Diode laser in the treatment of benign prostatic enlargement: a preliminary study

Benign prostat büyümesi tedavisinde diode lazer: Bir ön çalışma

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Abstract

Objective: To evaluate the efficacy of a novel treatment diode laser, in treatment of benign prostatic enlargement.

Materials and methods: We evaluated the surgical and functional outcomes of 85 patients who underwent diode laser treatment for benign prostatic enlargement between September 2007 and April 2009. Preoperative and postoperative the International Prostate Symptom Score (IPSS), the International Index of Erectile Function (IIEF), maximum flow rate, postvoiding residual urine, and prostate volumes were analyzed.

Results: All the patients were considered clinically as having benign prostatic enlargement. Mean age was 70.8±8.6 years and follow-up period was 12.6±6 months. In all patients, the power used was 120 W, the mean applied energy was 190±70 kJ and the total laser time was 21.9±7.2 min. Improvement in functional outcomes began in the third postoperative month and was sustained through 12 months postoperatively. Compared to preoperative data, at postoperative 12 months, we detected a significant decrease in prostate volumes (55.5±27.6 mL vs. 42.8±21.7 mL), IPSS (21.6±4.75 vs. 4.6±3.3) and residual urine volume (89.5±85.6 mL vs. 30.4±22.4 mL), and a significant increase in maximum flow rates (18.7±6.9 mL/sec vs. 9.6±5.6 mL/sec). No difference was detected in IIEF scores (36.8±21.2 vs. 37.8±23.7). Re-treatment was required in 5.8% of patients, and retrograde ejaculation was reported in 17% of patients.

Conclusion: The early results of diode laser treatment for benign prostatic enlargement were equivalent to other endoscopic and minimally invasive treatments.

Key words: Benign prostatic enlargement; diode; laser; minimally invasive; treatment.

Özet

Amaç: Benign prostat büyümesi tedavisinde, yeni bir tedavi şekli olan diode lazerin etkinliğini değerlendirmek.

Gereç ve yöntem: Eylül 2007 ile Nisan 2009 tarihleri arasında benign prostat büyümesi için diode lazer tedavisi uygulanan 85 hastanın cerrahi ve fonksiyonel sonuçlarını değerlendirdik. Ameliyat öncesi ve sonrası Uluslararası Prostat Semptom Skoru (IPSS), Erektil Fonksiyon İçin Uluslararası İndeks (IIEF), maksimum akım hızı, postvoiding rezidüel idrar ve prostat hacimleri incelendi.

Bulgular: Tüm hastalarda klinik olarak iyi huylu prostat büyümesi varlığı kabul edildi. Yaş ortalaması 70.8±8.6 idi. Ortalama takip süresi 12.6±6 aydı. Tüm hastalarda, kullanılan güç 120 W, ortalama uygulanan enerji 190±70 kJ ve toplam lazer süresi 21.9±7.2 dakika idi. Fonksiyonel sonuçlarda iyileşme ameliyat sonrası üçüncü ayda başladı ve 12 ay boyunca devam etti. Ameliyat öncesine göre postoperatif 12. ayda prostat hacminde (55.5±27.6 mL ve 42.8±21.7 mL), IPSS'de (21.6±4.75 ve 4.6±3.3) ve rezidüel idrar hacminde (89.5±85.6 mL ve 30.4±22.4 mL) anlamlı azalma kaydedilirken, maksimum akım hızlarında (18.7±6.9 mL/dak ve 9.6±5.6 mL/dak) anlamlı artış bulundu. IIEF skorunda ameliyat ile anlamlı fark görülmedi (36.8±21.2 ve 37.8±23.7). Tekrar tedavi hastaların %5.8'inde gerekti ve retrograd ejakülasyon hastaların %17'sinde bildirildi.

Sonuç: Benign prostat büyümesi için diode lazer tedavisinin erken dönem sonuçları diğer endoskopik ve minimal invazif tedavi yöntemleri ile eşdeğer bulunmuştur.

Anahtar sözcükler: Benign prostat büyümesi; diode; lazer; minimal invazif; tedavi.

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The standard surgical treatment for benign prostate enlargement (BPE) is transurethral resection (TURP).[1] Although advances in technology have decreased the incidence of side effects, TURP is not without complications and is related with morbidity.[2,3] The availability of lasers for surgical procedures has led to new concepts for the treatment of BPE. Nd:YAG, Ho:YAG and KTP lasers, in historical order, have been used for this purpose. Following comparable results to TURP, the use of a laser has been considered as a minimally invasive procedure for ablation of the prostate. Novel energy sources, including a diode laser and a thulium laser, have been shown to be effective for BPE treatment.[4,5] This study aims to present the preliminary functional outcomes of diode laser treatment for BPE.

Materials and methods

Between September 2007 and April 2009, 85 patients clinically diagnosed with BPE were included in the study. The mean age of patients was 70.8±8.6 years. All patients had been evaluated using the International Prostate Symptom Score (IPSS), prostate specific antigen (PSA), digital rectal examination, uroflowmetry, postvoiding residual urine measurement, the International Index of Erectile Function (IIEF), serum creatinine, transrectal ultrasonography (TRUS), urine analysis and urine culture. TRUS was performed by a single surgeon (H.K.) in the urology department. Three patients with PSA elevations underwent TRUS-guided prostate biopsy prior to surgery, and the pathology revealed benign prostatic hyperplasia. Five patients had a history of urinary retention, and they were free of catheters prior to surgery. Patients with a history of previous prostate surgery, urethral stricture, neurogenic bladder or urethral catheter were excluded. Patients on anticoagulant therapy continued their medications. The only accepted contraindication for the surgery was the inability to maintain lithotomy position for endoscopic surgery. The procedure was limited to prostates up to 100 g.

Microscopic hematuria was present in 8 patients, and pyuria was present in 5 patients. None of the patients had documented symptomatic urinary tract infection prior to surgery. One patient was receiving anticoagulant treatment for a history of cardiac valve replacement operation, and 5 other patients were using antiplatelet medication.

Surgery was performed as described previously.[4] Patients had been operated on mainly by 2 senior professors (B.O., H.K.), who had previous experience with KTP laser prostatectomy. Laser therapy was performed using a 980 nm diode laser side-fire probe, with the power adjusted to 120 W (Ceralas D 980 nm Diode Laser, Biolitec, Germany). The procedure was performed under general or spinal anesthesia. Sterile saline was used as irrigation fluid. Patients were given prophylactic intravenous cephalosporin during anesthesia induction. When the urine color was clear, urethral catheters were removed on the morning of the postoperative first day. All patients were treated as inpatients, and the median postoperative hospital stay was 1 day (range 1-3 days). Patients were followed up at 3-month intervals postoperatively. The above-mentioned tests were conducted at the follow-up visits.

The study was conducted and performed with the support of the Scientific Research Projects Office and was approved by the local ethics committee.

The information obtained from the patients was recorded and analyzed using SPSS 13.0 statistical software program. The data of the patients are given as mean±standard deviation. The preoperative and postoperative surgical and functional outcome parameters were compared using a paired sample t test, and $p<0.05$ was accepted as statistically significant.

Results

In all patients, the power was adjusted to 120 W. The mean total applied energy and total laser time were 190±70 kJ and 21.9±7.2 min, respectively. The mean follow-up period was 12.6±6 months. The comparison of preoperative and postoperative functional and surgical parameters at follow-up visits are given in Table 1. Because our institute is a referral center and most of our patients were living in distant locations, it was not possible to have follow-up tests for all patients included in the study. Although the number of patients was relatively small at the 3-month visit, the figure seemed to be adequate for 6-month and 12-month visits. As shown in Table 1, IPSS values significantly decreased at the 3-month visit, and the decrease was greatest at the 12-month visit. The maximum flow rate (Qmax) seemed to be significantly increased at the 3-month visit, and this high level was maintained through the other visits. Although the residual urine

Table 1. Comparison of preoperative and postoperative data of patients (mean±SD)

Parameter	Preoperative (n=85)	Postoperative 3rd month (n=21)	Postoperative 6th month (n=56)	Postoperative 12th month (n=43)
IPSS	21.6±4.75	6.2±4.8[a]	6.2±6.1[a]	4.6±3.3[a,b]
Qmax (mL/sec)	9.6±5.6	17.9±8.9[a]	19.3±10.5[a]	18.7±6.9[a]
Residual urine (mL)	89.5±85.6	55.3±81.6	27±35.7[a,c]	30.4±22.4[a,c]
IIEF	36.8±21.2	31.2±20.4	33.9±26	37.8±23.7

IPSS: the International Prostate Symptom Score, IIEF: International Index of Erectile Function.
[a]p<0.01 vs. preoperative, [b]p<0.05 vs. postoperative 6th month, [c]p<0.05 vs. postoperative 3rd month (paired sample t test).

volumes started to decrease at the 3-month visit, the decrease was significant at the 6- and 12-month visits. The IIEF scores did not significantly change before or after the operation. Postoperative prostate volume measurements were available in 22 patients. The comparison revealed a significant decrease in prostate volume measurements (55.5±27.6 vs. 42.8±21.7, paired sample t test, p=0.004).

No intraoperative or early postoperative complications occurred. In the follow-up period, additional interventions were performed in 5 patients (5.8%). Two patients underwent internal urethrotomy at the postoperative sixth and ninth months. TURP was performed in two more patients at 6 and 12 months postoperatively. The patient who was on anticoagulant treatment was hospitalized at 12 months postoperatively because of hematoglobe, and hematoma in the bladder was evacuated by cystoscopy. No stricture was seen, and the prostatic fossa of this patient was patent on cystoscopy. Of 66 patients who were postoperatively assessable regarding ejaculation, 11 patients (17%) reported retrograde ejaculation.

Discussion

Transurethral resection remains the standard treatment choice for BPE.[1] However, TURP is associated with complications, such as bleeding and TUR syndrome. These complications have been reported in up to 20% of patients.[3] Today, use of laser for the treatment of BPE seems to be the most commonly used alternative to decrease treatment-related morbidities. The first introduced laser was the Nd:YAG, with a wavelength of 1064 nm. However, because of its low absorption by prostatic tissue and deep coagulation necrosis with insignificant tissue vaporization, it required longer catheterization periods because of the longer time required for expelling the necrotic tissue. Besides these disadvantages, the relatively higher retreatment rates impeded the popularity of this method.[6] The next innovation was the Ho:YAG laser. It was used to enucleate the prostate, and this method was named Ho:LEP. Ho:YAG has a wavelength of 2140 nm and is absorbed by prostatic tissue very well, leading to good vaporization without significant necrosis. It has been considered an effective alternative to TURP with comparable long-term results.[7,8] However, the learning curve for this procedure seems to be longer and more technically demanding. Despite its good tissue effects and surgical outcomes because of its technical difficulties it could not gain popularity or widespread use as later laser prostate ablation techniques did. KTP laser, with its 532 nm wavelength, has the properties of good tissue vaporization and hemostasis, with a minimal coagulation depth. Today, because of its easy application, it has become the most frequently used and most popular laser technique for treatment of BPE. Although thousands of KTP laser prostate ablation procedures have been performed worldwide, the number of reports with long-term results are limited.[9] The lower ablated prostate volume and lack of tissue retrieval are deficits of this method compared to TURP. The energy of novel diode laser is absorbed by hemoglobin in the tissue as well as the energy of KTP laser, and also by water in the tissue, thus making rapid vaporization and hemostasis possible.[10-12] Its application is as easy as KTP, and the energy generation device is more compact and cheaper compared to Ho:YAG or KTP. Thus, it is more mobile and affordable.[12] Moreover, an ex vivo study showed that diode laser has a higher tissue ablation capacity than KTP, which means a shorter operative time for the same amount of tissue.[10] A recently marketed laser, which operates between 1.75 μm and

2.2 μm, is the thulium laser. It is as new as the diode laser, with promising outcomes comparable to TURP, and experience with the use of the thulium laser for BPE is being accumulated.[5]

Another disturbing, although not life-threatening, complication of surgical treatment of BPE is erectile dysfunction (ED), which can occur in 13% to 17% of cases following surgery.[13,14] Some studies have identified a correlation between ED and lower urinary tract symptoms. Besides these problems, studies have shown that medical treatments can have either positive or negative effects on sexual functions.[15,16]

Although surgery is considered to be the gold standard treatment modality for BPE, in the era of minimally invasive treatments, sexual dysfunction secondary to surgery has gained importance in terms of quality of life. Lasers seem advantageous with respect to this topic. Studies have shown that laser ablation has fewer adverse effects on sexual function.[17] As reported in two recent studies on diode laser treatment for BPE,[18,19] our study also showed that IIEF scores did not change significantly. Besides this being a surgery without electrocauterization, a more comfortable postoperative period, relief of lower urinary tract symptoms and cessation of alpha-blocker therapies may provide explanations for these results. Also, retrograde ejaculation was present in a lower percentage of our patients compared to the other studies, which reported retrograde ejaculation in up to 30% of patients.[18] This result can be attributed to our surgical technique, in that we carefully endeavor to preserve the bladder neck.

The main drawback of diode laser is the lack of tissue retrieval, as with Nd:YAG and KTP lasers. Therefore, patient evaluation regarding prostate cancer is very important. Although lower tissue ablation capacity compared to TURP may be considered another shortcoming of the technique, it is still more superior to KTP, as shown in an ex vivo studies, than other laser ablation techniques.[12] The relatively low number of patients with postoperative TRUS imaging may be questionable because of the unwillingness of patients to have such an uncomfortable procedure after an operation. Despite these limitations, our present data revealed that significant tissue ablation can be attained.

There are a few preliminary clinical studies on the efficacy of diode laser technology in the treatment of BPE.[4,18-21] All these studies reported good results with minimal complication rates. Among these studies, only 3 of them used 980 nm diode laser, as in our study.[18,20,21] Our results are similar in terms of functional and surgical outcomes. The current study has the largest population of patients treated with 980 nm diode laser at a power at 120 W. Although prospective comparative studies in large patient populations with long-term results are needed to make conclusions about efficacy, the ex vivo studies and short-term clinical outcomes have shown that diode laser can be a good alternative for prostate ablation.

The results of our study showed that improvement in functional outcomes begins in the postoperative third month and are sustained through 12 months postoperatively.

As a conclusion, the search for the best and least invasive endoscopic treatment for BPE continues. The diode laser is one of the promising methods used for this purpose. Preliminary results of our series demonstrated that the efficacy of a 980 nm diode laser at 120 W for the treatment of BPE seems effective and safe, with minimal morbidity. The improvements in functional outcomes began in the third month and were sustained through 12 months of follow-up. However, to make a stronger recommendation, studies with long-term results, conducted in larger patient populations and in comparison with other treatment methods, such as KTP or TURP, are needed.

Conflict of interest

No conflict of interest was declared by the authors.

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