In terms of recurrence, further studies are still necessary in order to assess which method is superior.

A limited number of selected cases with malignant tumors may benefit from the use of coblation, but the patients must be carefully chosen in order to obtain good results. The stage of the tumor and differentiation must be thoroughly evaluated, using standard and complex methods [12], as these factors may greatly influence the outcome. Severe cases, with extremely advanced tumors, are not suitable for such interventions. In such patients, we can only provide palliative care [13, 14] and last generation oncologic treatment [15]. Less advanced cases remain suitable for the use of coblation, taking into account the complete assessment of the patient. However, the field remains open to research in order to determine the indications and limitations of the technology.

Another clear indication for coblation is represented by sleep surgery [16]. A wide number of interventions are available, including palatoplasty, pharyngopalatoplasty and uvullectomy, that can be safely carried out using this technology. The low temperatures and rapid healing make it suitable for minimally interventions.

Overall, the indications for use of coblation became more extensive in the past years. Although it associates higher costs as far the equipment in concerned, the significant advantages make it viable alternative in ENT practice.

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Experimental part

Coblation is based on chemical ablation of the tissue. The principle behind this technology relies on tissue dissolution using a radiofrequency generator and a conductive saline solution. When the current from the generator and transmitted thru the coblation wand passes thru the saline solution, the solution breaks into chloride and sodium ions. The ions poses an energy high enough to form a plasma field, that breaks the molecular bonds of the organic matter and cause tissue ablation. A lower energy transmitted by the energy does cause a plasma field and may be used for coagulation.

The energy produced by the generator ranges from 100 to 500 kHz and can be used for coagulation or tissue reduction and ablation. With the increase in energy, the plasma field is produced, but even for tissue ablation the necrosis is minimum. The local temperature remains low, of about 40-70 degrees Celsius. The ions generated by the plasma field have a destructive potential, explaining the principle behind the use of coblation. The generated ions are H and OH, the last one causing protein degradation.

The process itself is a multi-stage one. First, we have a transition from bubble to film boiling, causing a decrease in heat emission and an elevation of the surface temperature. The next stage, of vapour film pulsation, is when the tissue ablation takes place. Next, the process continues with a decrease in the currents amplitude at the level of the electrodes and the dissipation of the energy at the surface of the electrode. The last stage is when the recombination of elements takes place and the heat is dissipated. This entire process allows for tissue ablation with minimum damage to the surrounding areas.

In our clinic, Prof. Dr. D. Hociota Institute of Phonoaudiology and Functional ENT Surgery, we have successfully used this technology for a wide number of interventions. We wish to present our experience in this area, emphasizing both the advantages and limitations of the method.

As far as functional interventions are concerned, coblation proved useful for adenoidectomies, tonsillectomies or turbinectomies. The intraoperative bleeding is significantly reduced, compared to the cold instruments approach. Also, the fact that the same device can be used for hemostasis is extremely useful and shortens the intervention time. The chemical ablation of the tissue was efficient in these interventions, with little damage to the surrounding tissue. However, if in cases of endoscopic adenoidectomy or turbinectomy, it proved to be easy to use, for tonsillectomy it may require a certain degree of experience and adjusting to the modified aspect of the dissection plane, compared to the classical intervention (fig. 1).

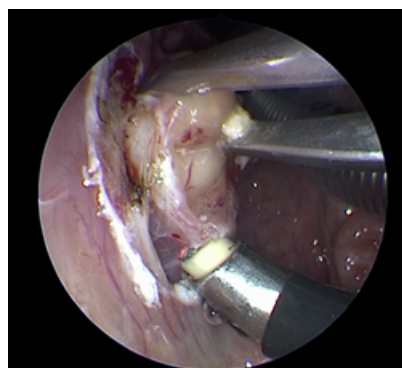


Fig. 1. Chemical ablation of the tissue with minimal thermal damage

The coblation wands may also be used for papilloma ablation under endoscopic control in patients with laryngeal papillomatosis. Although our experience is more limited in this area, we are able to say that the method provides reliable results, with an efficient ablation of the papilloma tissue. The thermal damage is minimal compared to the laser, but the time necessary for the intervention is significantly longer. We consider further studies to be necessary, in order to assess which technology provides a longer time with no relapses, if any significant difference is to be discovered.

We were able to use the coblation technology during more complex interventions as well, such as tumor removal. A clear example in which coblation proves efficient is the endoscopic approach of nasopharyngeal fibromas. Benign tumors, with a potential for significant bleeding, their approach is difficult, especially when aiming for a minimal invasive endoscopic intervention with complete removal of the tumor. The coblation technology proved valuable, due to the efficient hemostasis.



Fig. 2. Intraoperative view, after coblation dissection, with instant hemostasis and no damage to the surrounding tissues.

Results and discussions

The technology was used for a wide range of interventions, covering most of the ENT spectrum. Its versatility make it a reliable choice for multiple interventions where tissue ablation is required, with minimal side effects on the surrounding tissue. We found that it offers a number of advantages, compared to similar cutting/coagulation technologies.

One of the most obvious and important advantages is represented by the low temperature. Other devices, such as the classical electrocautery, associate high temperatures, of up to 400-600 degrees Celsius. The coblation, with its chemical dissolution in saline solution, only causes the local temperature to rise up to 40-70 degrees Celsius. This associates minimal damage to the surrounding tissue, which in turn explains the faster and superior scarring.

The tissue dissolution is less aggressive compared the burning or mechanical excision present with other interventions. This means that the remaining tissue is less affected and can resume its normal function faster. This fact is extremely important for nose interventions, where the mucosa must heal in order to sustain its normal functions.

Also, the tissue ablation is precise, due to the reduced thickness of the plasma field, of about 100-200 mm. This means that no healthy surrounding tissue will be affected.

The technology is smoke-free. This means a clean field with good visibility ar far the endoscopig interventions are concerned and an increased intraoperative comfort for the surgeon.

However, the technology has some disadvanatges as well. It is not efficient for significant bleeding, where a conventional electrocautery may still be necessary. It

requires experience in using it. Although for some functional interventions the degree of difficulty is low, when approaching a diverse pathology, such as sleep surgery or tumor ablation, a more extensive learning curve must be completed. Also, we must mention the high costs associated, especially since the wands are single-use.

Conclusions

Coblation proved to be a good and reliable technology, with superior results as far as tissue ablation is concerned. The fact that it is easy to use for usual interventions also helps promote it as one of the top choices.

We were able to observe that the low temperatures and minimal damage to the surrounding tissues provided by coblation translate into a better wound healing, less scarring, less pain, a faster recovery and a more rapid insertion into everyday activity. Also, as far as the local state of the mucosa is concerned, the minimal or absent tissue necrosis signifies a faster recovery of all its normal functions. This being the desiderate of minimally invasive surgery, it represents one of the main advantages of coblation.

We consider coblation and its chemical tissue ablation of tissue to be a versatile technology, with multiple uses in all the field of ENT. Its full potential however has not been yet established, and more studies may be necessary in order to assess the true limitations of the method. As far as minimally invasive tissue ablation is concerned, it is already one of the top choices, as our experience has proved as well.

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ERRATA

Considering the article *The Use of High - Sucrose Culture Media for the Identification of Oral Streptococci in Infant - Mother Pairs*, authors:

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we make the next modification, as request of the author **Lilla Lorincz**, therefore the real list of authors are:

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