

Original Article

Treatment satisfaction after 1 year high-power potassium-titanyl-phosphate photoselective vaporization of the prostate

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Abstract

To investigate the factors that influence treatment satisfaction after high-power potassium-titanyl-phosphate (KTP) laser vaporization of the prostate, we compared the characteristics between patients who were satisfied and those who were not satisfied. In all, 97 patients aged between 53–82 years (median age 67 years) underwent high-power KTP laser vaporization of the prostate for lower urinary tract symptoms due to benign prostatic hyperplasia. At 12 months postoperatively, 60 patients were satisfied with the treatment, whereas 37 were dissatisfied. Although there were no differences in International Prostate Symptom Score (IPSS) values at baseline, the satisfied group scored better in total IPSS at 1, 3, 6, and 12 months postoperatively ($P < 0.05$). At baseline, the maximum flow rate (Q_{\max}) was lower in the dissatisfied group and remained low throughout the follow-up period, with the exception of 1 month postoperatively ($P < 0.05$), compared with the satisfied group. There were no differences in other objective data between the two groups, including post-void residual and the number of voids based on the frequency-volume charts. In a multivariate model, a higher bladder contractility index was associated with a greater likelihood of treatment satisfaction 12 months after high-power KTP laser vaporization (odds ratio 1.024, 95% confidence interval 1.001–1.048, $P < 0.05$). Patients who were not satisfied following the surgery had a smaller improvement in subjective symptoms and Q_{\max} . In addition, our findings suggest that the relative risk of treatment dissatisfaction following high-power KTP laser vaporization was increased in patients with weak detrusor contractility.

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1 Introduction

Although transurethral resection of the prostate (TURP) is still regarded as the gold standard for surgical treatment in patients with lower urinary tract symp-

oms (LUTSs) secondary to benign prostatic hyperplasia (BPH), numerous new laser techniques have been introduced in clinical practice in an attempt to reduce the perioperative morbidity of TURP [1, 2]. Potassium-titanyl-phosphate (KTP) laser vaporization combines the outstanding tissue-debulking properties of TURP with the positive safety profile of laser surgery [1, 2]. High-power KTP laser vaporization is safe and efficacious for the treatment of large-volume prostates, with low morbidity, acceptable operative times and good postoperative results [3]. Furthermore, the technique of vaporization with the KTP laser is easy to learn and has gained wide acceptance.

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Two of the major drawbacks of high-power KTP laser vaporization are the relatively slow vaporization time and the lack of specimens for pathological assessment [4]. In addition, long-term quality data from randomized studies are still needed to assess the efficacy of high-power KTP laser vaporization. However, the properties of the KTP laser ensure good hemostasis, offer a bloodless surgical field and allow its use on patients with large prostates, those who are undergoing anticoagulation therapy, those with high cardiovascular and pulmonary risk, or those with acute urinary retention [5].

Patient satisfaction with treatment is increasingly being evaluated in clinical trials [6]. The main goals for BPH treatment not only include improvement in subjective and objective symptoms but also in patient-reported quality of life (QoL) and treatment satisfaction. Therefore, treatment-satisfaction measures with evidence of reliability and validity are needed to evaluate BPH therapies in clinical studies [7], and reduction of disease burden and subsequent improvement in the individual's health-related QoL should factor into treatment decisions for patients with BPH [8].

In the current study, in order to investigate the factors that influence treatment satisfaction after surgery, we compared the characteristics of patients who were satisfied and those who were not satisfied after KTP laser vaporization of the prostate.

2 Materials and methods

2.1 Patients

This study was approved by the institutional review board of Seoul National University Hospital, Seoul, Korea. A total of 97 patients aged between 53–82 years (median age 67 years) underwent high-power KTP laser vaporization of the prostate for LUTS due to BPH. The mean period of LUTS as a result of BPH was 63.1 ± 6.0 months (range 2–360 months). Preoperative evaluation included a history, physical examination, serum prostate-specific antigen (PSA) test, International Prostate Symptom Score (IPSS), 3-day frequency-volume charts, transrectal ultrasonography, uroflowmetry to evaluate maximum flow rate (Q_{\max}), evaluation of post-void residual (PVR) urine volume and urodynamic assessment. Inclusion criteria for the study were an IPSS QoL index score > 3 and $Q_{\max} < 10 \text{ mL s}^{-1}$ or moderate-to-severe LUTS (IPSS > 8). Exclusion criteria were urethral stricture, neurogenic

bladder, urinary tract infection and prostate cancer. In patients with a PSA value $> 4 \text{ ng mL}^{-1}$ or for whom digital rectal examination raised suspicions of prostate cancer, a 12-core prostate biopsy was performed, and a negative biopsy was required for inclusion in the study. The mean baseline prostate volume was $49.6 \pm 2.2 \text{ mL}$ (range 22.0–122.5 mL), the mean Q_{\max} was $11.4 \pm 0.7 \text{ mL s}^{-1}$ (range 3.0–41.6 mL s^{-1}), and the mean serum PSA was $2.7 \pm 0.3 \text{ ng mL}^{-1}$ (range 0.2–14.9 ng mL^{-1}).

2.2 Surgical procedure

KTP laser vaporization of the prostate was performed by a single surgeon. The technique of KTP laser vaporization has been described previously [8]. Laser vaporization was performed using an 80-W KTP laser using a GreenLight photoselective vaporization of the prostate (PVP) system (Laserscope, San Jose, CA, USA) and a StarPulse quasi-continuous wave laser (Laserscope). Vaporization was accomplished by holding the fiber 1–2 mm away from the target tissue. A clockwise-counterclockwise sweeping pattern was used to ablate the tissue. Laser vaporization began at the bladder neck and then proceeded to the lateral lobes, the anterior lobe, and finally the apical portion of the prostate. Lasing time ranged from 16 to 130 min (mean 51.9 ± 2.4 min). The total laser energy applied ranged from 23.6 to 316.0 kJ, with a mean of 141.6 ± 6.7 kJ. At the end of the resection, capsular fibers were visible, and a large cavity was evident instead of adenoma. There were no transurethral resection syndromes evident in these patients, and no blood transfusions were required. Following the procedure, a 20-Fr Foley catheter was inserted for irrigation.

2.3 Follow-up

Follow-up examinations were performed in our outpatient department 1, 3, 6 and 12 months after surgery. IPSS, 3-day frequency-volume charts, Q_{\max} and PVR urine volume were recorded.

2.4 Statistical analysis

All variables are reported as mean \pm SE or percentages. From the pressure-flow study, the bladder contractility index was calculated using the following equation: bladder contractility index = detrusor pressure at $Q_{\max} + 5 \times Q_{\max}$ [9]. For statistical analysis, patients were stratified into two groups on the basis of QoL index score at 12 months: < 3 and ≥ 3 .

To determine potential factors influencing treatment



satisfaction after surgery, all preoperative variables were included in the univariate model (age, body mass index [BMI], symptom duration, co-morbid diseases, PSA, transrectal ultrasonography, IPSS, 3-day frequency-volume charts, Q_{\max} , PVR urine volume and urodynamic assessment). Only those variables with $P > 0.1$ following univariate analysis were included in the multivariate logistic model.

Statistical analysis was performed using a commercially available data analysis package SPSS version 13.0 (SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered statistically significant.

3 Results

At 12 months postoperatively, 60 patients were satisfied with treatment, and 37 were dissatisfied. Table 1 shows the baseline characteristics of the two groups of patients. Mean BMI for the satisfied and dissatisfied groups were 24.5 ± 0.4 and 22.9 ± 0.7 kg m⁻² ($P = 0.029$), respectively. Total prostate volume and transition zone volume for the groups were 54.6 ± 2.8 and 41.4 ± 3.0 mL ($P < 0.001$), and 27.9 ± 2.4 and 18.9 ± 2.4 mL ($P = 0.005$),

respectively. Bladder outlet obstruction index (38.1 ± 4.1 vs. 25.2 ± 4.1 , $P < 0.05$) and bladder contractility index (116.7 ± 5.3 vs. 101.9 ± 6.1 , $P < 0.05$) were significantly higher in the satisfied group. Q_{\max} in the satisfied group was significantly higher than that in the dissatisfied group (12.5 ± 1.1 vs. 9.4 ± 0.6 mL s⁻¹, $P < 0.05$) (Figure 1A). There were no differences in the other parameters.

Comparative data for the two groups at 1, 3, 6 and 12 months postoperatively are shown in Figures 1–3. At baseline, Q_{\max} was initially significantly lower in the dissatisfied group than in the satisfied group and remained lower throughout the follow-up period ($P < 0.05$), with the exception of 1 month postoperatively (Figure 1A). However, there were no differences in PVR between the two groups at baseline, 1, 3, 6 or 12 months postoperatively (Figure 1B). Although there were no differences in IPSS score at baseline, the satisfied group scored better in total IPSS and QoL index at 1, 3, 6 and 12 months postoperatively ($P < 0.05$) (Figures 2A and D). Within the IPSS, there was a difference in voiding symptoms score between the two groups from 1 month to 12 months after surgery ($P < 0.05$) (Figure 2B),

Table 1. Patient characteristics at baseline.

Baseline characteristics	Satisfied group (<i>n</i> = 60)	Dissatisfied group (<i>n</i> = 37)	<i>P</i> -value
Age (years)	66.9 ± 0.9	68.0 ± 0.9	0.360
Body mass index (kg m ⁻²)	24.5 ± 0.4	22.9 ± 0.7	0.029
Symptom duration (months)	59.0 ± 6.2	69.7 ± 11.9	0.717
Co-morbid diseases, <i>n</i> (%)			
Hypertension	22 (36.7)	9 (24.3)	0.205
Diabetes	10 (16.7)	9 (24.3)	0.356
Cerebrovascular diseases	9 (15.0)	3 (8.1)	0.317
Prostate-specific antigen (ng mL ⁻¹)	31.0 ± 0.5	2.1 ± 0.4	0.055
Transrectal ultrasonography			
Total prostate volume (mL)	54.6 ± 2.8	41.4 ± 3.0	< 0.001
Transition zone volume (mL)	27.9 ± 2.4	18.9 ± 2.4	0.005
Transition zone index	0.47 ± 0.02	0.44 ± 0.03	0.328
Urodynamic study			
Functional urethral length (mm)	64.4 ± 3.1	66.5 ± 3.3	0.773
Maximum urethral closure pressure (cmH ₂ O)	65.5 ± 6.0	69.9 ± 7.9	0.545
Maximum cystometric capacity (mL)	389.8 ± 13.9	391.3 ± 14.2	0.799
Uninhibited detrusor contraction, <i>n</i> (%)	16 (26.7)	6 (16.2)	0.233
Bladder outlet obstruction index	38.1 ± 4.1	25.2 ± 4.1	0.010
Bladder contractility index	116.7 ± 5.3	101.9 ± 6.1	0.025
Operative time (min)	53.6 ± 3.0	48.9 ± 4.1	0.320
Energy used (kJ)	149.8 ± 8.7	127.7 ± 10.4	0.115

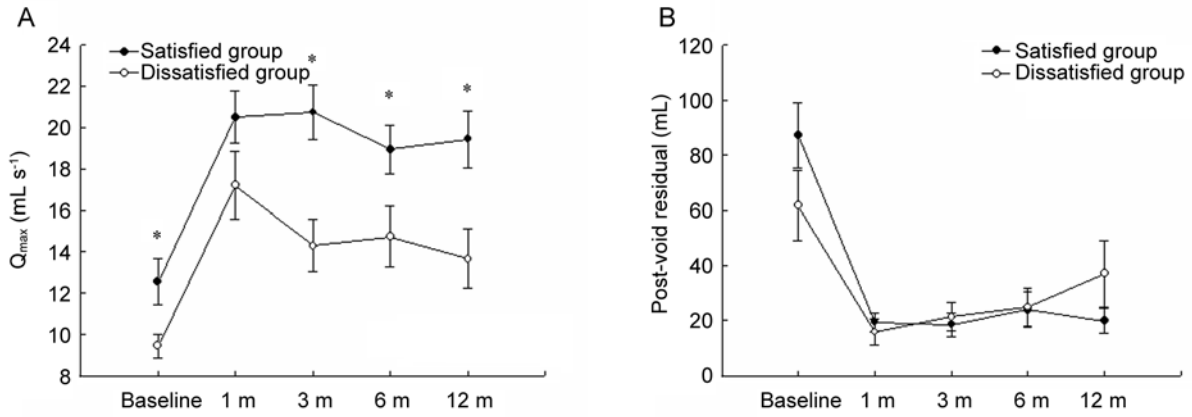


Figure 1. Changes in uroflowmetry parameters. (A): Q_{max}, maximum flow rate; (B): Post-void residual. **P* < 0.05, compared with the dissatisfied group. m, month.

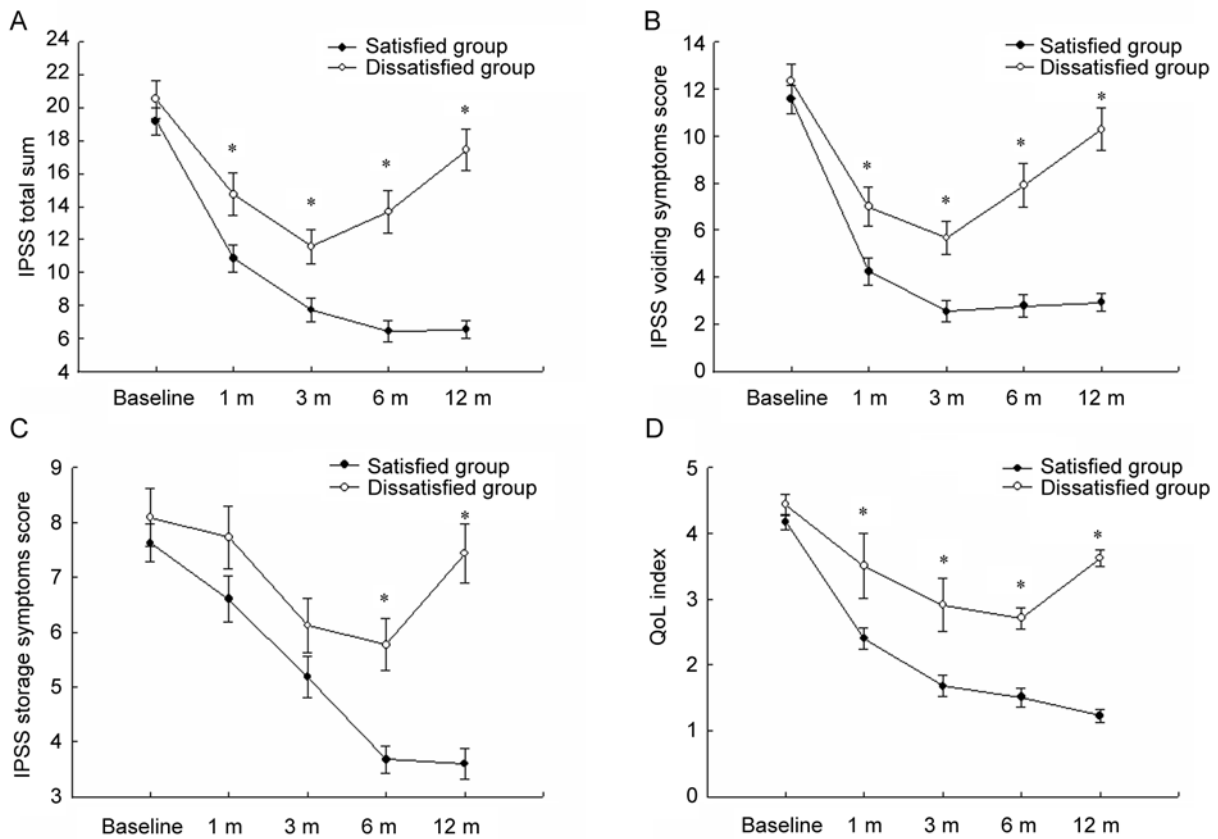


Figure 2. Changes in subjective symptoms. (A): Total international prostate symptom score (IPSS); (B): IPSS voiding symptoms score; (C): IPSS storage symptoms score; (D): Quality-of-life (QoL) index. **P* < 0.05, compared with the satisfied group. m, month.

whereas differences in storage symptoms score were not observed until 6 months postoperatively (*P* < 0.05) (Figure 2C). The frequency-volume charts showed a

reduction in the number of daytime and nighttime voids in both groups. During the follow-up period, there were no differences between the two groups, with the



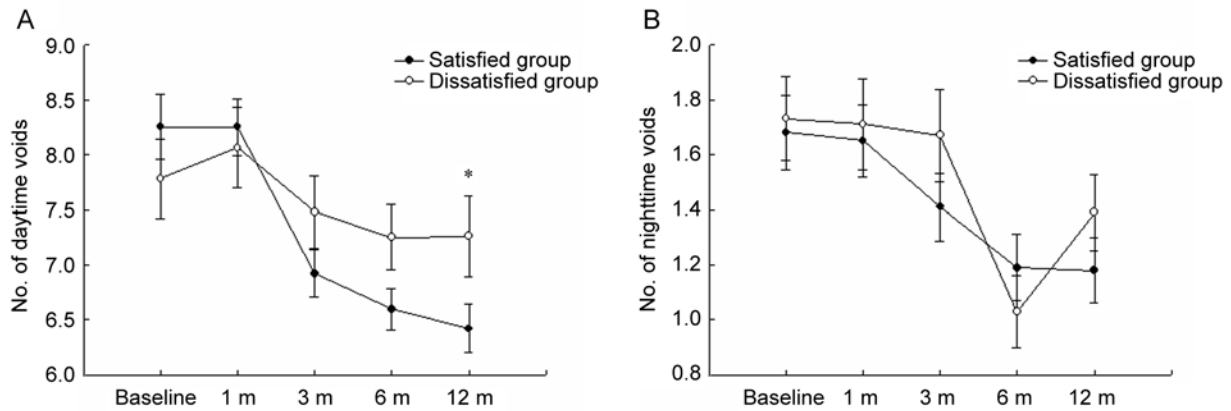


Figure 3. Changes in number of voids based on frequency-volume charts. (A): Number of daytime voids. (B): Number of nighttime voids. * $P < 0.05$, compared with the satisfied group. m, month.

Table 2. Multivariate preoperative predictors of satisfaction after surgery.

	Adjusted odds ratio	95% confidence interval	<i>P</i> -value
Body mass index (kg m^{-2})	1.236	0.961–1.590	0.099
Total prostate volume (mL)	1.014	0.954–1.078	0.660
Transition zone volume (mL)	1.001	0.929–1.078	0.982
Maximum flow rate (mL s^{-1})	1.051	0.933–1.185	0.414
Bladder outlet obstruction index	1.026	0.999–1.055	0.061
Bladder contractility index	1.024	1.001–1.048	0.038

exception of the number of daytime voids at 12 months (6.4 ± 0.2 for the satisfied group and 7.3 ± 0.4 for the dissatisfied group, $P < 0.05$) (Figure 3).

To evaluate which preoperative parameters were most closely associated with treatment satisfaction 12 months after high-power KTP laser vaporization, odds ratios and *P* values for trends were estimated using multivariate logistic regression analysis. BMI, total prostate volume, transition zone volume, Q_{\max} , bladder outlet obstruction index and bladder contractility index were possible predictors. In the multivariate analysis, only a higher bladder contractility index was associated with a greater likelihood of treatment satisfaction (odds ratio 1.024; 95% confidence interval 1.001–1.048; $P = 0.038$) (Table 2).

4 Discussion

Laser prostatectomy is an attractive treatment option for LUTS secondary to BPH, because it is remarkably safe and has lower treatment-associated morbidity compared with other methods. The first use of an 80-W

KTP laser on humans was reported by Hai and Malek in 2003 [10]. Since then, the efficacy and safety of high-power KTP laser vaporization has been demonstrated in multiple trials. Malek *et al.* [11] found that the IPSS values of their patients had decreased by 75% at 3 months, 79% at 6 months, 82% at 12 months and 82% at 24 months postoperatively. Q_{\max} values had increased by 250% at 3 months, 242% at 6 months, 255% at 12 months and 278% at 24 months postoperatively. In another study, decreases in IPSS values at 1, 3, 6 and 12 months postoperatively were 42%, 61%, 66% and 68%, respectively, and Q_{\max} values increased by 176%, 182%, 187% and 222%, respectively [12]. Results from Hai [13] established the long-term durability of high-power KTP laser vaporization, demonstrating that it can be used for glands of all sizes, in high-risk and anticoagulated patients, and with minimal morbidity and sustained clinical outcomes. Recently, Ruszat *et al.* [14] reported sustained improvements with a mean follow-up of 30 months, underscoring the long-term efficacy of PVP. Bouchier-Hayes *et al.* [15] showed equivalent obstruction relief outcomes for PVP and TURP after

1 year. Given the early success of the KTP laser, the extension of this technology to a variety of populations and surgical sites was a natural progression.

LUTS can be caused by many, often overlapping, pathophysiological mechanisms that may contribute to individual variations in response to treatment [16]. It is unclear whether LUTS is caused by obstruction because symptoms remain in up to 33% of patients after surgical removal of the obstruction [17]. Neal *et al.* [18] showed that men with lower voiding pressure had less favorable symptomatic outcomes after elective TURP. Some investigators have suggested that reducing obstruction might help restore bladder function with time and possibly prevent bladder dysfunction progression [19], whereas others report that relieving obstruction surgically does not improve contractility [20]. A recent report by Hamann *et al.* [21] examining urodynamic findings after high-power KTP laser vaporization showed that at 12 months after treatment, bladder volume at the first desire to void increased, functional bladder capacity increased, Schafer obstruction grade was reduced, and the incidence of urodynamically proven detrusor overactivity decreased. However, in the same report, detrusor contractility was not affected in any of the patients.

As some men experience benefit, weak contractility is not a contraindication for KTP laser vaporization. However, in the current study, we found that bladder contractility is most closely associated with treatment satisfaction 12 months after high-power KTP laser vaporization. In addition, patients who were satisfied with surgery showed more subjective improvement compared with patients who were dissatisfied with surgery. Interestingly, patients who were satisfied with surgery had a higher Q_{max} than those who were dissatisfied, although other objective parameters, including PVR and objective number of voids, were not different between the two groups.

Although the indications for BPH therapy continue to evolve, most patients undergo therapy for symptom relief. In addition, the degree to which a patient is bothered by his symptoms becomes a factor in the treatment decision [22]. Therefore, measuring satisfaction with the therapy provides important outcome information from the patient's perspective, related to his or her experience with the therapy [7]. Our results indicate that bladder contractility at baseline is important, because weak bladder contractility was closely associated with treatment outcome as well as with objective and

subjective symptoms after high-power KTP laser vaporization.

Increased recognition of the importance of patient-reported outcomes has led to the development of patient-reported questionnaires, and these tools have been used to assess patient-reported health outcomes. The Boyarsky score [23], IPSS [24], BPH Impact Index [25] and Patient Perception of Study Medication [7] are the ones most commonly used, and they are validated QoL instruments in BPH studies. One limitation of the current study was that only one questionnaire was used for the assessment of treatment satisfaction. Unfortunately, validated Korean versions of other questionnaires are not yet available. However, the IPSS index is currently the most widely used QoL instrument for patients with BPH and provides a reproducible, valid tool for evaluating changes in the status of LUTS [26].

5 Conclusion

The relative risk of treatment dissatisfaction after high-power KTP laser vaporization is higher in patients with weak detrusor contractility. These findings showed that urodynamic studies may be helpful in identifying subsets of men who will be satisfied post-operatively, and that detrusor contractility might be an important factor in treatment decisions.

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