Laser Assisted Uvulopalatopharyngoplasty

Ravinder Verma

Abstract

LASER is acronym for Light Amplification by Stimulated Emission of Radiations. Medical laser technology has revolutionized the way surgeries are being done. As laser provide exceptional benefits to the patients it is also called - "A BEAM OF LIGHT FOR THE BENEFIT OF MANKIND". Carbon-dioxide laser is used to excise and vaporize tissue. Surgical injury to the tissue is determined by the power density and spot size. Vaporization is carried out in the defocused mode while cutting or excision is done in focused mode. Laser is being used in almost all parts of the human body. Laser surgery has become the choice of millions world over as it provides exceptional benefits not only to the patients but also to the surgical community. In the last seven years, 195 patients suffering from obstructive sleep apnea syndrome were subjected to Laser Assisted Uvulopalatopharyngoplasty (LAUP). Trimming and reshaping of the Uvula and Palate is done as outpatient. It is like a visit to a dentist. It takes 10-15 minutes per session. The procedure is repeated 3-4 times. Sitzings are spaced about 3-4 weeks apart. The patient can go back to work the same day.

Keywords: Laup • Laser • Snoring • Sleep Apnea • UPP

Introduction

LASER is acronym for Light Amplification by Stimulated Emission of Radiations. Biomedical developments have revolutionized the health care sector in the last few years. One such invention in this field has been LASER. Medical laser technology has revolutionized the way surgeries are being done. Almost all the routinely performed surgeries can now be performed with lasers with many advantages to the patients. Laser surgery has become the choice of millions

world over as it provides exceptional benefits not only to the patients but also to the surgical community. Applications of laser surgery are tremendous and after expanding rapidly in the western countries, LASER SURGERY is all set to expand in this part of the world

As laser provide exceptional benefits to the patients it is also called - "A BEAM OF LIGHT FOR THE BENEFIT OF MANKIND". Einstein was the 1st to propose the theory of stimulated emission of radiations. Maiman¹ in 1960 invented laser. The principle behind laser application is selective absorption of energy delivered in a specific wavelength to produce thermal necrosis of the target tissue. In 1961 a prototype Ruby laser was used to destroy a retinal tumor in a patient. Goldman² established a medical laboratory at university of CINCINNATI in 1962. The first patient with malignant melanoma was treated with Ruby and Neodymium pulsed laser in 1962. Initially, the lasers had visible spectrum and used only for pigmented lesions. The development of carbon dioxide laser by C.K. Patel in 1964 in the Bell telephone laboratory allowed better and wider use of lasers in medicine. Polanyi³ invented first surgical carbon dioxide laser system in 1965. ND-YAG laser and Argon lasers were also invented in 1964.

In 1981, principle of selective thermolysis was formulated. The development of pulsed technology was a major milestone in laser medicine. Pulsed laser technology utilizes exposure time in sub milliseconds (micro-seconds and nano-seconds) range. The Pulsed energy transfer in shorter than the thermal relaxation time of the target tissue so the risk of scarring from non-selective thermal injury to adjacent tissues in the dermis was virtually eliminated.

Principles of Carbon-Dioxide Laser Surgery The wavelength of CO₂ laser is 10600nm, which is absorbed by water. Tissue destruction occurs by rapid heating and vaporization of intracellular water. Vaporization seals the small nerve endings. Precise photocoagulation of small vessels and lymphatics - leads to less post-operative pain, edema and bloodless field. Pulsed laser technology utilizes exposure times in sub

Ravinder Verma (✉)
Sr. ENT Head & Neck Surgeon
Verma Hospital & Research Centre
Saraswathi Laser Surgery Centre
Gujral Nagar, Jalandhar 144 001
India

wavelength and Pulsed structure. The interaction of laser energy with living tissue can produce three distinct reactions

1. Thermal Effects - Laser energy absorbed by chromophores within the tissues, then converted into heat.
2. Photochemical - Laser energy stimulates or reacts with specific molecules within a cell, causes chemical change, this effect is known as photochemical.
3. Mechanical - Disrupt cellular architecture by producing stress waves or photo acoustic waves.

Material and Method

In the last seven years, 195 patients suffering from obstructive sleep apnea syndrome were subjected to Laser Assisted Uvulopalatopharyngoplasty. The patients were selected out of 650 Patients who reported with complaints of snoring and sleep apnea. The main symptoms, apart from snoring and apnoeic spells at night, were daytime sleepiness with intellectual deterioration and inattentiveness. Most of the patients had difficulty in concentration, morning headache, impotency and behaviour changes. All these patients were properly examined to see the fitness for LAUP procedure. Complete E.N.T. examination was done. X-rays of neck and skull, Sleep studies (polysomnography) computed tomography- Para nasal sinuses and neck magnetic resonance imaging were done to rule out any other cause for snoring and sleep apnea. Polysomnography determines the stages of sleep, identifies the types of apnoeic events, arterial oxygen saturation, documentation of cardiac arrhythmias, and helps us the correct course of management.

The patients suffering from central sleep apnea and mixed sleep apnea were excluded after sleep study. Patients with large tongue volume, nasal problems, and hypo pharyngeal problems were also excluded after magnetic resonance imaging. The selected patients were having long, elongated uvula with elongated flabby, thick soft palate with prominent mucosal folds and reduced oropharyngeal space.

Procedure

To trim and reshape the Uvula and Palate is like a visit to dentist. Patient is treated as out patient. Patient is made to sit comfortably fully awake (Fig.1) 2% Xylocaine is injected at three points, at the base of uvula and on both sides of uvula where it meets the soft palate. Laser set in cutting mode between 20 to 25 watts. With the LAUP probe trenches are made on both sides of the uvula. The lower part of uvula is excised (Fig. 2). The final picture after laser excision is shown in Fig. 2a. Sometimes, lateral cuts are given through the posterior pillars. Each session takes 10 to 15 minutes. The procedure is repeated 3 to 4 times. Sitzings are spaced about 3 to 4 weeks apart. The patient can go back to work the same day. Oral intake is started after 2 hours. There is no need for analgesics in most of the patients. However some patients may feel little discomfort or pain during swallowing as in

Fig. 1 Preoperative Laup procedure

Fig. 2 Line diagram showing laser cuts on both sides of uvula and excision of uvula

Fig. 2a Postoperative Laup

millisecond (micro-seconds and nano-seconds) range. The pulsed energy transfer is shorter than the thermal relaxation time of the target tissue, so risk of scarring from non-selective thermal injury to adjacent tissue in the dermis is virtually eliminated. Tissue effects of LASER depend upon specific

sore throat on 4th to 7th day postoperatively. Such patients can be prescribed analgesics.

In our study, 650 patients attended this institution with complaints of snoring and sleep apnea. 195 patients were selected for LAUP procedure. 114 patients were subjected to three sittings where as 40 patients had four sittings. 31 and 10 patients had two and one sittings each. All these patients were followed up to one year. Objective criteria including sleep study and MRI were used to evaluate 20 patients whereas 175 patients were evaluated subjectively. Out of all 195 patients, 156 patients had excellent, 23 had moderate and 16 had poor results in terms of apnoeic spells at night, changes in daytime sleepiness, behavior, increased interest in life and working.

Discussion

Although lasers have been available for years, the efficiency of carbon dioxide laser as a surgical tool has only recently come into vogue. Extensive reports on laser technology have demonstrated this form of non-ionizing electromagnetic radiations to be an acceptable modality for the treatment of a variety of diseases.

Laser light has unique characteristics via-laser is coherent, collimated and monochromatic. These characteristics of laser makes it capable of tissue destruction. Carbon-dioxide laser is used to excise or vaporize tissue. Surgical injury to the tissue is determined by the power density and spot size. Vaporization is carried out in the defocused mode while cutting or excision is done in focused mode. There are hundreds of cures for snoring. Some are more effective than others. Various methods have been advocated to improve snoring and/or OSAS (Obstructive Sleep Apnea Syndrome)

- 1) Postural treatment- though effective but difficult to follow as patient has to sleep on his stomach and hence difficult for those suffering from arthrosis.
- 2) Nasal continuous positive airway pressure (CPAP) is also demanding and patient's compliance and rejection after sometime.
- 3) Palatopharyngoplasty (PPP) - was first described by Ikematsu 1952. Fujita and Simmons introduced this procedure in USA and in France; Dejean and Chouard developed this procedure. This procedure had good results. The main disadvantages are disfigurement of palate/uvula, more traumatic, velopharyngeal insufficiency and difficult intubations in these patients⁴.

LAUP has so far produced the best results in Obstructive Sleep Apnea Syndrome. Proper selection of the patient is the most important as far as results with LAUP are concerned. 30% of all patients who were registered as suffering from sleep apnea were selected for LAUP. 80% of these selected patients, treated with LAUP had excellent results. This shows that not all patients suffering from OSA/Snoring are fit to undergo laser surgery or uvulopalatopharyngoplasty.

The main advantages of laser are: It can interact remotely with the tissue (non-contact). Laser is gentle in its interaction with the tissue. It causes minimum damage to the tissue adjacent to the ablation site. It achieves a sterile bloodless operative field. It seals the nerve endings and lymphatics and hence less postoperative pain and edema. It is highly precise with great speed. There are no effects on pacemaker or electronic monitoring systems. It is useful in bleeding disorders and patients on anticoagulants. No side effects and general Anesthesia is not required in most of the cases. The recovery is fast. It is cost effective as compared to conventional methods in terms of time.

Lasers are potentially dangerous instruments and must be used with caution. Effective safety protocol, with stress on compliance and meticulous attention to detail on the part of the surgeon, anesthesiologist and the operating room nurse is a must to avoid any complication/mishappenning. General considerations concern the provision for protection of both the patient's and operating rooms personnel's eyes and skin, provision for adequate smoke evacuation from the operative field. Other precautions include the choice for anesthetic techniques, the choice and protection of endotracheal tubes and the selection of proper instruments especially while working in the head and neck region/tracheobronchial/aerodigestive systems.

Conclusion

Laser Surgery offers new and exciting possibilities for improving conventional surgical techniques and expanding the scope of our profession. CO₂ laser is a precise but potentially dangerous surgical instrument that must be used with caution. To overcome all the potential dangers, the experience of the treating surgeon carries the utmost importance. In the last seven years, 195 patients suffering from obstructive sleep apnea syndrome were subjected to Laser Assisted Uvulopalatopharyngoplasty. LAUP has so far produced the best results in Obstructive Sleep Apnea Syndrome. Proper selection of the patient is the most important as far as results with LAUP are concerned. 30% of all patients who were registered as suffering from sleep apnea were selected for LAUP. 80% of these selected patients, treated with LAUP had excellent results.

References

1. Maiman TH. Stimulated optical radiation in ruby. *Nature* 1960; 187:493
2. Goldman L., Balany D., Kindel D., Franke EK. Effect of the laser beam on the skin. *J. Invest Dermatol* 1963; 40:121-122
3. Polanyi TG, Bredemeier HC, Davis TW Jr. Lasers for surgical research. *Med Biol Eng* 1970; 8:541-548
4. Kamami YV. Laser-CO₂ for snoring, Preliminary results: *Acta oto-rhinolaryngologica belg.* 1990; 44: 451-456