

## Effect of KTP Laser on Surgically Resected Adenomas of Prostate

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**Introduction:** Transurethral resection of prostate (TURP) is the most common urological operation performed. Regarding the complications of this surgery, studies are looking for alternative endoscopic techniques in order to reduce risk of complications. Use of high energy lasers is the most promising method for managing patients with benign prostate hyperplasia (BPH). In this study, we evaluated the effect of homemade KTP laser on resected prostate adenoma after open prostatectomy.

**Materials & Methods:** A total of forty resected prostate adenoma by open prostatectomy, assigned in to the study groups. One part of specimens without any intervention was sent to the pathology department and the rests divided to four KTP dose response groups (10 patients in each group). The prostate specimens were ablated by KTP laser in one, two, three, and four sessions according to their number of subgroups. Prostate tissue was irradiated by 5-watt KTP laser for 15 seconds in each stage. All prostate specimens ablated with laser were sent to pathology for evaluation of tissue ablation capacity and tissue penetration depth.

**Results:** Mean age of the participants was  $73.25 \pm 6.8$  years with mean serum level PSA of  $3.65 \pm 2.1$  ng/dl. 1 to 2 mm of the tissue was ablated at each session of laser administration. In pathologic examination, 0 to 2 mm of tissue destruction with disappearance of nuclei of the cells, basophilia of the stroma, and damaged tissue (cutter like effect) were witnessed. Findings were compatible with burn effect.

**Conclusion:** KTP laser prostatectomy is a safe and effective procedure with low risk of complications in which bladder outlet obstruction symptoms will relieve. According to our study, extra penetration of prostate tissue during laser irradiation is rare. This finding could be suggestive this theory that KTP laser has little risk of capsule perforation.

**Keywords:** KPT Laser, Prostate, TURP

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### INTRODUCTION

Benign prostatic hyperplasia (BPH) is present in almost 70% of the men over 60 years old. It results in bladder outlet obstruction and gradual destruction

of the kidney tissue and could be negatively affect on patients' quality of life.<sup>(1, 2)</sup> Increase in the life expectancy has resulted in higher number of men who present to hospitals with urinary symptoms due to BPH. More than 30% of the men older than

65 years have obstructive or irritative symptoms.<sup>(1)</sup> Up to 80 years of ages, approximately 25% of the men undergo treatment for obstructive urinary symptoms.<sup>(2)</sup> Some of the patients are treated using medical methods including use of alpha blockers; but most of them need surgical intervention.<sup>(3)</sup>

The common surgical treatments in these patients include open prostatectomy and transurethral resection of prostate (TURP) which is itself the most common urologic surgery performed.<sup>(3)</sup> During the past decades, TURP has been supposed to be the treatment of choice in the treatment of BPH. In 1994, almost 400,000 TURP surgeries have been performed around the world with approximate cost of 5 billion dollars.<sup>(4)</sup> Although TURP is a confirmed method of treatment of BPH, it has some limitations. Mortality rate after this treatment is 0.23% within 30 days of the surgery which reaches 2.8% in 12 months of follow-up. Also its morbidity rate is 12-18% in a period of 6 to 12 months after the surgery.<sup>(5, 6)</sup>

Nowadays, alternative surgical procedures trying to achieve a marked volume reduction, to decrease bladder outlet obstruction and lower urinary tract symptoms with minimal morbidity are going into competition with TURP. The main goal of all these minimally invasive methods is the reduction of perioperative complications, e.g. uptake of irrigation fluid (TUR-Syndrome), and hemorrhage with consecutive need of blood transfusion. For the first time, laser has been used in the treatment of BPH in 1992.<sup>(7)</sup> Laser therapy encompasses a variety of techniques using different laser wavelengths, application systems, and surgical techniques to achieve different tissue effects. Ablative laser procedures showing effective removal of tissue and at the same time increased hemostasis as could be induced by either KTP-laser tissue vaporisation or by Ho:YAG-laser enucleation are becoming clinically accepted.

## MATERIALS AND METHODS

In an experimental study, 40 patients with urinary symptoms and diagnosis of BPH who were candidates for open prostatectomy were enrolled. All procedures were performed in Urology division of Tajrish hospital from 2007 to 2008.

After prostatectomy, prostate tissue was divided into two specimens; the first one was fixed in

formalin and sent for histopathologic evaluation without any intervention. The rests of specimens were divided into four KTP dose response groups and sent for KTP laser room as soon as possible. In the first group, the samples underwent 5-watt laser for 15 seconds. In the second group, the same laser was administered in 2 stages (after the first stage, the burnt tissue was taken and laser was re-administered). In the 3<sup>rd</sup> and 4<sup>th</sup> groups, laser was administered 3 and 4 times, respectively. After laser therapy, all the samples were preserved in formalin and assessed for pathological changes. The pathologist was completely blind to the samples sent for him. Any pathological finding including burn, necrosis, and tissue destruction and also penetration depth were reported.

Since the study was only evaluating the effect of laser on the tissue and had no interventional effect on the patient and disease process, it was approved by the ethics committee of Shaheed Beheshti University. The data was analyzed by SPSS software, Mann-Witney test, and Wilcoxon signed rank test.

## RESULTS

A total forty male patients with mean age of  $73.25 \pm 6.8$  years (range 62 to 83 years) and PSA level of  $3.05 \pm 2.1$  ng/ml (range 0.4 to 5.7 ng/ml) underwent open prostatectomy.

The reports of all specimens were benign prostatic hyperplasia. In histopathologic evaluation of the samples after laser irradiation, there was 0-2 mm cell structure destruction as fading of the cellular nuclei and basophilic changes of the cellular stroma (cutter effect). The depth of laser penetration was 0 to 1 mm in each group at each session of laser therapy. In statistical evaluation of the 4 groups, the depth of laser penetration was independent from the previous laser irradiation. Table 1 shows the depth of organ penetration more than the place of laser effect according to the times of laser administration. In 28(70%), 3(7.5%), 8(20%), and 1(2.5%) patients, the depth of laser penetration was 0mm, 1 mm, 2 mm, and 3 mm more than the place of laser effect, respectively. The only sample with 3 mm depth of laser penetration beyond the place of laser effect was belonged to 4 sessions of laser therapy. However, there were 8 specimens in this group that had no penetration depth.

**Table1.** Depth of prostate penetration in more than the place of laser effect according to laser sessions

Laser session (Num)	Extra penetration depth (mm)				Total Number
	0 mm Number (%)	1 mm Number (%)	2 mm Number (%)	4 mm Number (%)	
One session	6	3	1	0	10
Two sessions	6	0	4	0	10
Three sessions	8	0	2	0	10
Four sessions	8	0	1	1	10
Total	28 (70)	3 (7.5)	8 (20)	1 (2.5)	40

## DISCUSSION

Increase of the life expectancy has resulted in higher prevalence of those patients referring to urology clinics because of BPH. TURP is the treatment of choice in these patients.<sup>(8)</sup> Regarding the complications of this surgery and the recent advances in medical instruments such as different sources of laser, laser therapy has been suggested to be useful in the treatment of BPH. Such laser techniques are the clinically established KTP-laser-induced prostate vaporization and the Ho:YAG-laser enucleation of the prostate replacing the Nd:YAG treatment modalities of the 90th including its side effects. In 2005, Bachnamm and colleagues evaluated 108 patients with lower urinary symptoms who underwent 80-watt KTP laser and saw that in 12-month follow-up, the patients' Qmax increased and urinary residue decreased. A significant decrease was seen in IPSS and it was concluded that KTP laser was a method with least bleeding in the treatment of BPH.<sup>(9)</sup> Sulser and coworkers evaluated the same effect on 65 patients in 2006. Except for the patients with BPH, those with advanced local prostate cancer were also included. They concluded that these patients had no complications and no need for blood transfusion. Their Q max increased and IPSS decreased.<sup>(10)</sup> Hai and Malek performed a study in Michigan on patients with urinary symptoms due to BPH. A patient had mild hematuria which was due to warfarin use and 2 patients complained of mild dysuria. IPSS, urinary residue, and prostate volume decreased, while, peak flow rate increased.<sup>(11)</sup> Nagahama and colleagues evaluated 67 patients between 56 and 75 years of age in Japan (2001) which used 20-watt KTP laser for prostatectomy. In 2 weeks, no bleeding was detected in the patients. Mean maximum flow rate increased dramatically

and the residue was decreased.<sup>(12)</sup> Chahal and coworkers performed a study on 148 patients with obstructive and irritative symptoms due to BPH. Thirty-four-watt KTP laser was used in association with 60-watt-Nd YAG laser. In 2-year follow-up, the symptoms decreased significantly. However, some sexual dysfunction developed.<sup>(13)</sup> Carter and colleagues performed KTP and Nd YAG laser on 204 patients (1999) which showed a significant decrease in IPSS.<sup>(14)</sup>

Regarding to these studies, the effect of KTP laser on BPH symptoms has been totally confirmed. However, no evaluation has been performed on the effect of KTP laser on in-vitro prostate tissue, while pathologic changes could not be evaluated because of lack of tissues. With regard to the high price of imported instruments and our capability in producing homemade KTP laser, we performed this study to evaluate effects of this type of laser on resected adenomas of prostate. However, its effect was not directly evaluated on the human beings.

We discovered that the extra depth of KTP laser penetration was 0 mm in 28 men, 1mm in 3 men, 2mm in 9 men, and 3mm in 1 man which shows this laser could be an appropriate laser for resection of the prostate tissue without any harmful effect on surrounding tissue.

In general, extra penetration of prostate tissue during laser irradiation (not beyond the area of laser administration) is rare. This finding could be suggestive this theory that KTP laser has little risk of capsule perforation which assures the surgeon that prostate resection by this technique could be safe. According to other studies, prostatectomy with KTP laser is a very quick and safe procedure in the treatment of obstructive symptoms in BPH patients. Homemade KTP laser is a cost effective instrument prepared by AEOI that we offered its application by Iranian urologists.

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