Newly Emerging Lasers.

Anil Goyal
Sr. Consultant Urologist, Goyal Hospital & Urology Institute, Krishna Nagar, Delhi-110035, India

***Abstract**: The latest technical improvements in the surgical armamentarium are remarkable. In particular, advancements in the urologic field are so exceptional that we could observe the flare-up of robot-assisted laparoscopic radical prostatectomy for prostate cancer and laser prostatectomy for benign prostatic hyperplasia (BPH).*
There is currently a renewed interest in laser in the field of urology, essentially for the treatment of benign prostatic hypertrophy. Laser is light coherent in time and space emitted continuously or in pulses. Only its thermal and photochemical properties are used in urology. The recent development of lateral firing laser fibers and contact tip fibres has led to a renewed interest in laser in benign prostatic hypertrophy. Intraoperative bleeding is minimal and the length of hospital stay is decreased. Endoscopic pulsed laser urinary lithotripsy (Ho YAG), although effective and atraumatic, but its use is still limited because of its high cost compared to traditional lithotripter. In conclusion, laser technology, has currectly reached an important phase of development with applications for urological disease, essentially in the treatment of benign prostatic hypertrophy in order to reduce the morbidity of classical endoscopic resection. However, other urological applications of laser could be validated in the near future due to the development of less expensive lasers diode and thulium.

INTRODUCTION

The goal of the surgical management of BPH is to reduce the bulk of the prostate to relieve the obstruction of the urinary tract due to the enlarged prostate. The classical treatment is open prostatectomy or transurethral prostate-ctomy (TURP).
Although TURP remains an effective treatment & gold standard of care in the treatment of the benign prostatic hyperplasia (BPH) 15% to 20% of patients develop significant complications, and 10% to 15% require a second intervention with in 10 years[1]. To improve safety outcomes, a number of minimally invasive surgical techniques have been developed, such as needle ablation, electrovaporization, vaporization resection, holmium laser, ultrasound, and microwave therapy. These alternative surgical treatments have shown favorable outcomes to date[2,3]. Each laser used for prostatectomy has its unique wavelength and tissue interaction characteristic that make each wavelength act differently when applied to prostatic tissue[3].
Use of KTP laser provides a significant improvement in symptomatic and urodynamic outcomes and a low postoperatory morbidity, but it is a time-consuming procedure and its high cost associated has limited its widespread use[4,5].

EMERGING LASERS

1.Thulium Laser

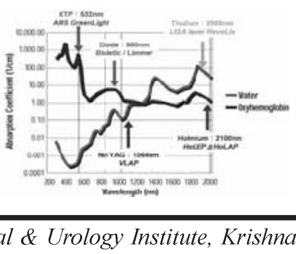
In 2005, the thulium laser entered clinical practice and has become the most innovative and universally accepted laser equipment in urology after the introduction of the holmium laser[6]. The thulium laser is a high – performance laser using a similar 2,000 nm wavelength to the holmium laser but is delivered as a continuous wave (CW) rather than pulsed. Rapid absorption in water, short penetration depth, and incisional and hemostatic features are similar to those of the holmium laser, but the cutting is much smoother owing to the CW mode. The thulium laser is not only suitable for transurethral vaporization, bladder neck incision[7], or vaporesection[8,9], but is also suitable for vapoenucleation of the prostate[10-12]. Mattioli et al reported data on 99 patients with small prostates <35 g), showing clinically efficient vaporization in this group of patients[13]. The term *vaporesection* was introduced to point out the physical characteristics of the 2,000 nm CW nTm:YAG laser system with increased vaporization capacity[7]. With vaporesection, tissue ablation is not only achieved by resection of TUR-like tissue chips, but also by simultaneous vaporization. Meanwhile, using the vapoenucleation technique (median lobe, lateral lobes) as described in HoLEP, but again, the vaporizing capacities of the Tm:YAG laser improve the tissue ablation by concurrent vaporization. There is one randomized clinical trial comparing thulium with holmium laser enucleation[12]. In both groups, catheter removal was undertaken in an average of 18 hours with 95% of patients voiding successfully. Blood loss was minimal, an improvements in sysmptom scores, QoL scores, and peak urinary flow rates were similar at 1 year postoperatively. No significant adverse events occurred. However, large series and long-term results are missing.

Thulium laser prostatectomy

The Thulium:yttrium-aluminium-garnet (Tm:YAG) laser is a continuous wave (cw) laser , operating at a wavelength of 2000 nm. As the wavelength is close to the absorption peak of water, the small penetration depth leads to an high energy density, resulting in rapid vaporization of the tissue. Ex-vivo investigations on blood-perfused porcine kidneys showed that the 2000- nm cw thulium laser offers a higher tissue ablation capacity and hemostatic properties comparable with the KTP laser[14].
Two different techniquest using the thulium lase are possible for the treatment of BPH 1) enucleation of the prostate[15,16], which is technically comparable to HoLEP and (2) vaporesection of the prostate[17,18]. Intraoperative complications rarely occur with either techniques and the system exhibits favorable hemostatic properties and safety in comparison to TURP[18]. Currently only data with a maximum follow-up of 1year are available. The reoperation rate is between 2.8 and 3.1% and no significant difference could be detected in comparison to TURP. Despite the encouraging results, further studies are essential to confirm these data.
No deep penetration ! Only 0.2 mm necrosis

Results of Thulium laser in 80 patients

	Initial	**3 months**	**6 months**	**12 months**
AUA-SI	27.7±5.7	8.7±4.5	6.8±5.0	6.2±4.7
Peak flow (ml/s)	2.3±3.7	16.5±5.1	16.4±5.2	14.8±6.1

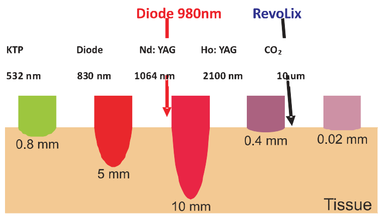


980nm is 2300 times more absorbed in H_2O than 532nm
532nm is 74 times more absorbed in H_bO_2 than 980nm

***Correspondence: Dr Anil Goyal**, Sr. Consultant Urologist, Goyal Hospital & Urology Institute, Krishna Nagar, Delhi-110035, India*
***E-mail:** drgoyalhospital@gmail.com*

Thulium : *Laser Type and Specification*

Laser type:	**D**iode **P**umped **S**olid **S**tate Laser DPSS (Thulium ©' Laser) (The 2 micron laser is excited by an internal diode laser.)
Wavelength:	2 micrometer
Power:	5 Watt – 70 Watt, adjustable
Operational mode:	Continuous Wave (cw)
Chopped:	50 milliseconds to continuous
Delivery system:	Flexible silica fibres



Thulium12: Fields of Application

Endourology:	TUR-Laser, Opening of Strictures, Incisions, Excisions, Ablation of Bladder Tumours.
Open Urology:	Excision of Tumours from the Cortex of the Kidney, Bladder Surgery.

Prostate tissue after VapoResection with Thulium

QOL	4.4±1.1	1.04±0.65	1.04±0.65	1.64±0.92

Morbidity Profile

ITEM	NO.	INCIDENCE %
Incontinence	0	0
UTI	5	6.2
Hematuria	1	1.25
Urine retention	2	2.5
Reop for check bleeding	1	1.25
Impotence	0	0
Bladder neck stenosis/stricture	1	1.25
Prostate cancer	6	7.5

2.Diode laser

Various types of diode lasers performing at wavelengths of 940,980 or1,470 nm are available for diode-laser prostatectomy . To date, only a few studies have reported clinical applications of these lasers with a maximum follow-up of 1 year. Seitz et al reported that the high-power , 980 nm wavelength diode laser is a new promising alternative with a more rapid ablation rate and excellent hemostatic properties in ex vivo and in vivo animal models[19]. There are only few clinical pilot studies for the vaporization of the prostate using diode lasers. Two series used 980 nm diode lasers of different manufacturers[19,20] and one used a 1,470 nm diode laser prototype[19]. Complication rates were low and the authors reported low or no perioperative bleeding. In a single nonrandomized clinical series comparing the diode laser treatment at 980 nm with the LBO laser[21], the authors described excellent hemostatic properties of the diode laser. Even though most of the patients continued anticoagulation treatment, only 2 patients (4%) needed irrigation postopertively vs.25 patients (40%) in the LBO laser arm. However, as a result of the increased tissue necrosis induced by the diode laser compared to the LBO laser, irritative symptoms as short term complications such as prolonged dysuria or transient urge incontinence occurred more often in the diode laser group. During the follow-up, retreatment rates and incontinence rates were also higher in the diode laser arm[21]. In a recent comparative clinical study followed-up for 1 year using the GreenLight HPS laser (532 nm, 120W) and the Diolas LFD diode laser (980 nm, 200W), Chiang et al demonstrated that the diode laser showed superior hemostatic properties compared with the GreenLight HPS laser[22]. Postoperative incontinence and postoperative irritative symptoms were more noticeable after diode laser prostatectomy. Higher incidence of dysuria with sloughing tissues and epidiymitis was noted after diode laser prostatectomy. Other complications were comparable for both procedures.

Diode Laser vaporization of the prostate

Diode lasers for the treatment of BPH are currently available at the wavelengths 940, 980 and 1470 nm. In a preclinical ex-vivo model of the blood-perfused porcine kidney, the 980 nm diode laser has shown a higher tissue ablation capacity, similar hemostasis and a smaller coagulation zone than the KTP laser[23]. Data concerning the coagulation zone could not be confirmed by other authors, showing a five to nine times deeper necrosis zone than the KTP laser in ex-vivo investigations on porcine kidneys and human cadaver prostate tissue[24,25]. Ex-vivo studies with a 1470 nm, 50-W and a 940 nm diode laser, showed a significantly lower capacity for tissue ablation and a significantly larger coagulation zone compared to the 80-W KTP laser[26,27].

Currently only a few studies have investigated the clinical applications. With a maximum follow-up of 1 year further studies are essential in order to evaluate the technique. While all the studies show a high intraoperative safety and hemostatic properties superior to PVP, reports on the long-term durability and safety are inconsistent with a reoperation rate of up to 32.1% and high stress incontinence rates after one year[28-30]. Despite its favorable intraoperative safety, long-term follow-ups and large scale trials are necessary to finally evaluate the technique.

DISCUSSION

The selection of an appropriate treatment for symptomatic BPH can be a challenge for both patients and urologists, ideally, the choice should be made with primary concerns for clinical efficacy, patients specific goals, reasonable assessment of surgical risk and finally, the cost of treatment. The diode laser procedure for BPH provides acceptable hematuria. The efficiency, short learning curve and low morbidity profile together make the diode laser a highly acceptable treatment modality for BPH. Our experience showed the diode laser is a new technology for most urologist. However, the expense, safety precautions, long-term effectiveness and general acceptance are all important prohibitors for this procedure. Future studies should include a comparative study with large sample sizes and long term follow-up.

Though the TUR of prostate is considered to be the golden standard of care in the treatment of BPH, its perioperatory morbidity (hemorrhage, urethral stenosis, reabsorption syndrome, and catheterization times has encouraged and search of alternatives which can reduce it and offer at least similar clinical results. For the last few years, different types of laser and different wavelengths have been proposed as candidates to be considered real alternative to the TUR. Seitz et al. have reported the preliminary data of a study based on the utilization of a diode laser of 1470 nm at 50 W of power, obtaining some promising results in patients with BPH. However, the combination of a good absorption both for water and for hemoglobin make the laser of diode at 980 nm a more attractive option in the treatment of the BPH by means of vaporiazation of the prostrate tissue. Guazzoni et al. published in 1996 the use of the diode laser at 980 nm in the treatment of the BPH (VLAP modality), though only a decade later new contributions with this energy source have been collected. In an ex vivo study, the diode laser of 980 nm used at 120 W of power showed a capacity of ablation clearly superior (almost double) to the one obtained with the laser KTP of 80 W. Unlike other lasers, the speed of vaporization with the diode laser at 980nm does not seem to depend on whether the tissue is mucosa or fibromuscular stroma. Regarding its hemostatic properties , it is considered to be equivalent to KTP. Using 120 W of output power, the depth of the coagulation was similar to that obtained by monopolar RTU960. A recent contribution comparing the results after 6 months between a group treated with KTP laser 120 W and another one with diode laser of 200 W, can barely find differences between both therapies, though the group treated with diode shows a slightly more intense dysuria than the group treated with KTP. Prostate vaporization with diode laser basically shares the same principles stated for laser KTP . The cystoscope fiber and the stages of the procedure are identical, and a side-fire fiber is also used in a similar fashion.

It should only be pointed out that when a minor performance of the fiber is noticed, it is possible to use it in the contact way to get an improvement of the vaporization, though this way of proceeding may increase the damage of the fiber. Even if it seems that the speed of vaporization and the depth of the zone of coagulation is similar in the pulsed mode and in the continuous mode of the 980 nm diode laser, the bleeding is practically absent in both modalities, though in the continuous mode seems to be even lower.

The median lobe generally slows down the process of vaporization and accelerates the deterioration of the fiber; half incision of the lobe and to proceed later to the vaporization on both sides seems the most reasonable way of handling this circumstance. The most reasonable way of handling this circumstances could be to perform half incision of the lobe in the first place, and vaporization on both sides later on.

To date, no clinical studies with 980 nm laser were available. The results that we have obtained are satisfactory both the symptomatic improvement-IIEF and Qol scores-and the urodynamic parameters(Qmx), while reporting a low intra-perioperatory morbidity. The diodes that produce the light emission are smaller, more efficient and possibly cheaper than other types of laser . In addition, the easy managing and installation of the device (its weight is lower than 30 kg, includes refrigeration in the same module and only needs an ordinary electrical socket) make it attractive to the urological community.

Nevertheless, long term studies need to be carried out to confirm the favorable short-term results reported in this study.

CONCLUSION

Until now, outcomes of laser prostatectomy of BPH are very encouraging. However, more clinical data are warranted for laser prostatectomy to replace the status of TURP as a gold standard of surgical treatment for BPH. Thulium laser offers rapid tissue ablation and resection in patients with BPH. Various wavelenghts of Diode lazers ar available and 980mm at 200watts appear to be efficient in the low morbidty profile and has a short learning curve. Both Thulium and Diode lasers are newly emerging lasers and the expense, long term effectiveness, safety precautions and general acceptance are important prohibitors for their wider usage.

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Plagiarism on the Rise in Science Research *by Max Martin in Bangalore*

Academic policies compel academicians to publish "research" for the sake of promotions; the perks have also encouraged paper writing, with scholars borrowing/ recycling or stealing from previous published papers. There has been a considerable increase over the past decade in the number of papers being retracted because of such unethical practices and misconducts as reported by the Indian Institute of Science (IISc) Professor Abinandanan's study revealed that the number of research papers withdrawn for use of unethical means was just seven (7) for 1990-2000, it rose to 69 by 2001-10. There were no retractions before 1990. The country's scientific output went up from 31,500 paper in the 90's to 1,03,000 in 2001-10. However , there has been a nearly 14-fold increase in the number of retractions,Abinandanan said. "We know that almost all cases of misconduct were **plagiarism**". Of the 1,03,000 papers during 2001-2010-reflected in an international database called Pubmed, only 69 had been retracted. Plagiarism was the leading factor accounting for all but one retraction. "There is definitely a compulsion to publish and present papers in seminars. There are some shady journals with lenient norms that accommodate such lax or lapsed researchers. But the trend has dipped of late, because there are easy methods available online to catch copycats.

People are stealing or recycling content

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